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Acknowledgements

The preparation of this report has spanned more than a year of extensive literature review and meetings with innumerable citizens, government officials, experts, sector specialists, industrialists and others. While there is a huge sense of satisfaction in having achieved what seemed at times a Herculean task, it is only appropriate that we gratefully acknowledge the invaluable contribution of those who made this report happen

First of all we would like to thank the unfailing and complete support and encouragement that was provided by the State govenemnt of Uttaranchal after it gave us the opportunity to carry out this important study. Our grateful thanks to Dr. Tolia and his team of able and committed officers

We thank Mr. C. V. S. Negi, Member Secretary of the Uttaranchal Environment Protection and Pollution Control Board (UEPPCB), and his team who were our partners in this entire process and supported and facilitated our work in the State over the last year. The UEPPCB is the true owner of this document in letter and in spirit

We would like to thank the various experts and advisors who came for the formal and informal meetings that we had and were candid in their views about the report. We have consciously sought to address each and every one of their points and we are grateful for their contributions

We would like to thank Ms. Radha Holla Brar who agreed to painstakingly review, edit and rework the work of at least five different people with very different styles and approaches and bring it into what we hope is a reasonably coherent document.

We would also like to thank Mr. Nasser Munjee, former MD & CEO of IDFC whose vision is what has brought about IDFC's achievements and whose personal encouragement and support for this project gave us the courage to undertake and deliver on this very challenging assignment.

We believe that this is only the first step in what is a very important process for the State of Uttaranchal. One that can either set it firmly on the path of sustainability or one that can potentially destroy a major environment treasure of the country. We are however confident of the wisdom of the state and its people in doing the right thing.

The SoE Team comprising of
- *IDFC Environment Management & Social Development Group*
- *Academy for Mountain Environics*

Foreword

It gives me great pleasure in presenting the first ever "**State of Environment Report for Uttaranchal".** Ministry of Environment and Forests, Govt. of India nominated Environment Protection and Training Research Institute (EPTRI), Hyderabad as **National Host Institute** and Government of Uttaranchal nominated Uttaranchal Environment Protection and Pollution Control Board (UEPPCB) as **State Host Institute,** and Infrastructure Development Finance Company (IDFC), New Delhi as **Assisting Agency** for preparation of the SoE Report.

A State level **Steering Committee** under the chairmanship of Chief Secretary was also constituted by the Govt. of Uttaranchal on Februray 17, 2003. Principal Secretary/Secretary, Industrial Development Department; Secretary, Department of Tourism; Secretary, Department of Agriculture; Principal Chief Conservator of Forests; Director, G. B. Pant Himalayan Institute of Environment; and the Member Secretary, UEPPCB were the members of this committee.

Memorandum of Understanding was signed between UEPPCB and IDFC on July 7, 2003 for preparation of this report. Govt. of Uttaranchal also constituted an **Advisory Committee** on March 8, 2004 for review of SoE report. Advisor, MoEF, Additional Director, Central Pollution Control Board, Delhi and the Directors of various Central Institutions like Forest Research Institute (FRI), Wadia Institute of Himalayan Geology, Indian Institute of Remote Sensing (IIRS), G.B. Pant Institute of Himalayan Environment Research and G. B. Pant University were the members of this committee. After a series of meetings and discussions with the Sterring Committee and members of Advisory Committee, IDFC first submitted the Inception Report and later draft SoE Report and then final SoE Report. The draft SoE report was also discussed during UEPPCB's 4th meeting held on August 11, 2004.

The SoE report of Uttaranchal explains various factors responsible for environment degradation such as exploitation of natural resources, deficit in biodiversity, insustrial pollution, solid waste, natural disaster, siltation of rivers, use of forest land for other purposes etc. The report has suggested various measures for environment protection and sustainable development. The suggestions include **Millenium Assessment for Ecosystem Compensation, Carbon Credit, Conservation of Natural Resources, etc.** The Report has also given

recommendations for preparation of **State Environment Policy and Action Plan** for its implementation.

I hope the findings in the report will be quite useful for various departments of State Government, Regulatory Agencies, Policy Makers and Town Planners to develop sound planning and ensuring sustainable development without causing any harmful effect to nature and natural resources.

I am thankful to Hon'ble Miniter of Environment and Forests, Govt. of Uttaranchal for his vision, keen interest and providing valuable guidelines to the preparation of SoE report. Dr R. S. Tolia, Chief Secretary, Govt. of Uttaranchal, was kind enough to provide guidance in technical matters and his interest and support was highly commendable. I am also grateful to Mrs. Vibha Puri Das, Principal Secretary, Govt. of Uttaranchal and Chairperson of the Board for her valuable suggestions and fruitful discussions at every stage towards finalization of this report. Contributions by members of various Research and Educational Institutions for their critical comments are highly appreciated to helping us in finalizing the report in time.

(C. V. S. Negi,
Member Secretary)

I. EXECUTIVE SUMMARY

A. Background

The State of Uttaranchal has embarked on a process of preparing its first ever assessment to prepare a State of Environment Report. Under the ongoing national programme, the State Government recognized that this national process has a huge scope for generating positive transitions in the status of conservation and sustainable development in the fledgling State. To this purpose the Government of Uttaranchal nominated the Uttaranchal Environmental Protection and Pollution Control Board (UEPPCB) as the state host institution to undertake this effort from the Tenth Plan Period. The board has taken the services of IDFC (Infrastructure Development and Finance Company Ltd.), which has been a part of several initiatives in the State. IDFC have anchored the process with Academy for Mountain Environics (AME) as the local institution.

Uttaranchal became a separate state carved out of hill districts and sub Himalayan regions of Uttar Pradesh in the year 2000 and is the newly formed hill state in the Indian Himalayan Region. The formation of the new state is the outcome of people's initiative with a vision to evolve a hill oriented development process for the people of the state. The geographical location (latitudes $29^0$5' – $31^0$25' N and longitudes $77^0$45' – 81^0 E) resource setting of Uttaranchal is unique and shares its borders with China and Nepal and hence also becomes strategic. The population of Uttaranchal is spread across 13 Districts and 95 blocks and is estimated at 8,479,562 persons in 2001.

The DPSIR framework of analysis was chosen to lead to specific and contextual diagnosis. The driving forces for the State of Environment have clearly been;

1. The Liberalisation, Privatisation and Globalisation model of economic development being relentlessly pursued;
2. The rapid changes that occurred due to the 1962 War and
3. The political and administrative convenience drives many decisions and this too has been a prime driver leading to the current situation.

The ecological footprints are evident of the impacts, which have been induced by driving forces in combination with the natural processes of geological formations in Uttaranchal. Different sets of environmental concerns are: The ***transient environments*** like the periglacial regions where the geographical evolution of glacial environments into fluvial environment is currently taking place is a region, which is prone to avalanches, landslides and rapid change in surface morphology. The varied geographical situations brings about several ***transitional environments,*** which are prone to dramatic changes with small triggers often beyond the resilience of the systems such as between Bhabhar-Terai, glacial margins etc. The best case of this is the avalanches, which periodically come down with lot of ice and soil, creating flash floods and landslides. (Madhmaheshwar, 1998 Uttarkashi floods, 1978}. The ***tectonically unstable environments*** refer to regions along the major thrust and fault belts, which are intrinsically unstable and will be continually prone to impacts from seismic events, small or large. The possibility of human intervention to avoid impacts in these zones is minimal and the best effort would be to understand them in greater detail and address

situations where it may snowball into a crisis. (Varnavrat landslides, Uttarkashi). Apart from the nature driven environmental fragility, several ***inappropriate development regimes*** have impacted the environment. A number of areas are affected by denudation because of past processes of inappropriate development or neglect such as several areas where mining has degraded the slopes or altered river regimes. The huge costs and time for recovery is well known from the experience of mining in Doon Valley. There are certain communities, which are a part of ***subsistence environment*** and need a proactive approach to address their issues. Regions in the rain-shadow areas, isolated valleys and forest villages where the communities have to precariously manage their existence need particular concern and attention than regular process can support (Taungiya villages).

B. State of the Environment

A significant cause of the present state of environment in Uttaranchal has been the development perspective that has motivated state policies and implementation. This perspective has defined the current environmental situation, as well as that of the people.

Land and the People

The people of Uttaranchal - their ecology, their socio-economic status and their culture – are defined by the topography and the climate of the Himalayas. The higher the altitude, the more difficult is the life of the people, and the more isolated they are from so-called development programmes. Living in such harsh conditions, the people have evolved systems of sustainably using and managing their natural resources.

Women are the keystone of the sustainable natural resource management systems in the Himalayas. They are therefore the first and most vulnerable victims of processes that tend to destablise the natural resource base. As such, they have therefore been the leaders of the ecological movements that have originated in the state.

Forests and biodiversity

Forests are the most important natural resource of the people of Uttaranchal. They provide the material base of survival in the mountains – food, fuel, fodder, and shelter. Besides harbouring hundreds of species of medicinal and food plants, the forests of Uttaranchal are also home of several indigenous fauna.

Forest policies since British rule have affected the floral and faunal diversity present in the forest, and led to numerous conflicts between people and animals, between people and the state, and between communities. As usual, the worst victims of these conflicts have been women.

In the recent decades, both the state and people have come together to experiment with new systems for managing forests sustainably based on a shared responsibility with the community.

Agriculture

The majority of the people of Uttaranchal are involved in agriculture. However, new definitions of productivity have enhanced the introduction of new technologies and crops and cropping systems that have often been particularly unsuitable for the mountain habitat, and have made farming an uneconomical proposition for the farmer.

Water

Though Uttaranchal is considered the Water Reservoir of northern India, its citizens face acute water shortage, for both drinking water and for agricultural use.

Energy

Uttaranchal has tremendous potential for generating energy. However, mega projects like Tehri Dam have huge environmental and socio economic costs.

Transport

Transport is an indicator of development. Developing conventional transport in the mountains can be fraught with difficulties, especially in higher regions. Such systems are associated with destruction of forests and the mountain environment, upsetting the fragile equilibrium of an already fragile region, and with displacement of people and wildlife. Development of conventional transport systems is also associated with increased use of non-renewable energy resources such as fossil fuels, as well as air pollution.

Industry

The economic development of the state is almost always associated directly with industrialisation. Because of the mineral wealth in the region, one of the dominant industries in the state has been mining.

Tourism

Uttaranchal is known as Dev Bhumi – the land of the gods. It has always been the most important state for pilgrimage in the country. However, there is a growing class of people who now visit the state for its other attractions – scenic beauty, biodiversity, trekking and other adventure sports. Tourism, if properly planned, has the potential for becoming the most important revenue earner for the state.

Urbanisation

Uttaranchal has an old history of urbanisation. Dehradun is one of the earliest urban centres created during the time of the British. However, urbanisation in the state is skewed, both as a result of topography, as well as administrative definitions.

Urbanisation has a critical impact on the environment. Rapidly expanding unplanned urbanisation leads to the destruction of the surrounding environment, particularly of neighbouring forests. It also causes immense pressures on infrastructure.

Disasters

Disasters in Uttaranchal are as much the result of the geography of the state, as due to human intervention. Many development projects – dams and roads for instance –

disturb an already fragile ecosystem, often weakening it in the process. Unplanned urbanisation does not take into account the needs for constructing earthquake proof buildings. While all disasters may not be preventable, the impact of most can be reduced through adequate planning prior to their occurrence. Uttaranchal is the only state to have a Ministry for Disaster Management.

C. Suggested strategies for the State

Institutional Strategies

In Uttaranchal the Environment Department has not evolved as yet, though the responsibility for all policy measures currently rests with the UEPPCB. The Department of Environment should form a part of the existing institutional arrangement and the department should relate to other sectoral departments to bring out a state environment policy in accordance with the National Environment Policy. The Draft National Environment Policy recognizes that the mountain ecosystems are suffering from problems of degradation and lop sided development process. A clear reference to local communities and their livelihood concerns has been highlighted and has pressed on the need to secure the survival needs of the communities.

Uttaranchal provides immense ecosystem services downstream without any returns to the state and local communities. The government of Uttaranchal is already negotiating for the same with the central government and has initiated a dialogue in with the XII Finance Commission. It has to be designed in a manner that it does not create conflicts within the communities and between communities and governments. Since new industrial policy has given space to industries with subsidies and other incentives as a driving force. There are enough clean technological aspects, which can be adopted by industrial processes. The UEPPCB will need to scrutinize a number of industrial and hydro-electric projects for which it will need a technical task force to evaluate and present it to the communities. Further, it has been recognized that unfocused external investments do not provide any improvement in the earning capacities of the local communities and the **need to explicitly include communities and Panchayats as a shareholders in the enterprise.**

Sectoral strategies

The State of Uttaranchal has to introduce sustainable governance measures, as the state cannot afford huge public expenditures on governance and without alternative ways of evolving viable occupational niches for the people. The planning commission also initiated a nationwide programme on agro-climatic regional planning which was also thoroughly done in Chamba block of District Tehri Garhwal. Such a programme involves the local governments and also has the potential to implement it in a decentralized manner. A number of new initiatives are called for, and the State has been attempting some of these already. The significant initiatives that reflect the resource potential of the
State and the current global economic scenario include the thrust in organic agriculture, medicinal plants, Bamboo and fibre development, creating infrastructure for software industries and ecotourism and several other measures are needed. However as the government is realizing quickly, these efforts need not just the technology but also

financial and institutional mechanisms for hand-holding to achieve significant results for which the Government must function as a true facilitator. In order to ensure that the wealth created while safeguarding the environment is retained locally, the government must ensure that the new initiatives are truly people oriented, rather than centralized initiatives. **The fact that Uttaranchal contributes to nearly Rs 11000 crores net bank deposits calls for innovative ways to apply local capital.**

There is a need to converge various sectoral plans to meet over the overall Environmental Framework at the state and the local level. Like, in the tourism sector, the plans of various sectors such as urban development, transport need to converge when developing destinations, so that the local communities have a say in the planning process, and benefit economically from such development. The promotion of medicinal plants would require that the forest department should have enabling laws so that people can use their van panchayat for more explicit livelihood uses. Concurrently, it would need the banks and rural development departments to increase the resource availability to the people, and scientific and technical departments to provide the requisite inputs for generating high quality products. **Therefore the Environmental Policy for the State has to enable streamlining policies that are interdependent and bring them to a common planning framework.**

D. Conclusion

Sustainability must be the key basis for development of this complex, fragile and risk prone state with a well-conceived and articulated definition of Sustainable Development. Even though the term has today become a cliché and its popularity is beginning to wane, the concept of sustainable development has however offered a challenge to find some unifying principles for human organization.

1. Sustainable Development at the broadest level could be conceived as a process of using resources that do not deplete the options for the future generation – more cryptically – it means generating more alternatives while conserving existing options.
2. If the processes for Sustainable Development of a community have to lead to its being in harmony with its ecology, then it should demonstrate at least four principles which have been clearly identified which characterize sustainable development viz.
   - It has to be environmentally sound and demonstrate the potential to renew;
   - It has to be enabling the evolution of a more equitable community;
   - It has to be creating a community which is self-reliant or endogenous in accessing its needs and investing into its future and
   - It has to be economically efficient.

It is also widely recognized that all these principles have to be concurrently adhered to and addressed at various scales (individual through community to the global scales) and different levels of human intervention (policy, programme and practices).

The current impasse that we are really faced with arises out of the precarious situation where developmental activities of the past have had a massive impact on deepening widespread poverty, squalor and environmental degradation, but a feeble impact on

sustainable development of local communities and their capacities to maintain/improve their environment and well being.

The real challenge that stare us in the face, is the challenge to hone our skills, choose our technologies and build our resources in such a manner that it provides for the human needs of Food, Clothing and Shelter and enhance the quality of Water, Energy and Biomass systems. This demands that walk beyond institutions and sectors to seek solutions and it is becoming clear that this can only happen as an accretionary process. While in several parts of the world the Community, Government and Markets have colluded and mutually destroyed the unified Society that represented the best of the republics of the past, the challenge today beyond the basic needs is that the Community, Government and the Market should be able to provide the basic inputs for societal development i.e. health, education and occupation.

II. INTRODUCTION

A. The Context of the SoE Process

The origins of the assessment of the "State of the Environment" can be traced back to the United Nation's Stockholm Conference on Human Environment in 1972. The conference declared "The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved."[1] For the first time, there was a global recognition that human action was starting to change the planet, and that humans had to learn to control their demands and impacts on the environment. The conference also made strong links between environment and development issues, and set the scene for the concept of sustainable development based on sustainable utilization of natural resources.

The Stockholm Conference mandated countries to produce a National Conservation Strategy to feed into the World Conservation Strategy, prepared by the International Union for the Conservation of Nature, United Nations Environment Program and the World Wildlife Fund. The strategy, promoted the idea of environmental protection in the self-interest of the human species, and warned that the destruction of natural resources eliminated future sources of food, medicines and industrial products. The World Conservation Strategy once more launched a public debate about sustainable development.

The 1980s also saw the release of the Brundtland Commission's report *Our Common Future*, the chemical accident at Bhopal, the nuclear accident at Chernobyl and the emergence of public attention on problems such as acid rain, the ozone layer, climate change, desertification, destruction of rain forests, garbage and toxic wastes.

In 1992, the United Nations Conference on Environment and Development, also known as the Earth Summit, convened the largest ever meeting of world leaders and released *Agenda 21*, a blueprint for making development socially, economically, and environmentally sustainable.

On a global scale, the United Nations Environment Programme (UNEP) produced an annual *State of the Environment Report* from 1973 through 1992, followed by the *Global Environmental Outlook* (GEO). These reports employ the pressure-state-response framework that has become the most prevalent methodology for state of the environment reporting.

In India, 1985 - the year following the Bhopal disaster - the Centre for Science and Environment (CSE) released the *first Citizens' Report on State of India's Environment*, prepared from the perspective of civil society and public good. The report focused the nation's attention on the need for thorough examination of development unlinked to the environment and to people's survival. CSE followed this report with four more reports.

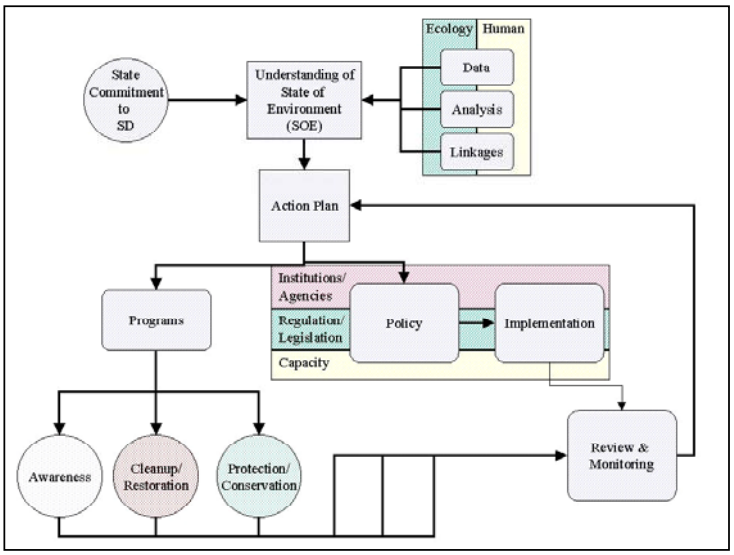
[1] Stockholm Conference, Declaration Of The United Nations Conference On The Human Environment (1972)

In response to the growing acceptance of the need for dovetailing environmental protection with development, the Planning Commission launched in its 10th Plan a nation-wide exercise to prepare State of Environment (SoE) reports for each state and Union Territory (UT) under the aegis of the Ministry of Environment and Forests (MoEF), as a First step towards enhancing the capability of states and Union Territories for handling environmental and sustainability issues. The program is expected to provide strategic planning and policy inputs on matters of development, environment and sustainability.

B. Objectives of an SoE

SoE reporting is a process undertaken so as to understand, describe, analyze and communicate information on conditions and trends in the environment. It seeks to document the condition of natural resources and the environment; and to assess the effect of any changes in the environment on health, economy and lifestyle. It is a method by which the ecologically sustainable use of natural resources can be measured, which is an effective and vital input for policy planning and implementation related to sustainable development. Figure 1.1 below shows a schematic for the SoE and its place in the Environment Management of a region.

Figure II-1 SoE in the context of state environment policies



The key principles that drive the SoE include:

- Promotion of the sustainable use of natural and physical resources and the maintenance of ecological processes and genetic diversity
- Encouragement of public involvement in resource management and planning
- Facilitation of economic development in accordance with the objectives set out above
- Promotion of the sharing of responsibility for resource management and planning between the different spheres of government, the community and industry in the State

The SoE is the first step in the development of an environment policy and strategy for the state to foster sustainable development. An initial SoE serves to identify the

priority areas related to environment and sustainability as well as provide pointers for frameworks to be put in place to effectively manage the environment.

The SoE needs to be followed by an Action Plan to address the issues of concern.

C. *The SoE for Uttaranchal*

The state of Uttaranchal was formed on November 9, 2000. The region has a long and rich cultural history where natural beauty and ecological features have played a central role. Arguably, the most significant resources of the state are its natural resources or are resources that are closely linked to ecological wealth.

Since the formation of the state, while there has been a strong focus on infrastructure and economic development, there has also been a recognized need to ensure that the development path adopted does not compromise the local environment.

With this end in mind, even as strategies for infrastructure and economic development are being established, the state of Uttaranchal embarked on a process of preparing its first ever SoE Report. This was carried out under the ongoing national program mentioned in the previous sub-section.

The national program defines the presence of a National Host Institution (NHI) and State Host Institution (SHI). For the State of Uttaranchal the NHI was the Environment Protection Training and Research Institute (EPTRI) based at Hyderabad. The Government of Uttaranchal nominated the Uttaranchal Environmental Protection and Pollution Control Board (UEPPCB) as the SHI to undertake this effort, which in turn sought the support of the Infrastructure Development Finance Company (IDFC), for developing the first SOE for the state.

IDFC is a national level Infrastructure Financial Institution. IDFC has been actively involved in supporting the State through several initiatives including working on agri infrastructure, Power sector policy, Tourism policy etc. IDFC has recently set up a joint venture company with the Government of Uttaranchal for promoting private sector infrastructure development. IDFC also has an active Environment Management & Social Development Group that has worked on project as well as policy level issues associated with economic development and sustainability.

To support the diverse nature of work required for such a report, IDFC teamed up with the Academy for Mountain Environics (AME) as a local partner. AME has been working actively on issues related to environment and development for over a decade in the region and has been in the forefront of multi-sectoral initiatives

D. *Developing the framework for the SoE reporting*

A SoE needs to integrate best practices with the ground realities in the state. IDFC adopted a two-part approach of developing the frame for analysis.

- The conceptual framework was provided by the DPSIR approach
- Consultations with all stakeholders for the prioritization of issues and providing inputs to the frameworks as required.

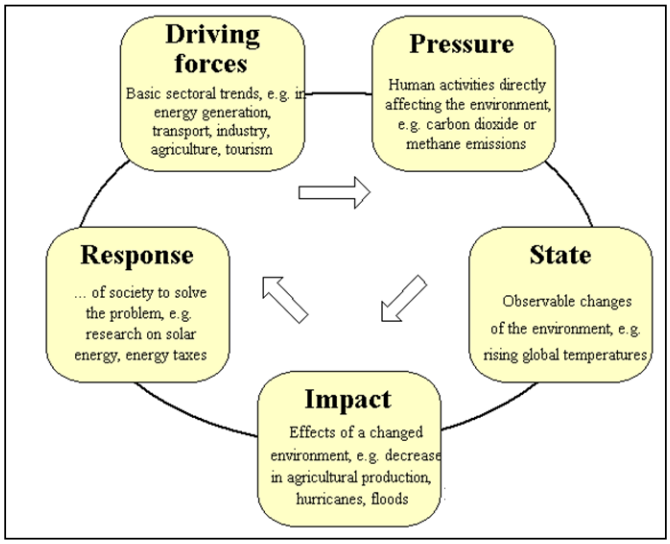
The SoE for Uttaranchal aims to:

- Underscore the key inter-sectoral linkages and multi sectoral issues in a democratic decentralized management of natural resources;
- Provide the foundation for a framework for benchmarking of primary and secondary information in the newly formed State
- Identify and analyze areas of development and conservation where the linkages are direct and strong and several other areas where the linkages are fuzzy and linkages apparently weak in short time horizons, so as to provide the inputs required for evolving a more comprehensive policy-framework.
- Explore alternative development options such as possible clean production centres etc, which again would provide for development without compromising the ecosystem.

Driving Force-Pressure-State - Impact and Response (DPSIR) approach

Sustainable development indicators measure sustainability or sustainable development performance. The Driving Force – Pressure – State – Impact - Response model is based on the Pressure-State-Response indicator model developed in the 1970s by the Canadian statistician Anthony Friend. The DPSIR framework has been commonly used by many recent SoE reports (such as the South Africa report, UP report etc). A schematic illustrating the DPSIR framework is shown below.

Figure II-2 Schematic of the DPSIR framework



Driving forces

These are the underlying human activities that lead to environmental change. They may be governmental activities, such as agricultural policies, or energy subsidies; corporate activities, such as irresponsible disposal of waste or inefficient use of raw materials; or they may be consumer activities, such as private vehicle use, or recreational activities.

Pressures

This aspect relates to the pressures that are exerted on the environment and natural resources, often as a result of the driving force, and includes increased pollution of air, water, and soil; or depletion of natural resources such as fish stocks and woody biomass.

State

This describes the current state of the various indicators, and where data are available, shows trends in environmental quality over time.

Impacts

These are the consequences of the pressures on natural resources, such as reduction in biodiversity, soil degradation and desertification, or denudation of forests.

Responses

These cover the current policies and management strategies to combat environmental degradation, the effectiveness of these policies, and recommendations for additional activities.

Identification of priorities

IDFC launched the SoE with a meeting with state officials and stakeholders to understand state priorities from various perspectives. The priority sectors were identified as

- Tourism and eco-tourism
- Biodiversity and forestry
- Water resources and watershed management
- Industrial development
- Infrastructure especially roads and consideration of ways of improving connectivity and access
- Natural disasters and their management
- Agriculture
- Carbon finance and its relevance to the state

The stakeholders' consultation in particular highlighted the need to understand issues such as the carrying capacity of regions and their geographic uniqueness, marginalization of local institutions and local governance structures that ensure full democratic participation, the impact of the money order economy on migration, and trends in land use policies. The consultations also stressed the need to emphasize

- local wisdom and knowledge
- the role of women
- linkages between resources and livelihoods
- human health and environmental degradation and
- the emergence of market forces and mechanisms and their impact on resources and livelihoods

Data collection Process

The data sets generated by various agencies are often designed to satisfy the needs of the institution or the department and therefore are often not directly applicable in another context. Further the periodicity and nature of data sets vary from sector to

sector as also sometimes by regions or administrative units. Recognizing these issues, the project team developed specific data-sets customized to easy data collection by the nodal officers. Data was sought and organized at state and district Level.

In addition to the data sets, questionnaires were used to highlight some of the key issues facing the state in development and environment. Central Government agencies, local academics and other sources were also resorted to when needed.

As the SoE is intended as a practical document with pointers for action, case studies were considered an important basis for providing insights into the processes and the potential for various interventions.

The data sets also factored in the analysis needs of the SoE, so as to enable the understanding of trends and drawing of inferences.

Organization of themes

The report develops the following themes as a starting point to understand the overall "State of Environment".

Land and people The land resources are diverse, and resource enhancement and depletion have always been concerns of the community. This background paper focuses on the two interdependent resources and the processes that have shaped the present day structure.

Forests and biodiversity are the unique wealth of Uttaranchal and an understanding of people-ecosystem cycle would enable a sustainable growth and survival of such important resources with the state.

Agriculture is the mainstay of the majority of the people in the state. The agriculture systems are determined by numerous factors and their uniqueness offers the state scope for developing niche agriculture.

Water resources are vital to existence and the crisis of water has been attracting national attention. Since Uttaranchal has water resources serving a huge population within the state and downstream, the need is to address water resources comprehensively including quality and quantity of potable water along with irrigation requirements in both rural and urban settlements, as well as look at traditional systems of water management.

Energy is also one of the promising potential drivers for revenues and development for the state and is already one of the prime objectives of the state. The production of energy is also linked to various environmental and social dimensions that need appraisal.

Industrial development has been limited in the state. This section considers industrial development particularly in the context of optimum resource utilization, remunerative employment generation, and rapidly introducing cleaner production mechanisms.

Transport is a vital aspect of infrastructure development that impacts all other sectors. The topography of the region makes environmental sustainability a critical factor of transport policy.

Tourism is an important revenue earner for the state of Uttaranchal, but unplanned tourism has a devastating impact on the environment. With proper planning, the state can exploit the vast potential its topography and culture has for environmentally friendly tourism.

Urban development has been an important area for investments. Since concentration of urban population is the maximum in the Terai belt as compared to the hills, it is important to know the urban-rural interdependencies and the technologies and skills for optimum use of the investments.

Natural disasters have been one of the problems that the state has had to deal with. The recent array of disasters and their increasing frequency have posed a challenge for the state and people to cope with. The need for developing an information base and identifying pockets at risk is critical. Developing policy guidelines and remedies addressing unsafe settlements and therefore uncertain livelihoods, could initiate and enable mechanisms to address such issues. It is also vital to develop networks to help manage and mitigate the impacts of these disasters.

Finally, the SoE report has been developed not as a rigorous analysis of hard validated data but an anecdotal report that relies largely on local perspectives of all stakeholders from the government to local community representatives. All the data made available has been incorporated and analysis carried out where the data was adequate in temporal and spatial distribution.

Annex II-1 SOE Launch Meeting - 26 July 2003

List of participants:

Madhukar Gupta, Chief Secretary, Uttaranchal
R.S. Tolia, Principal Secretary, Forest & Rural Development, Uttaranchal
S. Krishnan, Principal Secretary, Industrial Development
C.V.S Negi, Member Secretary, UEPPCB
Shobha Chaturvedi, UEPPCB
Ajay Narayanan, IDFC
Brig (Retd.) Vinod, IDFC
J. Sridhar, EPTRI, Hyderabad
R. Sreedhar, AME
D.K. Gupta, Additional Secretary, Urban Development
S.S. Sandhu, V.C, M.D.D.A
Gambhir Singh, Addl. Secretary, Forest & Environment
Yatendra Kumar, Addl. Secretary, Tourism
B.S. Sokhi, IIRS
Brij.B.Rattan, TCPO
R.K Maikhuri, GBPIED, Srinagar
R.C. Arya, Addl. Director Medical Health
Manisha Panwar, Addl. Secretary, Health
K.S. Dadhwal, Head, Soils & Agronomy, CSWCRTI
Rakesh Goel, Sr. T.D., N.I.C
V.K. Wahie, Asst. Director, UAHSDP
S.P. Kandwal
Kunwar Singh, Addl. Secretary (Drinking Water)
Jagdish Singh Kushwal, Secretary, Uttaranchal Jal Sansthan
Bharti Solanky, IDFC
Anand Srivastava, IDFC
Ashok Emani, IDFC
Kirtan Sahoo, IDFC
Nishant Alag, AME
Shanti Prasad Pokhriyal, AME

.

Annex II-2 First Stakeholder Meeting

List of participants:

1. H.C. Pokhriyal, LBSAA
2. Vimal Bhai, Matu Peoples' Organization
3. J Sridhar, EPTRI, Hyderabad
4. R.K. Mukerjee, TARN
5. Balendu Joshi, SPEED
6. Aurobindo Ogra, CMAU
7. Hem Gairola, PSS
8. Sarokar
9. Dinesh Pratap, DAV College
10. Mohan Kandpal, SEED, Almora
11. Ritwick Dutta, Environmental Justice Trust
12. Tribhuvan Singh Chauhan, Himtrek
13. R. Sreedhar, AME
14. Ajay Narayanan, IDFC
15. Bharti Solanky, IDFC
16. Ashok Emani, IDFC
17. Kirtan Sahoo, IDFC
18. Anand Srivastava, IDFC
19. Shanti Prasad Pokhriyal, AME
20. Nishant Alag, AME
21. C.V.S Negi, Member Secretary, UEPPCB
22. Shobha Chaturvedi, UEPPCB

Annex II-3 Second Stakeholder Meeting, November 15-16, 2003, Gairsain

List of participants:

1. E.Theophilus, FES
2. K.Ramnarayan, FES
3. Chandulal, Secretary, Van Panchayat Sangh
4. Ghamand Singh, Sarpanch, Van Panchayat
5. Purshotam Asnora, Journalist & Member - PUCL
6. S.C.Joshi, GBPIHED
7. Trilok Negi, Sarpanch, Van Panchayat
8. Vijaylal, Member Khetra Panchayat
9. Gamali Ram, Member Khetra Panchayat
10. Anita, Student
11. Seema, Student
12. J.S.Rawat, SADAN
13. Ramchandra
14. Purshotam Sati, Uttaranchal Jal Nigam
15. Sudhakar, Social Worker
16. Padam Singh, Sarpanch, Van Panchayat
17. Rakesh Bisht, Member, Van Panchayat Sarpanch Sangh
18. Dalip Singh
19. Dr. A.S.Negi, Health Centre
20. Jaya Mishra, Kumaon Sewa Samiti
21. Jyotsana Sitling, Conservator, Nanda Devi
22. Surendra Singh, Block Pramukh
23. Mohan Kandpal, SEED
24. Dyal Singh, Gram Sabha
25. Makar Singh, Sarpanch, Van Panchayat
26. Bachuu Ram Tamta, Gram Jagri
27. R.Sreedhar, AME
28. Ashok Emani, IDFC
29. R.K. Mukerji, TARN
30. Nishant Alag, AME
31. Hem Gairola, HCFC
32. Vijay Manori, HCFC
33. Dev Singh Farswan, Community worker
34. Partapilal, Community worker
35. Govind Ram, Gram Rikholi
36. Dhirendra Prasad, Forester
37. Kavi Dayal, DFO, Kedarnath

Annex II-4 Nodal Officers from Departments

Forestry	Mr Jairaj, Conservator Shivalik Division
Mining	Mr R.K.Sinha, Regional Officer, IBM
IIRS	Dr B.S.Sokhi, Head - Human Settlement Analysis Division, IIRS
Water Resources	Mr D.D.Dimri (UJS), Mr. S.K Semval, Asst. Manager (UPJN)
UJVNL	Mr. S.C Chabra, GM (I&P)
Rural Development	Mr. H.B Thapliyal, OSD
Panchayati Raj	Mr. R.B Dinkar (Asst. Director)
Horticulture	Mr. Mahandrapal (OSD)
Statistical Department	Mr. Y.S Pangti (Deputy Director)

Annex II-5 Data Requirements from Various Departments

Identified Department	Sectoral Themes	Datasets sought
State Planning Dept	Demographic details	District wise Population – Urban & rural
Bureau of Economics & Statistics, Uttaranchal	Social structure	Income groups across the state; Sectoral Contribution to State Domestic Product
	District wise migration pattern	Out migration and in migration,
	Region-wise trends in land utilization	9 fold land use for Garwhal, Kumaon & Terai region
Urban Development, Uttaranchal	Growth trend in cities/towns over the years	No of dwellings, type ,Estimated slum population in the major cities
	District wise urban infrastructure	Amenities, water supply, wastewater generated, treated, electricity consumption, solid waste generated, sanitation and drainage facilities in major cities etc.
Dept of Agriculture; Uttaranchal Diversified Agriculture Support Programme	Agriculture; land degradation: causes & consequences	Trends in land use & cropping pattern, soil types taluka / district wise, Agro-climatic zonation of the entire state, type of farming; conventional & un-conventional, plains or terrace farming; cropping pattern, sale and consumption of fertilizers & pesticides across districts and state; livestock population in the different districts: trends
Uttaranchal Peyjal Sansthan	Rural & urban water supply	Status of water resources, supply, schemes/programme etc. Water supply system and toilet installation in the rural and urban areas
Uttaranchal Jal Sansthan	Water resources	State water policy, distribution of water resources across the state, water supply requirements for major cities, reserves, utilization, standards of surface, ground, drinking, sewage water
Uttaranchal Jal Vidyut Nigam Ltd	Electrification	Status of generation, transmission, electrification etc.
	Roads	Status of rural & urban roads, mountain road development,
Uttaranchal Tourism Department	Tourism	Garhwal Mandal Vikas Nigam, Kumaon Mandal Vikas Nigam, tourist areas, revenue inflow, tourist destinations, number of hotels and resorts
Indian Institute of Remote Sensing	Thematic maps	Classification of physical features; terrain maps, physical map of Uttaranchal showing

		resource classification
Dept of Irrigation, CGWB; MoWR	Irrigation related development watershed development	Major and minor dams; check dams; List of districts with deficient or scanty rainfall during the previous year; watershed development projects: achievements, rainfall pattern, total rainfall: trend over the years, select cases
Dept of Mines and Mining	Mineral resources	Mineral available, number of mines in the state & the minerals mined, area affected by mining & mining area reclaimed
Uttaranchal Environment Protection & Pollution Control Board	Water, air, & noise pollution	Water bodies - lakes: capacities; contaminant flow into surface water sources groundwater pollution ;classification of air pollution sources; emissions level in major cities as compared to the prescribed standards; ambient noise levels in major cities in comparison to the specified levels; industries generating hazardous waste and their location; quantities of biomedical waste generated and current methods of disposal; municipal waste generated, handling and disposal practices; vehicular population growth trends and type of fuel used city wise across years
Department of Forest & Rural Development	Forests related aspects; rural development	Extent of forest cover: trends, R/S map; ownership pattern: trends; category of forests in each district reserved / unreserved forests; dense, open, etc. forest flora & fauna forest degradation; diversion of forest land for non-forest use; Horticultural development based on forests; afforestation efforts: achievements and select success cases; joint forest management; IUCN sponsored projects in biodiversity; threatened or rare animal species; biodiversity hotspots
Uttaranchal Health Systems Development Programme	Health related aspects	Health indicators; important diseases prevalent; life expectancy; IMR; MMR; medicinal plants – bio-prospecting; endangered or rare plant species
Department of Industries & UEPPCB	Industrial development and pollution	Type of industries: no of factories; major polluting industries; status of pollution control in 17 categories industries & compliance situation; location of industries and industrial estates in the state (map representation); categories and location of new industries; total industrial solid waste

		and effluents generated in the state; current methods for disposing off industrial waste in the state
Social Welfare Department	Women development	Women policy, gender issues and development
Disasters Mitigation Department	Natural disaster: earthquakes / land slides /droughts	Recent natural disasters; drought prone areas; damage due to droughts (last 5 years); flood affected area and flood damages; areas prone to floods, droughts landslides and earthquakes in the state: diagrammatic representation on map

III. FROM ENVIRONMENTAL ASSESSMENT TO SUSTAINABLE DEVELOPMENT

Environmental assessments are temporal. As the Hiesenberg uncertainty principle would have it, environmental assessment cannot be all encompassing and at the same time definitive. This is especially true if we are to consider the environment in its totality as the dynamic state of biophysical and psycho-cultural conditions because of the geographical, financial and knowledge constraints that accompany any assessment process. Often the purpose dictates the definition of the environment and therefore the outcomes. The current process, depending on the political will, administrative support and community demand can either become a powerful tool for change or be reduced to a submission to a larger national international process of documentation. In general, earlier efforts have been mid-way. Environmental assessment is definitely the first task in such a process and the current programme affords some element of designed continuity in assessment. The spirit in which this assessment is made is that, despite the legacy systems and constraints, there is an overwhelming potential for the new state of Uttaranchal to become a pioneer in the practice of sustainable development. This assessment gives an overview and points to the directions for the future.

A. Introduction

The new state of Uttaranchal, formerly a part of Uttar Pradesh, was formed on November 9th, 2000 as the 27th state of the Indian Union. The present state of Uttaranchal was earlier a part of the United Province of Agra and Awadh which came into existence in 1902. In 1935, the name of the state was shortened to the United Province. In January 1950, the United Province was renamed as Uttar Pradesh and Uttaranchal remained a part of Uttar Pradesh before it came into being as a separate state.

Uttaranchal is located between latitudes $29^{o}5'$ -$31^{o}25'$N and longitudes $77^{o}45'$ - 81^{o}E covering a geographical area of 53,485 km^2. The Tons River separates the region from Himachal Pradesh in the northwest, while Kali separates it from Nepal in the east. Starting from the foothills in the south, the region extends up to the snow-clad peaks of the *Himadri*, marking the Indo-Tibetan boundary. As it is situated centrally in the long sweep of the Himalayas, the region forms a transitional zone between the per-humid eastern and the dry to sub-humid western Himalayas. It comprises of two administrative units *viz*., Garhwal (north-west portion) and Kumaon (south-east portion).

The state has a unique character emanating from its ecological and geological quality. It is rich in scenic beauty, lush green mountain slopes, glaciers, river valleys and mineral resources. It is referred to as the water tower for practically the whole of north India, as it has perennial sources of water. Its forest resources have been meeting the requirements of rest of the country since the colonial period when Uttaranchal supplied a large part of the wood required for constructing India's railway network. Its natural and cultural richness, which are intrinsically bound together, is especially vulnerable to threats of sustainability. Numerous disasters in the form of earthquakes, landslides, cloudbursts, etc. are examples of how fragile the ecosystem of Uttaranchal is. A critical factor underlying the sustaining of the ecosystem has been the relationship of the people to their ecological wealth.

Over millennia, people have evolved both ways of utilizing the natural resources and systems of community-based checks and balances to ensure that the natural resources are maintained for future use. The last two centuries have seen the disruption of many of these systems and its negative impact on the environment. If the environment of Uttaranchal has to be maintained at its current status, let alone restored fully, it is imperative that the future development of the state be planned keeping the environment and the people at the centre.

This chapter presents an overall analysis of Uttaranchal's environment and attempts to highlight the significant environmental issues which merit attention in immediate future. To achieve this, the SoE analysis has been attempted below in the DPSIR approach. The DPSIR framework provides a bird's eye view of what are the driving forces and how they have applied pressures, which have resulted in the state of environment being what it is.

B. Driving forces and pressures

Three core driving forces, and the pressures they evoked, have influenced the environment of Uttaranchal:

- Liberalization
- The 1962 war with China
- Political and administrative convenience

The pressures arising from the core driving forces have been pressures of population, of lack of state finances, of the need to come into the mainstream of the so-called development process, of achieving "productivity" of food grain production, of generating power for sale, of industrialization and urbanization to indicate a standard of development, and so on.

Liberalization

As stated earlier, over millennia, people have developed sustainable systems for utilizing and maintaining natural resources. Communities, rather than individuals and governments, have been central to such systems. Principles of conservation and moderation rather than exploitation and profit have driven these systems. Free market economies, rooted in the concept of individual profit and not community sustainability, not just disrupt such systems; they create new, inequitable and exploitative relationships between people and nature. They also create new systems of governance, distancing people from their natural resources and the governed from those who govern. In the process, the rights of the former are taken over by the latter, including the right to make decisions related to natural resource use. Liberalization, in the context of the free market economy, was experienced by India as a state under colonial rule.

The rights of the people in any community are not very clearly defined and are often articulated broadly in constitution or national charters, the legislations and customary sanctions. Broadly, we can position the control over natural resources in terms of the three major social institutions:

- Communities
- States
- Markets.

The Constitution of India guarantees a set of fundamental rights, which are legally inviolable. Further, the Constitution provides for the protection and honoring of the customary rights of different segments of the society. These provisions have been backed by appropriate legislations and specific court rulings have also upheld them.

Evolution of state control

Prior to the enclosures of the forests by the British, the people of Uttaranchal followed the system of gram panchayat, of which the system of the lath panchayat was probably the most evolved for forest management. The lath or rod moved from one family to the other. Whoever had the lath was the family ultimately responsible for managing the forest.

For the British, the concept of community control over resources was unimaginable. All land had to be under the control of the State, either of a "despotic ruler" or of an "enlightened government".

"If we have any business at all in the East, it is to try and found something better than the old approved patterns of Oriental despotisms, and to give India the change at least of becoming a great independent and intelligent community."2

After the Revenue Administration was taken over by the British, the Indian Forest Act, enacted during the British rule in 1865, initiated a systematic control over people's rights. The forest resources were commercialized for colonial interest but with an avowed objective of scientific management and conservation.

An important consequence of reservation of forests was that people could no more create settlements in areas that were ecologically suitable – areas with adequate water resources and forest resources, which people could harvest without depleting them. Instead, communities were forced to move to ecologically unsuitable areas, where in order to survive, they were forced to exhaust the natural resources. Rather than enabling people to conserve these resources, enclosures of the forest turned people into exploiters and the increasing population into a negative pressure on the environment.

In the post Independence era, even while the Constitution recognized people's rights to resources, in the name of ***`good'*** governance several of these rights continue to be restricted, which has lead to regional and ethnic grievances and progressive increase in the control of resources by the state.

The control of the state has not been achieved without costs to the people and the natural resource regime. The state control over resources has meant an exponential increase in management costs. It has also meant exploitation on a wider scale as the resources are for use everywhere and for national economic purposes rather than the specific utility for which local communities harvested these resources. It has already

2 Quoted in H. Gairola and R. Sreedhar's paper, "Peoples Forestry Management: From policy perspectives to conflict resolution", 1999.

become obvious that most of these government conservation policies and projects, planned and control by the bureaucracy have ignored the close traditional linkages between the wildlife habitat and local population. In the last few decades, a considerable amount of land and forest resources throughout the region have been excluded from people's use in the name of biodiversity conservation - a chain of national parks, sanctuaries, biosphere reserves and other such means of protection have been created without any discussion or debate with the people affected. This has led to a situation where communities who are critically dependent upon the natural resources of an area for their survival, are often seen as law-breakers. While some effort is being made to create participatory frameworks, people's right to share in making crucial decisions is still a long way off.

Peoples' rights and natural resources

In the current era of globalization and rapid transformations in the economy, particularly in the developing countries, there is an ongoing threat to the livelihood and survival of people who are dependent on the availability of natural resources and traditionally having their rights and control over these resources.

In a situation where the wealth of the state is equated to the revenue earned by the state, and there is constant pressure on the state to earn even more revenue, there is a deepening of the erosion of people's rights to natural resources. More often than not, these resources, which people are barred from using, are used by the state to generate further revenue, such as large capital--intensive projects including dams, large scale mining and power projects and exploitation of resources for industrial development.
People's struggle for survival and upkeep of the sustenance base in the state of Uttaranchal continues from Monarchic and Imperialist days. The people of Uttarakhand were brave enough to resist their king and the mighty British Empire in order to keep local control of local resources such as forests, water resources particularly the springs and lakes. They continue to exhibit some of the finest traditions in conservation. The present condition is however very critical with a near complete break down of local institutional authority. Faced with a massive change in the environment that threatens survival itself, the state today is seeing a huge out migration of work force and a `money-order' economy.

The wave of globalization and liberalization has clearly favored the large corporate sector to consolidate their hold over mega interventions such as the power sector, and thus over the natural resource base. The nature of corporate controls are also a matter of concern as the complexity through which corporate ownership and control is exercised and the growing ability of the small segment of corporate speculators who alter the control of resources lends supports to the credence that in the market place, it is the profits that matter and not the long term health of the resource base.

The issue is even starker in the case of mining. In the absence of any clear statement of priorities of the country on the exploitation of the resources, corporations are devising new ways to grab the wealth of the nation for small short-term gains. The rapidity with which the global interests want to usurp these resources is reflected to the stock markets today. It is with the same rapidity that mining is devouring lands and livelihoods of many communities.

Such a process of enclosure of rights of rural and indigenous communities and the rapid transfer of the controls to the market forces is becoming the prime cause of poverty. The urgency with which the World Trade Organization (WTO) regime is being brought to bear upon local communities suggests that this round of exploitation and establishment of rights on control will go beyond the physical resources of the indigenous communities and encroach into their traditional knowledge base. Under such alarming circumstances, an appraisal of the rights and the *dejure* and *defacto* control over natural resources becomes imperative.

The local and indigenous may perhaps not able articulate in the modern language of biodiversity and global conservation but are still replete with knowledge about the practical methods for long term conservation of these resources. Their centuries of sustenance in and around what are now being presented as areas that need protection, fending for themselves and managing their community needs of water, fuel, fodder, medicine are proof enough of their understanding of the habitat and the careful husbanding of the resources. This wisdom pleads for greater understanding and even acceptance of many of the traditional but sophisticated management systems.

Decentralization

The progressive centralization of the resource control and the concurrent growth in the dissonance among different states, regions and ethnic groups have forced the Indian union to decentralize. Decentralization has become a catchword over the last two decades. However over the decades the state governments themselves were robbed of their revenue mechanisms. Despite two decades of the Sarkaria Commission's recommendations, the states have been virtually constrained by lot of the programmes and policies of the Central Government with the result that there is only a small window for innovation at the state level.

The constitutional amendments brought about to transfer the power to manage local resources and ensure people's basic rights still remains only a *potential mechanism* for the transfer of control to local communities. As the state government itself has very few revenue mechanisms, there is only token devolution further to the local bodies. The areas of business allocated to the local bodies are linked to direct programmes of the Central Government, which have become very complicated for management.

Further, the basic shift in the quality of community formation instigated by the electoral process is that these institutions remain as local political entities and do not form a coherent natural group. However there is a very little actual shift in the control by state and its sectoral instrumentalities, both over the political process at the level of the local communities and the natural and financial resources that exist in any region. While the control of the state was hoped to increase the quality of utilization of the resources, almost all natural resources, such as water, land and forests have degraded in quality and diminished in quantity. This degradation in quality and quantity is paving the way for private investors to take control over natural resources and totally alienate local communities, a trend that is being propounded by the new wave of liberalization. The market economy propounded and being put into practice is already transferring to private investors a very significant proportion of resource in the form of rights and privileges in various guises, control over the management of many public and private sectors through the stock market, giving rights to extraction of forest resources and

making it easier for them to overlook several constitutional and legal provisions to ensure local participation.

Implications of Liberalization

The free market economy is therefore going to progressively shift the control of resources in larger and larger measure from the communities and the state to the market forces. The real effects are at least three fold:

1. Denial or defeating the purpose of rights and egalitarian legislations which are the hall mark of democracy
2. Loss of control of the state in managing critical natural resources by transferring their management to corporates particularly the MNCs
3. Progressive abstraction of the real value of natural resources based on global market speculation and cartels adding to consequent vulnerability of the local and larger economy.

These effects are being already noticed in some situations and the examples of the sudden collapse of the Southeast Asian economies that took the world by surprise are excellent precursors to the worsening condition of the developing countries. The interplay of the forces of development at various levels and scales is already forming a complex web that, unless they are assessed and comprehended from the local to the global level, the securing of a sustained livelihood for the growing numbers in the developing countries will remain a mirage. It is therefore timely that a critical appraisal is undertaken of the status of people's rights and the control they are able to exert over the use of natural resources in the region and to identify appropriate strategies for positive community response. The modern forces, which are displacing the local communities, adopt a plethora of tools to gain control. The progressive divisions of the local communities in the name of the religion, caste, political, economic and other social groupings are subtle measures to undermine their collective capabilities.

The 1962 War with China

The 1962 war with China had a number of critical impacts on the state of Uttaranchal that have deeply impacted both the environment as well as people's livelihood options.

Construction of roads

One of the most critical impacts of the 1962 war was that for the first time, roads deep into the Himalayas were constructed. Though these were constructed primarily for reasons of national security rather than for development purposes, almost all the roads exist till today, and have become a major conduit for several infrastructural and other changes that are having a major impact on the environment and people's culture and livelihoods.

An important change related to the construction of roads has been in the people's attitude to tourism. Earlier people's tourism to places of pilgrimage took longer time. Tourists halted longer at each destination, and contributed to the local economy in a

dispersed manner all along the route in terms of food, stay, etc. With road development, tourism has become almost a weekend affair, with an overnight halt at Dehradun, Haridwar or Rishikesh, where the economic activity gets concentrated. Tour operators from outside Uttaranchal are usually the only ones to benefit from this kind of tourism.

Other impacts include changes in patterns of livelihood – setting up small eating and resting places along the roads to important places of pilgrimage, which requires excessive use of firewood, changes in building construction – which has led to an intensification in the impacts of the frequent disasters that visit the state, and so on.

Closure of economic activity with Tibet

Yet another significant impact of the war has been the closure of economic activity with Tibet. The tribal population of Uttaranchal, in particular the Marchas, Bhotias, Jadhs, and others had trade relations with Tibet, based on an exchange of food, fiber, art and culture. The closure has resulted in the displacement of tribals' environmentally friendly mechanisms for livelihood, forcing them to seek other avenues of making a living. In place of the lost livelihood, only those who could take out resources and sell them elsewhere, or who were capable or getting petty contracts with government works or get recruited into the army, have been able to eke out a living. This is one of the reasons for male migration out of the state.

Political and administrative convenience

Systems of governance related to natural resource use best highlight the difference between uniformity and diversity. By its very nature, a centralized system of governance has to be uniform. Conventional administrative activity is repetitive - most governments think that there must be uniform processes across a region or state, primarily because they can just repeat themselves. Probably that is why precedence is an important aspect of our whole political and administrative functioning. In contrast, the local communities in Uttaranchal have been very diverse and have developed different mechanisms suited to local settlements for managing both their natural resources and their affairs. Prior to the reservation of forests, communities were free to choose their settlement, and for their basic use, they could use natural resources without anyone else's permission. Currently the local institutions, even if they are constitutionally sanctioned like the panchayat, are forced to operate in the uniformity decided upon by the centre, whether it is the state government, or progressively now, the central government. If we see over the last 50 years, there has been less devolution of powers from the centre to the state; rather what was on the state government's list, is now being transferred to the central government.

Development and uniformity

In the case of development, the centralized convenience-driven governance system has resulted in uniform development activities being introduced right across the country, be it employment generation schemes, or conservation strategy plans, or even disaster mitigation plans, with the activities having little relevance to the diverse needs of diverse populations, and even less taking into account their diverse capabilities for

managing their own affairs. This has led to the need for designing very large programmes for which the local financial and technical resources seem inadequate, and because of inflation of its overall costs, there has been a need to look for investments from outside the state or outside the country. Once in this debt cycle, the state has to be dependent on more and more and larger and larger projects in order to sustain the its own existence. In the case of Uttaranchal, with its rich natural resources, this has led to a predominantly resource extractive model for development.

As with most approaches at conventional development, the trickle down of benefits, if any at all, to the local level is often limited. In Uttaranchal, the problem has been compounded by the serious geographical constraints that exist.

Another critical factor is that the ecological importance of the natural resources in the state are highly vulnerable and have significant value but have not been adequately factored in or monetized. Thus the state has consistently not recognized its own wealth. This is leading to the further distortion, where the major likely beneficiaries of the development policies will be corporations, who though they bring in investments from outside the state, will take away the returns without giving any benefit to the state and its residents. For example, in the agriculture sector, large food and agribusiness corporations will be encouraged to set up units in the state; farmers will be encouraged to turn from mixed cropping to monocultures to suit the whimsical needs of the markets, use higher levels of chemicals to boost production, and in the long run, devastate their soils and water resources. While in the very short term, the farmers may get added incomes, the majority earnings will be by the business houses whose headquarters are, more often than not, outside the country, let alone the state. The introduction of unsustainable agricultural practices in the middle and higher mountain regions also has a direct correlation with the reduction in slope stability and the increased risk of disasters.

Concerns with conventional development models

The model of economic development adopted was given popular legitimacy by couching it in rhetoric that it was the only course available to lift India out of the shackles of poverty, deprivation and backwardness. It was assumed that this path would satisfy the basic needs of a wider group of people.

However, what we have witnessed is that throughout this period local systems of production and management were undermined. In some cases, as with the building of large dams, and mining activities or extensive deforestation, these local systems were destroyed altogether. Sustainable local economies collapsed under the demands of achieving aggregate economic growth.

The overall impact of these processes was that rather than redistributing and democratizing the control and use of natural resources, the demands of the market economy created greater centralisation. Distributive justice and political participation were practically by-passed in this process. Overwhelming evidence now suggests that massive socio-cultural and ecological costs are an integral part of an economic model that seeks its primary justification in the maximisation of production and profit, within the current economic and political power relations on the planet.

Environmental movements have grown all over the country not just to protest against such 'development', but also to define an alternative model of development that respects democratic and decentralised decision-making and restores the access and control over productive natural resources to local communities. They argue that it is only through strategies that sustain and strengthen local economies and ecosystems can sustainable development be achieved. This therefore points not to tinkering around with the present system but a transformation that evolves out of holistic understanding of natural processes.

The challenge, if an alternative approach is to be followed by the state, lies in identifying the sources of revenues and capital investments. For this, it is suggested that the state seek to value its eco-system services and develop a frame for capital flows

coming in based on this evaluation. The Millennium eco-system assessment approach is proposed as the desirable option for this.

C. *Millennium Eco System Assessment*

The Millennium Ecosystem Assessment (MA) is a process designed to improve the management of ecosystems and their contribution to human development by enlarging the information base for making the best policy and management decisions. The MA is conceptualized at two levels:

- a **global scientific assessment of ecosystems**, which is as yet incomplete because scientific knowledge is often incomplete, and
- catalytic regional, national, and local assessments based on the knowledge of the people and local level evaluations

The MA approach also provides a frame that can be adapted for the SoE. The approach involves three basic components. These are

- Condition and Trend Assessment
- Scenarios Assessment
- Responses Assessment

The Millennium Ecosystem Assessment (MA) helps to

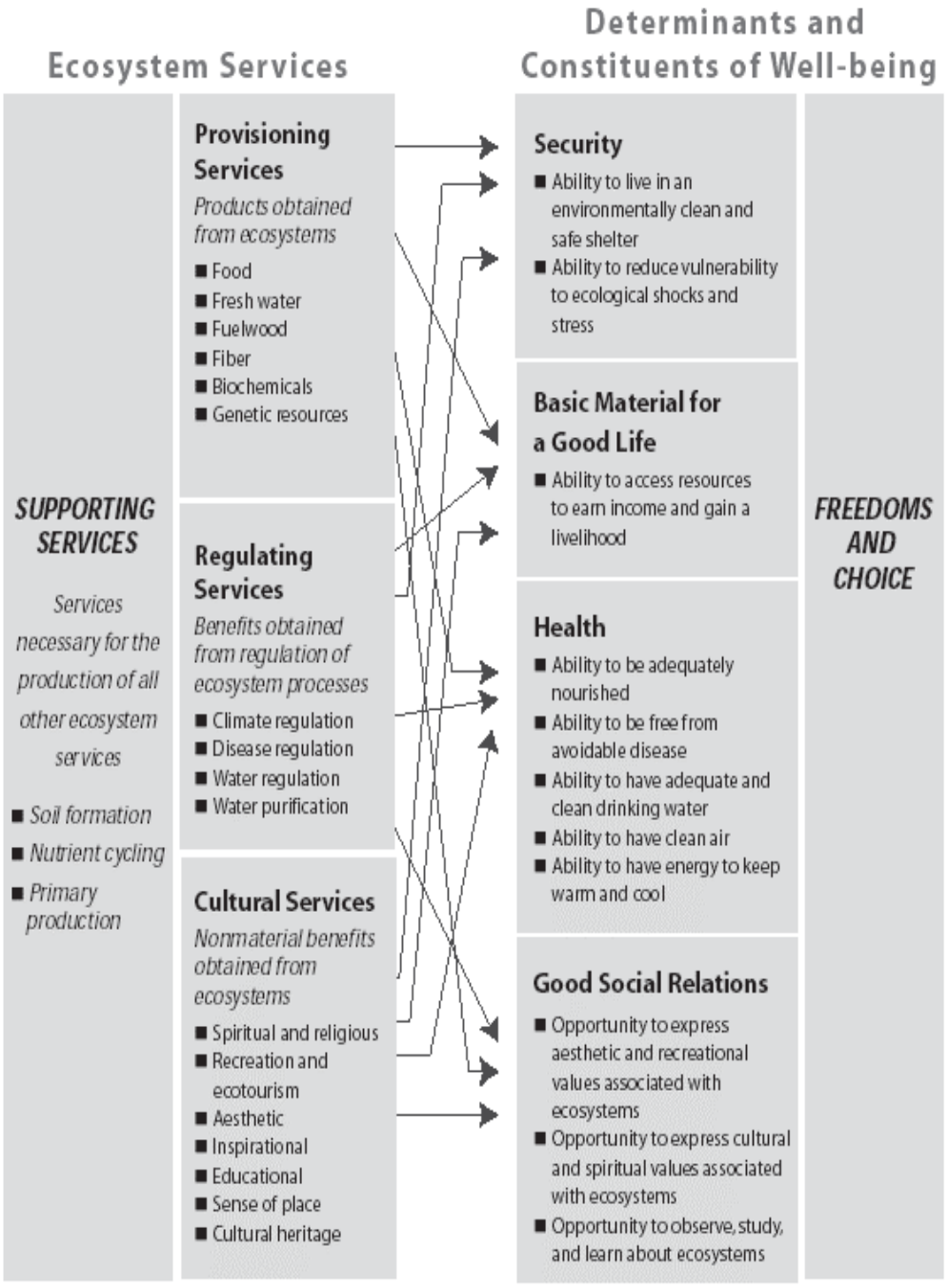
1. **better understand the trade-offs involved—across sectors and stakeholders —in decisions concerning the environment.** Ecosystem-related problems have historically been approached issue by issue, and rarely by pursuing multisectoral objectives. Progress toward one objective such as increasing food production has often been at the cost of progress toward other objectives such as conserving biological diversity or improving water quality. MA provides information on the full impact of potential policy choices across sectors and stakeholders.

2. **help make the most effective decisions at each level of governance.** Effective management of ecosystems will require actions at all levels, from the local to the global. However, the concerns may differ widely across these levels. The priority areas for biodiversity conservation in a country as defined based on "global" value, for example, would be very different from those as defined based on the value to local communities. The multiscale assessment framework developed for the MA provides a new approach for analyzing policy options at all scales—

The Environment assessment process recommended by the MA is shown as a schematic diagram below.

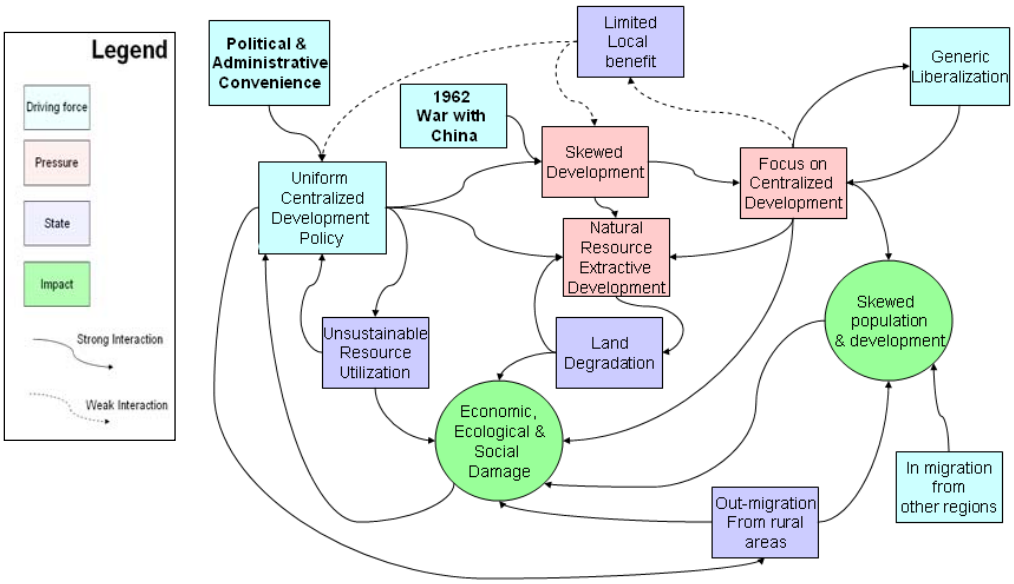
Figure 1-3. MA Analytical Approach

A focuses on evaluating the Ecosystem Services provided in a region/area and is particularly relevant in the context of Uttaranchal as it also provides a frame for capturing the linkages between human systems and eco systems, and was thus adapted with features of the DPSIR to enable the state potentially value such services in order to be compensated for them.



System diagrams for some of the sectors are presented below where the driving forces, pressures, state and impacts are presented in different colored boxes.

D. Overall Status



E. State

As a result of the increasing pressures on urban areas and rural areas (albeit of a different nature), increasing demands and inadequate meeting of these have led to the natural and social environment being modified over the years. The major conditions prevalent in Uttaranchal today are:

The state today has a skewed population distribution that is typified by high population densities in a few urban centers where the infrastructure is inadequate and a corresponding reduction in opportunities in rural areas and smaller urban centers.

- There has been a growth of a money order economy that has led to some subsistence incomes for the residents of the state but little investment and economic infrastructure being present due to lack of enterprise and economic activity. This refers largely to the rural and smaller urban centers.

- The focus on centralized development has led to a significant diversion of forest lands for industrial and mining purposes as well as a reduction in the density of forests on account of the increased need for local communities to be able to meet their fuel, fodder and other basic needs.

- Loss of bio-diversity

- Reduced community access to common resources

- Increased siltation in rivers
- Potential urban pollution in the form of Air, MSW and Water
- Industrial pollution
- Cultural fragmentation and problems
- Weakening of community institutions (Van Panchayats)

F. Environments of Concern

Land and the People

The people of Uttaranchal - their ecology, their socio-economic status and their culture – are defined by the topography and the climate of the Himalayas. The higher the altitude, the more difficult is the life of the people, and the more isolated they are from so-called development programmes. Living in such harsh conditions, the people have evolved systems of sustainably using and managing their natural resources. As forests are central to the topography, people have evolved ways of using forest resources for their benefit, but also ways of returning benefits to the forests.

Women are the keystones of the sustainable natural resource management systems in the Himalayas. They are therefore the first and most vulnerable victims of processes that tend to destabilize the natural resource base. As such, they have therefore been the leaders of the ecological movements that have originated in the state.

Forests and biodiversity

Forests are the most important natural resource of the people of Uttaranchal. They provide the material base of survival in the mountains – food, fuel, fodder, and shelter. Besides harboring hundreds of species of medicinal and food plants, the forests of Uttaranchal are also home of several indigenous fauna.

Over millennia, the people of the mountains evolved sustainable community based ways of using forest resources. The conversion of this common property resource into a state owned or privately owned resource meant primarily for generating revenue destroyed the close links people had with the forest. As the result, forests were exploited and degraded, while people's needs went unfulfilled. This also affected the floral and faunal diversity present in the forest, and led to numerous conflicts between people and animals, between people and the state, and between communities. As usual, the worst victims of these conflicts have been women.

In the recent decades, both the state and people have come together to experiment with new systems for managing forests sustainably. These include creation of Van Panchayats, and Community Conserved Forest Areas, as well as efforts by women to improve the status of their forests. In all such cases, the community as a whole has been concerned with protecting the forest from exploitation. Learning from these experiences, new ways have to be devised to ensure that while forests generate the much-needed revenue for the state and its people, they are not overexploited and degraded.

Agriculture

The majority of the people of Uttaranchal are involved in agriculture. However, productive agriculture is hard, because of the topography of the state, and out-migration has been a critical impact of the low-income generated from this activity.

The productivity of conventional agriculture in Uttaranchal is low, and the state needs to look at new ways of increase not just productivity, but also agricultural income. Horticulture and floriculture are being experimented with. One way that appears to be gaining ground is high value organic agriculture. In fact, Uttaranchal is one of the few states in the country that has declared itself as organic. As home to some of the most vaunted crops in the world – basmati rice, amaranth and buckwheat, Uttaranchal can focus on meeting the global demand for chemical-free food. The state has also declared biotechnology to be a priority area.

Water

Uttaranchal has often been called the Water Reservoir of northern India. Ironically, in spite of this, the people of the state face acute water shortage, for both drinking water and for agricultural use. This is mainly due to topographic and physiographic factors available in the state.

Sustainable water management requires active participation of the community. Drinking water schemes such as Swajal have made some headway in meeting the water needs of the state, but other ways need to be devised to ensure that all the people get adequate amount of potable water. Community participation is particularly important in agricultural use of water, and lessons need to be learnt from the past – regarding both community water management as well as community control over cropping patterns – to guarantee enough water for agricultural purposes to meet the food security needs of Uttaranchal.

Energy

Uttaranchal has tremendous potential for generating energy. However, mega projects like Tehri Dam have huge environmental and socio economic costs. Uttaranchal needs to look at alternatives such as micro-hydel projects, solar energy, wind energy, and so on, to both meet her own needs of power, and also generate income by supplying power to other parts of the country.

Urbanization

Uttaranchal has an old history of urbanization. Dehradun is one of the earliest urban centers created during the time of the British. However, urbanization in the state is skewed, both as a result of topography, as well as administrative definitions.

Urbanization has a critical impact on the environment. Rapidly expanding unplanned urbanization leads to the destruction of the surrounding environment, particularly of neighboring forests. It also causes immense pressures on infrastructure.

Being a new state, Uttaranchal has the possibility of demonstrating planned urbanization – creation of multiple smaller urban centers rather than mega polis. These centers will meet the needs of the urban population in terms of infrastructure, and also of the rural population in terms of services provided, especially marketing services for rural surplus.

Disasters

Disasters in Uttaranchal are as much the result of the geography of the state, as due to human intervention. Many development projects – dams and roads for instance – disturb an already fragile ecosystem, often weakening it in the process. Unplanned urbanization does not take into account the needs for constructing earthquake proof buildings. While all disasters may not be preventable, the impact of most can be reduced through adequate planning prior to their occurrence. Uttaranchal is the only state to have a Ministry for Disaster Management. The new ministry must take a multisectoral approach to planning for disaster management.

Industry

The economic development of a state is almost always associated directly with industrialization. Because of the mineral wealth in the region, one of the dominant industries in the state has been mining. However, in the recent years, environmental awareness has led to numerous strong movements against overexploitation of minerals, which causes environmental havoc.

The new state of Uttaranchal is keenly aware of the need to industrialize without polluting. Its focus is therefore primarily on its unique strengths – the high levels of literacy of its people, its natural resources including its biodiversity, its extensive handicrafts, and clean production technologies.

Transport

Transport is an indicator of development. Developing conventional transport in the mountains can be fraught with difficulties, especially in higher regions. Such systems are associated with destruction of forests and the mountain environment, upsetting the fragile equilibrium of an already fragile region, and with displacement of people and wildlife. Development of conventional transport systems is also associated with increased use of non-renewable energy resources such as fossil fuels, as well as air pollution. The state needs to look at unconventional modes of transport, such as rope ways, which have been successfully used in the neighboring state of Himachal Pradesh, and airships, which can takeoff and land vertically.

Tourism

Uttaranchal is known as Dev Bhumi – the land of the gods. It has always been the most important state for pilgrimage in the country. However, there is a growing class of people who now visit the state for its other attractions – scenic beauty, biodiversity, trekking and other adventure sports.

Tourism, if properly planned, has the potential for becoming the most important revenue earner for the state. Proper planning entails not just creating infrastructure to meet tourist needs, but creating an ambience for the better class of tourists, and rules for ensuring that tourists do not become pests, but are welcome visitors to the state, but also systems by which the people of the state can reap the benefits of tourism.

G. Significant Environmental Issues

The significant environmental issues have been categorized in three categories. This categorization has been based on the analysis of the information collected and the

developmental needs of the state. Most urgent are the issues that require immediate intervention by the state and other stakeholders to control and reverse the trend to the state and its people's advantage.

Significant environmental issues

Most urgent	Moderately urgent	Less urgent but significant
▪ Depleting forest ▪ Haphazard urbanization ▪ Natural disasters	▪ Degrading land ▪ Dwindling biodiversity ▪ Solid waste management ▪ Air pollution ▪ Water pollution ▪ Alternative energy	▪ Decreasing biomass energy ▪ Food security ▪ Groundwater depletion especially in Terai ▪ Industrial pollution ▪

Nature Determined Environmental Fragility

Transient environments

The periglacial regions where the geographical evolution of glacial environments into fluvial environment is currently taking place is a region, which is prone to avalanches, landslides and rapid change in surface morphology. As the glacial recession is taking place perhaps at a faster pace such eventualities should be kept in mind.

At a more localized level the paleo-slides, which have been put to human use and their history forgotten, would also be sites where the natural processes would find equilibrium and this will affect some communities. These include river valleys which have repeatedly been subjected to vertical movements thereby leaving lot of river sediments which have precariously settled, and which can be seen all along Bhagirathi and Alaknanda valleys. These are river boulder beds and terraces which are constantly sinking and their slopes fast retreating. And since these are river sediments and support thick soil, they happen to be better agricultural lands and there is a tendency to depend upon the lands, and there is a lot of settled community on these lands.

Transitional environments

The varied geographical situations bring about several transitional environments that are prone to dramatic changes with small triggers, often beyond the resilience of the systems. These include environments such as between Bhabhar-Terai, glacial margins etc. The best examples of this are the avalanches that periodically come down with lot of ice and soil, creating flash floods and landslides, for example the Madhmaheshwar avalanche and the 1978 flash floods at Uttarkashi.

Tectonically unstable environments

The regions along the major thrust and fault belts are intrinsically unstable and will be continually prone to impacts from seismic events, small or large. One example is the current Varnavrat landslides.

The possibility of human intervention to avoid impacts in these zones is minimal and the best effort would be to understand them in greater detail and address situations where it may snowball into a crisis.

Inappropriate Development Regimes

Denuded areas

A number of areas are affected by denudation because of past processes of inappropriate development or neglect such as several areas where mining has degraded the slopes or altered river regimes. The huge costs and time for recovery is well known from the experience of mining in Doon Valley.

Largely modified environments

The region where the dam is built and the submergence zones have significantly altered the local geography and meteorology and led to different kinds of problems to be faced. The urbanization along Chamba-Mussoorie ridge and the Bhimtal lake area represent such situations.

Lack of Mainstream Concern as Perceived by Communities

Subsistence environments

Regions in the rain-shadow areas, isolated valleys and forest villages, such as the Taungiya villages, where the communities have to precariously manage their existence need particular concern and attention than regular process can support.

Discontented environments

At every period in history there are communities, which are discontented with the ongoing social dynamics particularly when they find themselves helpless, and whose core problems do not appear to concern the mainstream. The Pratapnagar block which will become really more isolated with the coming up of the Tehri reservoir and the mindless restrictions placed on travel in the Chakrata Block are making these communities extremely discontented. So is the case with people within or at the periphery of the Protected areas.

Environmental Concern	Examples
Transient environment	Glacier melt, river sediments, and ancient landslides – Bhagirath and Alaknanda valleys
Transitional environment	Glaciers to rivers, from Bhabar to Terai. – Avalanches and flash floods
Tectonically unstable environments	Landslides, major faults and thrusts – earthquakes
Denuded areas	Mining areas, other industry, urbanization, road construction, dams
Largely modified areas	Dams, agriculture (plains), canal irrigation
Subsistence environments	Isolated villages, rain shadow areas, high altitudes
Discontented environments	Villages and peoples isolated through human interference: dams – Pratapnagar, national security – Chakrata, protected forests – Almost all forest living communities

The heightening discontent over several of these dimensions and the consequent struggle created a sense of togetherness in the various discontented communities, who sought to create a new state of Uttarakhand in which their common concerns could be addressed in the mainstream. The Uttaranchal that has been formed has to contend with far greater diversity. It has eroded that oneness and yet stands as a monument of our political compulsions. While keeping this context in the background, the key issues ahead are:

1. Introduction of sustainable governance measures
2. Making more effective use of resources without destroying the environment.
3. Continued peace and harmony in the region without the build up of vested interests.

Responses: Which Way Ahead?

In the current development debate, the State of Environment report can generate different kinds of responses, right from the process of assessing the environment to enabling some of the changes in current practices. In terms of assessment, several ideas have been thrown up, including Millennium Ecosystem Assessment. Such new ways of evaluating the environment may make a case stronger for seeking compensation for conserving it. This raises several questions, such as whether an ecosystem is worth preserving only if it is of immediate value to human existence, the intrinsic worth of ecosystems such as desert ecosystems, coastal ecosystems, deep sea ecosystems, etc. It also raises the specter of future conflicts over the management of the ecosystems.

For a state like Uttaranchal, which has a very small population living in diverse ecosystems, and where people have a very strong stake in their environment, not only for survival but also based on reverence, the current challenge is to respond to people's needs while enhancing the quality of the local ecosystems, rather than looking for solutions and resources from outside the state, whether in terms of corporate investment for few large projects, or total dependence on compensation for ecosystem services. The state also needs to devise ways to ensure that any revenue earned by corporate investment is not taken out of the state, and that any compensation received is actually ploughed back to local communities that are the true caretakers of the environment.

H. State Environment Policy

Uttaranchal is committed to development of the state with the objective of providing improving economic and quality of life benefits to its citizens. The Government and People of Uttaranchal recognize the enormous value of the State's natural resources and have been traditionally committed to its protection and enhancement. With the formation of the state, there is a recognition that development pressures are present and that it is critical for the State to ensure that this primary wealth of the State and the country, "its ecology", is protected. The state is shortly developing a State Environment Policy in line with the National Environment Policy, which will keep the environmental and development concerns of the people of the state as its central concern. The core parameters for developing the policy are:

1. Local Communities and Environment will be highest on the priority
   - The benefits to the State at large
   - The national benefits
   - And finally international benefits.

   Enabling the above, where the state will actively promote local development and encourage traditional approaches as a supplment to conventional development models

2. Integration of environment considerations into the development planning process. This will be achieved by formally considering the heirarchy of benefits mentioned in 2 above as well as the environment impacts at the planning stage itself.

Institutional arrangements

The Uttaranchal Environment Protection and Pollution Control Board (UEPPCB) is the nodal body for environmental management and policy in the state. UEPPCB was formed on May 01, 2002 as the Uttaranchal Pollution Control Board and since its inception , it has taken number of steps to improve environmental management and preserve ecology in the state. Keeping the broader environmental goal in mind it was renamed as Uttaranchal Environment Protection & Pollution Control Board by the Notification of Govt. of Uttaranchal on July 13, 2003 with over all mandate of promoting environmental protection by proactive and innovative approaches.

Functions of the Board

- To plan a comprehensive programme for the prevention, control of water and air pollution in the state.
- To collect and disseminate information relating to water and air pollution and the prevention, control or abatement thereof.
- To collaborate with Central Board in organizing the training of person engaged in programmes relating to prevention, control or abatement of water and air pollution and to organize mass education programmes relating thereto.

- To inspect (i) sewage or trade effluent, works and plant for treatment of sewage/effluent, (ii) any control equipment, industrial plant, manufacturing process and (iii) air pollution control areas; and to give directions for prevention and control of pollution.

- To evolve efficient methods of disposal of sewage and trade effluent.

- To lay down standards of treated sewage, trade effluent to be discharge.

- To advise State Govt. with respect to the location of any industry or premises which is likely to pollute a stream or well and/or cause air pollution.

- To perform such functions as may be prescribed from time to time be entrusted by Central Board or the State Govt.

- To recognize laboratories for efficient functioning of the Board.

- To ensure the compliance of Environment Acts and Rules made there under.

Major Highlights of the Board

1. World Environment Day is being celebrated every year by the Board
2. Annual Report 2002-03 of the Board was released by Hon'ble Minister of Forests and Environment, Govt. of Uttaranchal on September 16, 2003.
3. Board launched its own web site '*www.ueppcb.com'* on Nov.08, 2003
4. For preparation of effective Action Plan for Environment Protection and Pollution Control 'District Level Committees' have been setup under the chairmanship of DM with DFO as Convener.
5. State level task force has been constituted for implementation of Municipal Solid Waste Management Rules.
6. Board has made a temporary arrangement for transportation of Bio- medical Waste of Hospitals of Dehradun and nearby areas for its treatment and disposal to B.H.E.L., Haridwar through M/s Signet International.
7. M/s Medical Pollution Control Committee has been given Consent to Establish for development of Common BMW Treatment Facility.
8. Status Report and Time Bound Action Plan for Hazardous Waste in Uttaranchal has been prepared and sent to Supreme Court Monitoring Committee.
9. Board has prepared the Uttaranchal Water and Air (Prevention and Control of Pollution) Rules, 2004 and submitted for approval of to Govt. of Uttaranchal.
10. Board has prepared its own Service Regulations – 2004 and submitted for approval of Govt. of Uttaranchal.
11. Action Plan on different activities of the Board for year 2004-05 has been prepared and targets have been fixed.
12. Water Quality of River Ganga in Rishikesh and Haridwar, and Naini Lake in Nainital; and is being monitored on monthly basis. Air quality of Dehradun city is also being monitored regularly.
13. Two workshops one at Nainital and another at Dehradun were organized for mass awareness on Bio-Medical Waste Management.
14. A total of Rs. 213.27 Lakhs has been received by the Board since its formation.

Issues in present arrangements

One of the critical issues that has been observerd in the way Environment Management is presently structured is the absence of a separation between the regulator function and the policy function. This is because the UEPPCB is vested with both implementing the provisions of the environment regulations as well as advising government on policies. While so far it has done an admirable job, this is avoidable in terms of good governance practice. In this regard, a new approach for Environment Management in the state is required to be looked at.

Annex II-1 Best Practices

Clean Production & development

As a state where the ecology and environment are precious, Uttaranchal can convert this apparent constraint into an advantage by positioning itself as an ecologically sensitive industrial development destination. While this will also provide a rationale for avoiding hazardous and potentially ecologically damaging activities, it will enable selected investment to come in which can in the long run provide both economic development options as well as protection of the state's natural resources. One strategy could be to develop eco-industrial parks

Defining Eco-Industrial Parks

An eco-industrial park or estate is a community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic, and social performance through collaboration in managing environmental and resource issues. By working together, the community of businesses seeks a collective benefit that is greater than the sum of individual benefits each company would realize by only optimizing its individual performance.

The goal of an EIP is to improve the economic performance of the participating companies while minimizing their environmental impacts. Components of this approach include green design of park infrastructure and plants (new or retrofitted); cleaner production, pollution prevention; energy efficiency; and inter-company partnering. An EIP also seeks benefits for neighboring communities to assure that the net impact of its development is positive.

Some developers and communities have used the term EIP in a relatively loose fashion. To be a real eco-industrial park a development must be more than:

1. A single by-product exchange or network of exchanges;
2. A recycling business cluster;
3. A collection of environmental technology companies;
4. A collection of companies making "green" products;
5. An industrial park designed around a single environmental theme (i.e., a solar energy driven park);
6. A park with environmentally friendly infrastructure or construction; or
7. A mixed-use development (industrial, commercial, and residential).

Although many of these concepts may be included within an eco-industrial park, the vision for a fully developed EIP needs to be more comprehensive. . The critical elements are the interactions among the park's member businesses and the community's relationship with its community and natural environment3.
Several basic strategies are fundamental to developing an EIP. Individually, each adds value; together they form a whole greater than the sum of its parts.

3 See Clarification of Terms later in this chapter to understand the distinction between eco-industrial parks, by-product exchanges, and eco-industrial networks.

Integration into Natural Systems

Select the site using an assessment of ecological carrying capacity and design within the limits it defines.
Minimize local environmental impacts by integrating the EIP into the local landscape, hydrologic setting, and ecosystem.
Minimize contributions to global environmental impacts, i.e. greenhouse gas emissions.

Energy Systems

Maximize energy efficiency through facility design or rehabilitation, co-generation,[4] energy cascading,[5] and other means.
Achieve higher efficiency through inter-plant energy flows.
Use renewable sources extensively.

Materials Flows and 'Waste' Management for the Whole Site

Emphasize cleaner production and pollution prevention, especially with toxic substances.
Seek maximum re-use and recycling of materials among EIP businesses.
Reduce toxic materials risks through materials substitutions and integrated site-level waste treatment.
Link the EIP tenants to companies in the surrounding region as consumers and generators of usable by-products via resource exchanges and recycling networks.

Water

Design water flows to conserve resources and reduce pollution through strategies similar to those described for energy and materials – cascading through uses at different quality levels..

Effective EIP Management

In addition to standard park service, recruitment, and maintenance functions, park management also:

- Maintains the mix of companies needed to use each others' by-products as companies change over time;
- Supports improvement in environmental performance for individual companies and the park as a whole;
- Operates a site-wide information system that supports inter-company communications, informs members of local environmental conditions, and provides feedback on EIP performance.

Construction/Rehabilitation

With new construction or rehabilitation of existing buildings, follow best environmental practices in materials selection and building technology. These include recycling or reuse of materials and consideration of lifecycle environmental implications of materials and technologies.

4 Co-generation is the capturing and using of otherwise "wasted" heat from the electrical generating process.

5 Energy cascading is using residual heat in liquids or steam from a primary process to provide heating or cooling to a later process. For example, excess steam from a power plant or refinery may be used in a food processing plant or greenhouse.

Integration into the Host Community

Seek to benefit the local economy and social systems through training and education programs, community business development, building of employee housing, and collaborative urban planning..

Benefits to Industry

For the companies involved, an eco-industrial park offers the opportunity to decrease production costs through increased materials and energy efficiency, waste recycling, and elimination of practices that incur regulatory penalties. Increased efficiency may also enable park members to produce more competitive products.

In addition, some common business services may be shared by firms in the park. These may include shared waste management, training, purchasing, emergency management teams, environmental information systems, and other support services. Such industrial cost sharing could help park members achieve greater economic efficiency through their collaboration.

Small and medium size firms often have a problem in gaining access to information, consultation and know-how. The integrative approach of EIP development can support such enterprises in overcoming these barriers and gain access to investments they may require to improve performance. (Fleig 2000)

These benefits for participating companies are likely to increase the value of property for private or public real estate developers. The services generate new revenues for park management companies. Overall, EIPs may gain a competitive advantage, an especially important benefit in a time when there is over-capacity in the industrial real estate market in many Asian countries.

Benefits to the Environment

Eco-industrial parks will reduce many sources of pollution and waste, as well as decrease demand for natural resources. The site tenant's will reduce their environmental burden through more innovative approaches to cleaner production. These include pollution prevention, energy efficiency, water management, resource recovery, and other environmental management methods and technologies. Decisions about an EIP's siting, infrastructure, and recruitment targets will be reached in the context of the constraints of local carrying capacity and ecological characteristics of potential sites.

Each eco-park will serve as a working model for park developers and managers to learn how to improve their bottom line while meeting high environmental and social standards.

Benefits to Society

The enhanced economic performance of participating businesses will make EIPs a powerful economic development tool for communities. Such parks are likely to attract leading-edge corporations and open niches for new or expanded local ventures. Both will create new jobs in much cleaner industrial facilities. Companies in the region will gain new clients for services and buyers for products in the new firms in a park. Development of EIPs will create programs for extending their economic and environmental benefits across a community's whole industrial sector.. This promises

cleaner air, land, and water, major reductions in waste, and a generally more attractive environment.

EIPs offer government, at all levels, a laboratory for creation of policy and regulations that are more effective for the environment while less burdensome to business.

Costs, Risks, and Challenges of EIP Development

Developing an eco-industrial park is a complex undertaking, demanding integration across many fields of design and decision-making. Success depends upon a new level of collaboration among public agencies, design professions, project contractors, and companies locating in the park. The possible inability to overcome traditional fragmentation within and between these groups is a major risk.

Some of an EIP's benefits may only become apparent when costs and savings are calculated in a longer time frame than is typical in industrial park financing. Developers may need to make a strong case for banks to finance a project with a longer payback period, such as inclusion of renewable energy for critical backup power. On the other hand, some options for infrastructure may actually cost less to build and maintain. If you are able to get contracts with major companies to locate in your EIP, this will help prove the concept to financiers. A developer with significant signed leases has a bankable project.

Some eco-industrial parks *may* cost more to develop than traditional parks, depending upon the design choices in a project. Added costs may come from the design process, site preparation, infrastructure features, construction processes, and aspects of building design. When this occurs, the additional costs may or may not be offset by savings in operating the park as an EIP, given the payback period acceptable to the developer. Public development authorities may be better prepared to bear this possible increase in development costs than private developers. Or the public sector may fund some aspects of the development with strong public benefits.

Companies using each other's residual products as inputs face the risk of losing a critical supply or market if a plant closes down. To some extent, this can be managed as with any supplier or customer relationship, (i.e., keeping alternatives in mind and writing contracts that insure reliability of supply).

Exchange of by-products could lock in continued reliance on toxic materials. The cleaner production solutions of materials substitution or process redesign should take priority over trading toxics within an EIP site.

Possible innovations in regulation to enable EIP development may not be allowed by regulatory agencies or they may be slow to approve environmental impact reports for innovative projects. We discuss issues in policy and regulation in Chapter 7.

Some companies are not used to working "in community" and may fear the interdependence this creates. Collaboration may be particularly difficult if your EIP includes companies from many different countries and cultures. On the other hand, many large and small companies see such interdependence as a major source of competitive advantage. We cite precedents in the last section of the next chapter.

Some industrial parks include large numbers of small-to-medium enterprises (SMEs). While they may benefit from shared environmental services they are least able to afford

any technologies that may be required to improve their environmental performance. This suggests the need for financial service support in the EIP package.

Small local industries outside industrial parks often produce a bulk of pollution, because of lack of staff, outmoded technologies, and inefficient resource uses. A broader, regional approach is needed to reach such businesses. Often these smaller firms are suppliers to companies in industrial parks, who can require them to clean up their act and perhaps offer training and even investment to support this.

By-product exchange and resource recovery may cause displacement of small businesses. "In many countries, an extended informal sector profits from wastes and by-products. Establishing recycling or by-product exchange networks amongst companies could destroy the subsistence of numerous families." (Fleig 2000) EIP developers can offer support to such micro-entrepreneurs to strengthen their operations and follow good environmental standards. They could become participants in resource recovery parks or centers.

Many environmental policies in developing countries emphasize end-of-pipe treatment rather than the more holistic and preventive solutions of industrial ecology. Many overseas aid organizations add to this pressure with aggressive sales of their countries' end of pipe technologies and services. This deepens the problems of SMEs who cannot afford the technologies. Fortunately, Cleaner Production and industrial ecology are beginning to impact design of policy and even the strategies of aid organizations, such as the German, GTZ. Industrial park developers and their associations can lobby for improvements in policy and regulations that support EIPs.

Incentives for setting up EIPs

A key instrument of policy is the creation of incentives for eco-industrial park developers, for park managers, and for companies located in EIPs. This is a form of industrial development that seeks major environmental, economic, and social benefits. The public sector should compensate for these benefits by taking measures that reduce the risks and costs of development. We have touched on some of these incentives above and will fill out the list of options here.

1. Participation by national agencies in public private partnerships supporting EIP development.
2. Creation of revolving loans, grants, and subsidies for environmental investments, Cleaner Production Centers, or community-wide programs.
3. Streamlining and integrating of permitting processes.
4. Preferences in government procurement for EIP or EIN members with demonstrated excellent environmental performance.
5. Facilitation of financing from international sources available for reductions in greenhouse gas emissions and other global environmental issues.
6. Technical support and participation in program design and implementation in areas such as GHG reductions, Cleaner Production, and energy efficiency. Training for such programs.
7. Green seal type award systems for environmental management systems designed with industrial ecology principles and values and aggressive Cleaner Production goals.

8. Research and development to support the clustering of environmental industries or key objectives such as by-product utilization.

Incentive programs are probably already in place that can be directed toward eco-industrial development. For instance, the Indian government has established the following incentives to encourage environmentally friendly activities by industry:

The government realizes that most medium and small scale manufacturers cannot afford to install pollution control equipment. Therefore, the government will subsidize pollution control treatment facilities in industrial parks.

Industrial facilities may take a 100 per cent depreciation allowance on devices and systems installed for minimizing pollution or for conservation of natural resources.

In order to encourage industries to shift away from congested urban areas, the government is providing a tax exemption on capital gains arising from the transfer of used lands or buildings, which must be used for acquiring land or for constructing buildings for conducting business at a new place. This could be used to encourage participants to join EIPs.

A modified value added tax credit has been extended to manufacturers of pollution control equipment, reducing the cost of production by 6 to 7per cent.
The government has listed machinery on which it will allow an investment allowance of 35 per cent on the actual costs of purchases expected to assist in pollution control or conservation of the environment.

Donations given to any association or institution for programs on conservation of nature and natural resources are tax exempt.

There are a number of excise and duty exemptions: (a) excise duty is exempted on the production of building materials using fly ash or phosphogypsum in 25 per cent or more as raw materials; (b) custom duty is exempted on the import of equipment, machinery, and capital goods required for the production of building materials which use fly ash or phosphogypsum; and (c) excise duty is exempted on the production of low cost building materials and components. (Bowonder 1994)

India's Ministry of Non-conventional Energy Sources and state governments offer incentives, concessions, and fast-track approvals for such projects. Most of the projects are expected to generate power for their own use, while some will interface with the government power grid. Thus far, most projects have used wind, solar, co-generation, and mini-hydro electric sources.

Research Partnerships

We outline several clusters for eco-industrial park recruitment, including renewable energy, resource recovery, green chemistry, and support to sustainable farming. All of them will benefit from research support. By-product utilization itself requires technical innovation in materials design.

National R & D policy–makers should work closely with the business and university communities to create an eco-industrial research agenda. There is no reason Asian developing countries should not seek to gain competitive advantage in these emerging areas of opportunity. Clearly Asian markets will be strong in the next decades for advanced business solutions to the environmental problems accompanying their economic growth.

Industrial ecology provides an organizing framework for researching *the systems of technologies and business forms needed to achieve key environmental objectives in an economically feasible way,* not just individual technologies. The example we gave above of a business system for dealing with the pollution of animal manure from feedlots is one illustration. Government support to technological development needs to be guided by awareness of the potential synergies among separate lines of inquiry and the way in which a breakthrough in one area may make possible commercial application of several other innovations.

Analysis of the flows of energy, water, and materials in specific watersheds or bioregions is a specific line of enquiry that could support the establishment of eco-industrial networks and the operation of EIPs. Industrial metabolism is the branch of IE that studies the inter-linked natural and human systems as a network of resource flows. Such studies enable regional stakeholders to identify critical threats to human and ecosystem health and to pinpoint strategic points for intervention. Given basic policies seeking to optimize resource utilization, such studies can also be used to identify significant business opportunities. Studies of resource flows in the national economy are also important in setting sustainable resource policy.

To develop this systems approach to technology policy and research in a developing country requires partnering with UN agencies, international aid organizations, overseas universities, and regional research institutes. A number of universities in North America have growing programs in industrial ecology and Cleaner Production, including Yale, the University of Michigan, the University of California at San Diego, and Dalhousie University in Nova Scotia, Canada.

Umbrella Permitting and Programmatic EIA

The one-stop shop is a relatively easy way to implement a level of umbrella permitting. Local jurisdictions in the US and Asian organizations like the Philippine Board of Investments have offices that coordinate permitting activities for a variety of agencies. This streamlines the process for developers and for companies building new plants. When this works well, the agencies coordinate their processes for each client and cut the time and investment required to complete the permitting step. A developer could request this integrated approach for an industrial park development.

For eco-industrial parks there is a more ambitious concept: site-wide or umbrella permitting. This could ease the burdens of environmental management for companies as well as for regulators. This would make site-wide environmental management of materials and energy flows feasible, support the sense of collaboration among tenants on an industrial park site, and provide to them a performance challenge. In many cases it might require clusters within the bubble for different levels of environmental burden. However, it is a solution that raises a number of critical issues. Would each plant be liable for the noncompliance of any plant under the permit? Would it make sense to

lump together large and small companies, or those with very different levels of potential exposure to liability?

Establishing an EIP regulatory "association" would be one effective way to manage regulatory permitting and compliance matters. Through the association, each EIP tenant would pay a weighted up-front cost and monthly fee based on its level of regulated releases. Some of the regulatory association's funds could be leveraged against future environmental liabilities. When considering joint liability, the association could exercise the authority to fine or remove tenants if they remain in noncompliance.

Another way of resolving the issues with site-wide permitting is to design umbrella permits as administrative structures that leave potential liabilities in the hands of each member. The companies would establish limits for the group as a whole, with distribution of these limits negotiated among those under the permit.

The EIP management could be the administrator, monitoring environmental performance, handling regulatory reporting, and providing feedback to company personnel. A goal of this system would be to reduce time devoted to regulatory issues by companies and regulators. So long as the environmental performance for the EIP as a whole was within targets (both regulatory and self-imposed), companies would have more flexibility in managing individual performance. At the same time, peer pressure rather than external policing would create the sanctions needed to regulate plants that are outside of limits. Another useful variation is to create different umbrella permits for different groups of companies, depending on their size and potential exposure to liability.

Levels of EIP financing

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There are at least four levels of the project's development that require financing and management:

1. Completion of predevelopment feasibility and engineering studies;
2. Development of the EIP's physical infrastructure and marketing program;
3. Construction of possible speculative plants and the financing of tenant facilities;
4. Development of supporting institutions like the business incubator and training center;
5. Broader sustainable community initiatives that may provide benefits to the EIP development, such as a community green house gas reductions program.

These four interrelated projects are a model for sustainable local development. They support meeting the business and financial objectives of the property development and at the same time increase the self-reliance of your community and country. At each level they provide a mix of private and public benefits, suggesting that project financing and other support should come from a mix of private, public, and civic (e.g. foundations and other non-governmental funds) sources. The balance between the two will vary by project.

The EIP project may benefit from finance from public and civic sources in its pre-development and design phase. The park can probably fully qualify for private sector

funding in the actual development of the eco-park, however public sources such as industrial development agencies should also be evaluated.

The financing of tenant enterprises and their facilities will generally come from private equity and debt capital sources, though the public sector may provide industrial development bonds or other forms of public support.

Support structures like the incubator and training center will probably qualify for funding from government or international and/or bilateral development banks. Since they will benefit recruitment to the property, it is appropriate that the EIP's private investors should also contribute to their success.
Community development initiatives may also be largely financed from public and civil sector sources, with contributions from the EIP development budget (as part of its investment in mitigating the impacts of development).

This blending of different public, private, and civil sources of support at different levels suggests that the EIP developer should form a number of overlapping public private partnerships (PPP) with members appropriate to each level of the project. These partnerships will seek timely development for the elements they are managing. Through their coordination, the project will derive the mutual benefits stemming from their interaction.

For instance, the developer could seek support for feasibility planning of the EIP from development banks, bilateral banks and aid organizations, and national industrial development or economic development agencies. Where the development includes employee housing, national housing authorities may also help. Generally international funds have to go through a government entity, which then joint ventures with the development company. The public benefits of the EIP in economic development, job creation, and superior environmental performance would repay this public investment. The completed feasibility study then becomes the basis for private investment to develop the infrastructure for the park.

If the land is owned by the government, another sort of public private partnership would work through a phased timetable for acquiring the property. So long as the option for all future parcels is firmly binding, this arrangement would reduce the carrying costs and taxes on the land in each stage of eco-park development. An alternative would be to explore the possibility of the government continuing as owner, providing a long-term lease to secure tenure. The patterns of industrial land tenure are quite different from country to country. In China the government still owns most industrial parks. Thailand is going through a transition from ownership by the Industrial Estate Authority to joint venturing with private development companies.

One of the primary purposes for forming PPPs is to use public funding to offset risks and to compensate for public benefits that projects offer. Thus, using public funds for the more speculative but critical elements–like the land development feasibility study for the EIP–builds the basis for more risk-averse private investors to come in at the implementation stage. For associated projects that will benefit public and private interests alike–like the business incubator–it is appropriate for costs to be shared. On the other hand, large development companies may have the capital available to fully fund all predevelopment activities.

The public private partnership model may appear to increase the number of decision-makers who can impact the course of the financing process. Even when a partner is bringing capital, the conditions on that investment may create costs and risks that are not worth the potential return. This means that developers have to proceed carefully in forming PPPs, define the roles clearly, and limit the range of decisions any partner participates in.

On the other hand, partnering with he community is really another form of efficiency, not an add-on. Having a good place to live for one's employees, a happy and skilled workforce, a peaceful community, and excellent local suppliers all add to the competitive advantage of the development.

Decentralization

Decentralized Infrastructure: An alternative model for consideration

Conventional approaches to infrastructure development consider large solutions to be the only answer to problems. For instance, approaches addressing the shortage of power in the country automatically consider large-scale generation as the first and possibly only option. Urban Infrastructure requirements such as waste handling and disposal, water supply and sanitation are also approached in the same manner. There is a strong orientation towards the large-scale creation of centralized infrastructure for all situations.

Centralized approaches have however largely failed to provide access to infrastructure services at the last mile. For instance, 80,000 villages in India are yet to receive electricity and of the 'electrified' villages, only 31per cent households have power in their houses. This coupled with the long gestation period, high costs, environment and social issues and time and cost overruns have raised issues about the relevance and viability of this approach for all situations.

There is also the urgent need for ensuring that development impacts reach the 'last mile' to directly benefit the community at large.

Thus the case exists for considering complimentary, more locally focused approaches to development based on commercial principles as a supplement to conventional centralized infrastructure development. It is with this perspective that Uttaranchal can explore an alternative model for development predicated on commercial principles

Public Private Partnerships

Donor programs are based on capacity building and financing of pilots with the accountability being based on the reputation risk for the implementing agencies and monitoring agencies. There is normally no commercial stake for the players and the project risk of failure increases after the donor involvement comes to an end.

Recognizing this as well as its own interest in creating new approaches for "last mile" infrastructure service provision, UA should seek to combine the development agenda of development agencies and commercial principles through DINT projects. The models

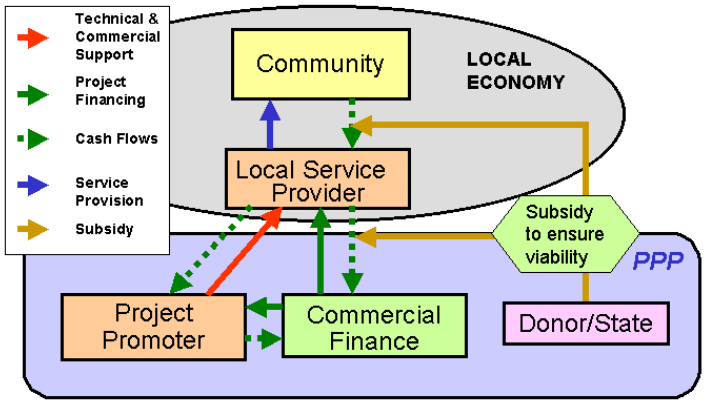
being explored are based on commercial risk return principles with the leveraging development financing.

DINT projects are not completely commercially viable due to the nature of the beneficiary as well as the sector. In this connection is a need for soft funding/subsidy to cover the following:

- Project development costs
- Subsidy to reduce user payment requirements
- To create risk mitigation/sharing facilities to reduce risk and remove the barriers for commercial finance

A schematic representation for a DI model is shown below

Figure III-1 A model for decentralized infrastructure



The premise is that private sector collaboration with the development sector would help projects to provide last-mile impact and would be expandable and sustainable even after the development support comes to an end. It also works on the model of increasing leveraging of the development finance to move towards greater commercial viability. The model seeks to address

- Stakeholder/beneficiary interest in project that should sustain after the project development process

- Reduced monitoring and evaluation costs as the commercial model is seen as self regulating

It is predicated on that if pilot developmental projects are successful then they can be easily replicated with the subsidy coming from the state. In a sense for the pilots, the donor is a proxy for the state role for enabling development and poverty alleviation.

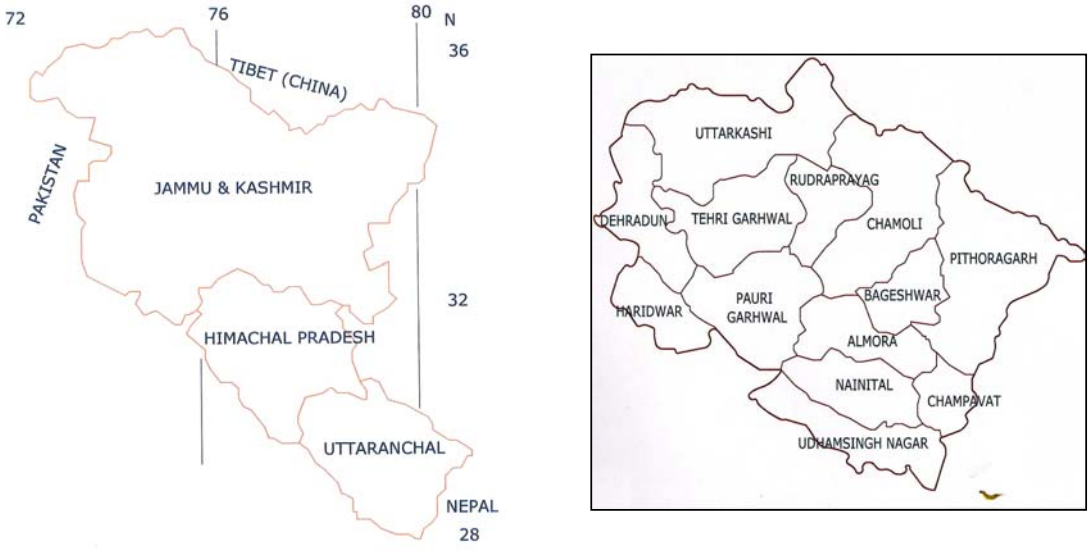
IV. LAND AND PEOPLE

A. *Introduction*

The state of Uttaranchal is located between latitudes 29°5' -31°25'N and longitudes 77°45' - 81°E and covers a geographical area of 53,485 km^2. The river systems demarcate the boundaries with neighboring states of Himachal Pradesh, separated by Tons River in the northwest, and Kali River separating it from Nepal in the eastern region. Starting from the foothills in the south the state extends up to the snow-clad peaks of the *Himadri* abutting Tibet.

Uttaranchal was carved out of the state of Uttar Pradesh and granted the status of a federal state on November 9th, 2000 as the 27th state of the Indian Union. A century ago, under the British, the region was composed of the Kingdom of Tehri and parts of the United Province of Agra and Awadh. In 1935, the name of the latter state was shortened to the United Province. In January 1950, the United Province was renamed as Uttar Pradesh.

Figure IV-1 Location of Uttaranchal



Source: adapted by IDFC from Maps of India

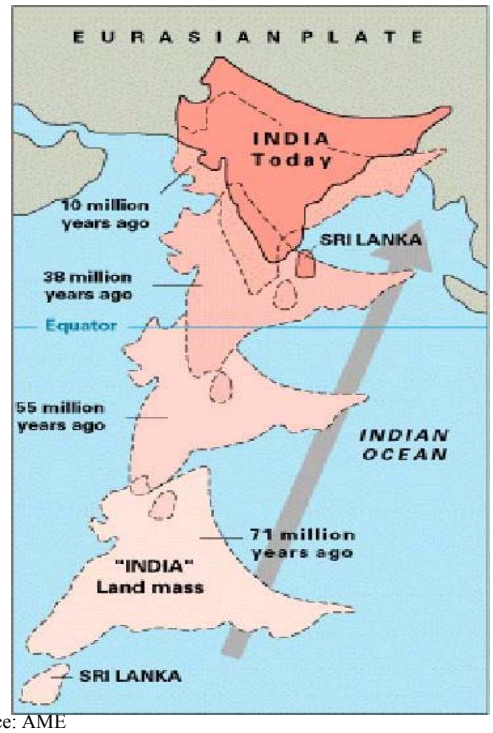
B. *Geological Setting and Physiography*

Uttaranchal is the epitome of diversity – geographical, floral and ethnic. The southern extremes of the state lie in the Terai region of Udhamsingh Nagar District and the Ganga-Yamuna Doab[6] region of Haridwar District. The northern extremes are in the Trans Himalayan region. The difference in altitude between the lowest parts and the snow peaks of Nandadevi is almost 7000 meters.

6 Alluvial Plain between two rivers.

The geology of Uttaranchal reflects billions of years of earth's history and is the action ground for current tectonics. The continuing evolution of the Himalayas is reflected in its seismicity and active land movements. The Indian Plate is among those which have had the most extensive movements in the last 100 million years (Fig 2.2)[7]. Currently the Indian Plate is estimated to be overriding the Eurasian Plate at an estimated rate between 2.5 cm to 6 cm /year. The global geotectonic environment has left a strong imprint on the region and is continually altering it to present dynamic landforms and distinct changes that are not only restricted to Uttaranchal but to the entire Himalayan-Indo-Gangetic region of India and continuum of mountain along Hindu Kush Himalayas. This is shown below.

Figure IV-2 Geological formation of the region



Source: AME

Uttaranchal's tectonic imprint is a result of three major latitudinal fault zones extending across the region. South to North, they are:

1. Foothills fault
2. Main Boundary Fault
3. Main Central Thrust
4. Indus Suture Zone

Longitudinally the tectonic features are the re-entrant thrusts along the major rivers - the Yamuna, Ganga, Ramganga and the Sarada. These have the imprints of the newer movements over pre-existing ridges now buried under the alluvium of the Indo-Gangetic plains.

7 Understanding plate motions [This Dynamic Earth, USGS].htm

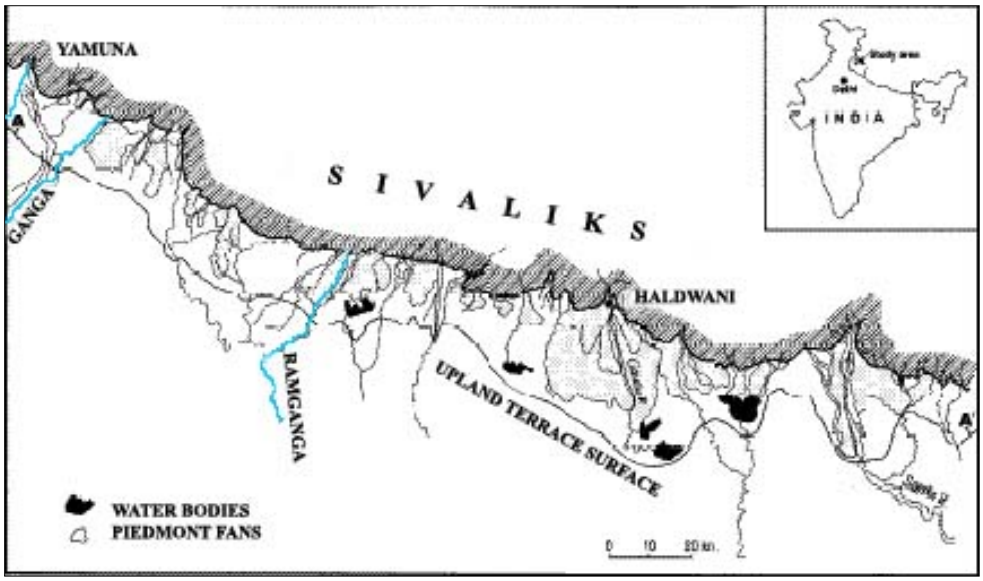
The southernmost zone is the Foothills fault that is all along the foot of the Shiwalik hills. This is not a single fault extending throughout but a series of overlapping and sometime interlacing faults across which the land mass has moved significantly.

The relative movement between the plains and the Shiwaliks should be seen from the perspective of the hundreds of meters of alluvial material that has accumulated with a thickness of over 500 meters and the heights of nearly 1600 meters attained by these hills. This continual upheaval and burial has brought about a unique physiographic situation in the region south of the Shiwaliks.

The streams of Shiwalik form a system of coalescing alluvial fans and cones due to their high gradient and dramatic decline in slope. The zone close to the hills is almost wholly comprised of boulders and conglomerates, and is highly permeable. This zone is called the *Bhabbar*. The streams lose their watercourse into this zone and are mostly seen as dry beds of boulders. During monsoons these stream flow as torrents for very short durations. The streams, which lose their course in the Bhabbar, reappear as springs marking the northern edge of the Terai.

The *Terai* belt immediately to the south of the Bhabbar is composed of the fine material at the edge of the fans and cones. This is often marshy with very shallow ground water levels and water bodies.

Figure IV-3 The Piedmont Zone



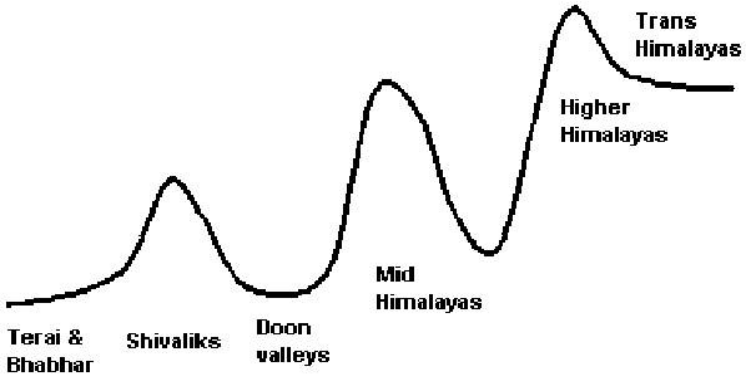
Source: AME

This "Piedmont zone" indicated in the figure above, developed adjacent to the Himalayan foothills and forms the northern limit of the Ganga Plain. The entire Piedmont surface has been formed in the geologically recent times. Incorporating gravelly Bhabbar and Terai areas, the Piedmont zone is made up of discrete coalescing alluvial fans, forming a 10–50 km wide belt adjacent to Himalaya, The Bhabbar belt is 7–15 km wide, and away from the Shiwalik hills, it grades into a 10–40 km wide belt of Terai. Along the Himalayan front it shows an unequal development from east to west.

The Shiwalik hills with its rugged topography are very recent in origin, being only 18.5 million years old compared to Himalayas (40 million years old), Vindhyachal (1,000 million years old) and Eastern Ghats (2,500 million –3.5 billion years old). The sedimentation of Shiwaliks (Tertiary rocks) took place broadly in three cycles i.e. (i) Lower Shiwalik during Early Pliocene (ii) Middle Shiwaliks during Mid Pliocene and (iii) Upper Shiwalik during Early and Middle Pleistocene during Himalayan tectonic upheavals. The Shiwalik system is a 5,000 meters thick detrital stratified mass of sandstone, sandrocks, mudstone, and conglomerates. The modern sedimentation in the Indo-Gangetic plains is very similar to Shiwalik formation except that with the passage of time the latter became compact and elevated due to fault and thrust movements. The presence of conglomerate faces in the upper Shiwaliks suggests that deposition took place during decreased sinuosity of the streams due to increase in gradient. Due to decrease in sinuosity with the time, the sedimentation rate increased from 17 cm per thousand years in the Lower Shiwaliks to about 45 cm per thousand years in the Upper Shiwaliks. This is clearly indicated by the presence of hard sandstone in the Lower Shiwaliks and loose fragile mass of sand rocks and conglomerates in the Upper Shiwaliks.

The *Duns* are longitudinal valleys formed between the northern slopes of the Shiwaliks and the southern slope of the first ranges of the Lesser Himalayas. The Dehradun is the best pronounced of these valleys and is nearly 100 km long with a maximum width of about 45 km. As we proceed eastward the valleys become smaller in dimension. The Duns are composed of gravels, conglomerates, sand and silt and form excellent ground-water aquifers.

Figure IV-4 Schematic of State elevation



Source: AME

Beyond the Duns the Lesser Himalayas form a belt largely comprised of metasediments. The Lesser Himalayas have a very complex geology difficult to reconstruct mainly because of two reasons. First, there are numerous thrust sheets that move older rocks above the younger ones to great distances. Therefore, at many places what we see is an inverted stratigraphy. Secondly the rocks are generally devoid of fossil remains that would have helped determining the relative age of rocks.

The Duns marking the beginning are separated by the second major tectonic lineament from the South, the Main Boundary Thrust, Lesser Himalayas. The Main Central Thrust separates the Lesser Himalayas and the Higher Himalayas. Both these thrusts

are active, though the movement along the Main Boundary Fault is less discerned. The Main Central Thrust is the zone around which recent seismic activity has been maximum. The Lesser Himalayas attain a maximum height of around 3500 meters.

The Higher Himalayas or the `Himadri', in which lies the zone of permanent snow, attains a maximum of nearly 8000 meters. Mount Everest is in the eastern continuation of this zone. The rocks are crystalline in nature and are often called the Central Crystallines. The Indus Suture Zone separates the Higher Himalayas and the Tibetan Plateau, which is the physical expression of the co-joining of the two large continental masses. The rocks here are marine sedimentaries with fossils.

Table IV-1 The sub regions & administrative areas

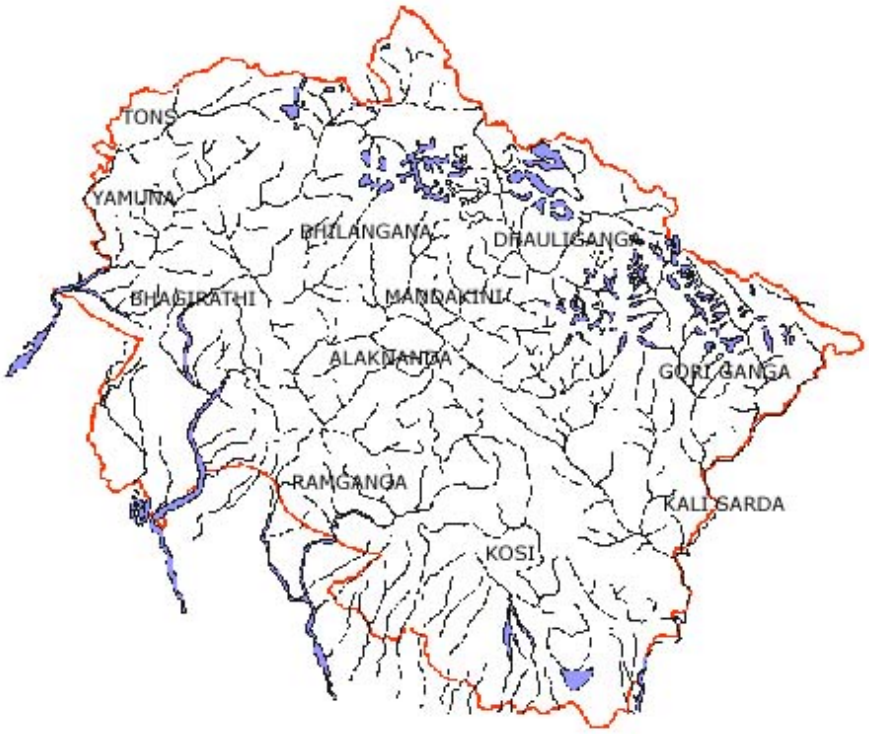
	Sub-regions	Yamuna-Ganga	Ganga-Ramganga	Ramganga-Sarda
1	Terai and the alluvial plains	Parts of Haridwar District	Kotdwar Tehsil areas close to Najibabad	Udhamsingh Nagar
2	Bhabbar	Few Settlements of Haridwar District	Kotdwar tehsil, Pauri Garhwal	Udhamsingh Nagar, Nainital, Champawat
3	Shiwalik Hills	Parts of Haridwar District (Southern Slopes) Dehradun (Northern Slopes)	Pauri Garhwal	Nainital and Champawat Districts
4	Duns	Dehradun Dehradun Tehsil	Chaukambhadun and Kotharidun Parts of Pauri District	Patlidun, Kotadun Parts of Nainital District
5	Lesser Himalayas	Chakrata Tehsil, Parts of Tehri, Rudraprayag and Uttarkashi Districts	Pauri, Chamoli, Rudraprayag	Nainital, Champawat, Almora, Pithoragarh
6	Higher Himalayas	Uttarkashi District	Chamoli District	Nainital, Almora, Bageshwar, Pithoragarh
7	Trans-Himalayas	Uttarkashi District Bhatwari Tehsil	Chamoli District	Pithoragarh

Source: evolved from maps of Uttaranchal by AME

C. Drainage

Most of the perennial rivers are snow fed and originate in the Tibetan plateau or the Himadris.

Figure IV-5 River drainage in Uttaranchal



Source: adapted by IDFC from Maps of India

The northern parts of districts of Chamoli and Uttarakashi, most of which lie in the snow covered zone, provide the most important reservoirs of water. Most rivers form part of the Garhwal Himalayas, the drainage system of which falls under:

1. The Ganga System
2. The Yamuna System
3. The Ramganga System

Tons river marks the north-western boundary of Uttaranchal. Tons is formed by two rivers the Rupin and Supin with their confluence at Naitwar. The flow recorded at Tuni downstream of Naitwar is an average of 78.9 cum/sec. East of Tons is the River Yamuna. The flow of Yamuna recorded at Naugaon is 86 cum/sec. The total quantum of water estimated over the year at Paonta Sahib after the confluence of Tons is nearly 80 million cum, which flows down to the plains.

East of Yamuna is the river system which forms the Ganga. The main rivers in the upper reaches are the Bhagirathi, Bhilangana, Mandakini, and Alaknanda. Bhilangana joins Bhagirathi at Tehri, just upstream of the Tehri Dam. Mandakini joins Alaknanda at Rudraprayag. The Dhauli Ganga, Vishnu Ganga, Pindar and Nandakini are important tributaries draining into Alaknanda before its confluence with Mandakini. The confluence of Bhagirathi and Alaknanda is at Deoprayag, beyond which it is called the Ganga. The estimated flow of Ganga at Rishikesh is 27 billion cum.

Among the major rivers to the east, the Western Ramganga is the only major non-glacial perennial river emerging from the Dudhatoli ranges.

River boundaries and international disputes

In the 1990s, development projects on the Mahakali River raised a serious controversy between India and Nepal. The Mahakali, which also is known as the Kali (called Sarada in India), flows along the Nepal-India western border. The river was fixed as the western boundary between Nepal and British India in 1816, by taking the mid-stream of the river as the boundary, which later on became a source of conflict. In December 1991, India and Nepal signed a Memorandum of Understanding (MOU), which allowed India the use of 577m of Nepalese territory required for the construction of the left afflux bund for its Tanakpur Barrage in exchange for 10 million units of electricity, as well as of 150 cusecs of water for irrigation.

This issue became extremely controversial in Nepal internally. The Nepalese opposition, raising concern for Nepal's territorial sovereignty, argued that while signing the agreement, the Koirala government which was then in power had overlooked Nepal's national interests to appease India. The Indian government resisted any change in the agreement on Tanakpur. The controversy remained hotly disputed for five years. In December 1992m Nepal's Supreme Court ruled that the MOU was in fact a Treaty, necessitating ratification. Subsequently, the Nepali Congress Party lost its majority status in the mid-term elections in 1994, but made a coalition government. In December 1995, during the Katmandu visit of the Indian Foreign Minister, the Treaty was re-negotiated. It was now called 'Integrated Development of the Mahakali River including Sarada Barrage, Tanakpur Barrage and Pancheswar Project' and was signed in February 1996.

The Tanakpur Barrage is linked with the Sarada Barrage, which was built in the 1920s when an agreement was signed between British India and Nepal to exchange 4000 acres of the eastern flank of West Nepal. The Pancheshwar Multipurpose project to be built on a stretch of the Mahakali would generate 9 billion units of electricity, to be consumed mostly by India. It provides water for irrigation from Tanakpur Barrage as well as protects environmental needs below Sarada. The project will inundate 134 square kilometers of land (54 in Nepal and 80 in India) and is likely to directly displace 65,000 people (15,000 in Nepal and 50,000 in India).

The Mahakali Treaty was ratified on September 20, 1996 by the Nepali Parliament. The new treaty was as contentious as the old, especially Clause 3. According to the Nepalese government's interpretation, Clause 3 meant that both countries have equal rights to the water of the Mahakali and not equal rights to the water remaining after accounting for existing uses, which compromised Nepal's right to a 50 percent share of the waters of a border river. If Nepal does not use its equal entitlement of water of the border river and allows it to flow downstream, she cannot trade or claim financial or other benefits from this unused portion of its rights.

The Mahakali Treaty has been widely criticized by the Nepalese environmentalist groups on the basis of non-viability of large-scale water infrastructure projects. The agreement has failed to address the associated social and environmental factors and has not involved ordinary people in the management of shared water resources, despite being the most affected party. Officials have stopped the survey for constructing a re-regulation Dam under the proposed Pancheswar Project at Purnagiri in far-western Nepal following protests by the local people, as the Purnagiri Dam, if constructed, would submerge the fertile land of Jogbudha, Alital and Shirsha in Nepal and affect more than 50,000 people on the Nepali side.

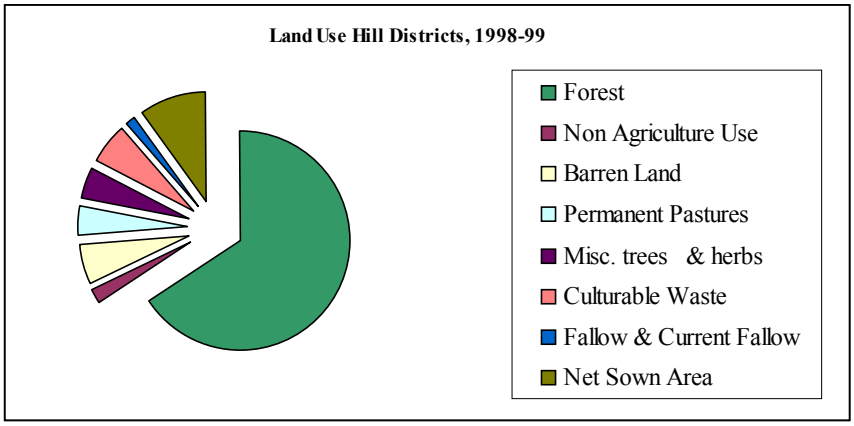
Source: "Water disputes in South Asia" by Farzana Noshab and Nadia Mushtaq, ISSI, 2003

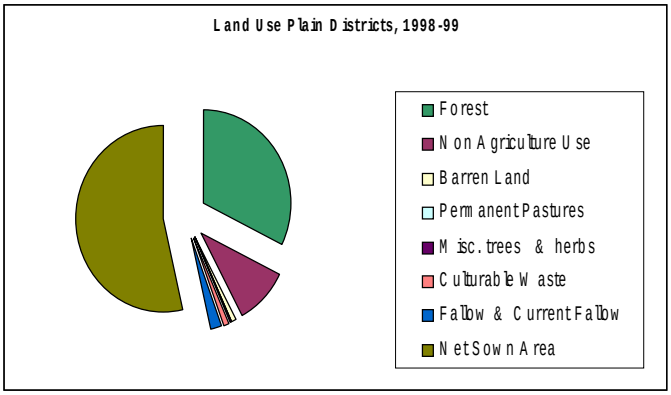
The Ramganga East flows from the Namik Glacier and meets Ladhiya at Rameshwar and drains into the Kali River. Saryu, Gori and Dhauli also drain into the Kali river which marks the boundary with Nepal.

D. *Land Resources*

The figures below present details of land use for Uttaranchal for the plain districts and the hill districts for the year 1998-99.

Figure IV-6 Land use patterns in Uttaranchal





Source: Govt. of Uttaranchal

Forest land is the major land use in the hills of Uttaranchal and the forest department is the sole owner of the forest land. A clear distinction can be made between land use patterns in the hill and the plain districts in terms of net area sown, barren land, culturable waste, permanent pastures. Some of these classifications show degradation in the upland lowland ecosystems and the others indicate the important role certain land use(s) play in maintaining the ecological balance. For example, the culturable waste land and fallow lands are generally lands left fallow temporarily to regain soil fertility. The districts of Pauri Garhwal, Chamoli and Rudraprayag have considerable percentage of barren and fallow lands (see Table II.2)probably because of the cultivation practices. A mere 10 per cent of the area is sown in the hill districts, given the constraints of irrigation and physiography; whereas the sown area in plain districts is more than five times that of hills.

The issue of land settlement is directly linked with the land use in Uttaranchal Certain phenomena, which are most common in Indian Himalayan region, and that exist in Uttaranchal too, are the presence of permanent pastures, miscellaneous trees and herbs

on which people depend for their livelihoods. The Dudhatoli pastures, which are immense in terms of rich water resources feeding downstream ecosystems and healthy micro-climate, sustain around 400 villages for livestock feeding.

Table IV-2 District-wise land utilization pattern of Uttaranchal (1998-99)

Districts	Reported Area	Forest	Non Agriculture Use	Barren Land	Permanent Pastures	Misc. trees & herbs	Culturable Waste	Fallow & Current Fallow	Net Sown Area
Uttarkashi	817631	726290	6758	19736	13648	7478	8911	3835	30975
Chamoli	644395	439420	11311	10310	013644	22105	20845	1067	32903
Bageshwar	138913	65928	3846	7094	13384	10247	13262	1866	23286
Pithoragarh	480089	267693	11166	19106	60075	32527	39721	10099	39702
Rudra Prayag	202682	87314	6366	58028	7680	12442	11733	600	18519
Tehri Garhwal	574542	397199	11647	12927	3015	24	77013	8934	63783
Nainital	411073	300153	8719	3025	1211	16306	26792	5381	49486
Almora	585219	323472	13795	25440	47998	36749	47562	6692	83511
Pauri Garhwal	752728	444341	16748	32777	41449	58940	42489	17217	98767
Champavat	168011	73557	4965	8497	26716	14465	17665	4490	17656
Dehradun	304894	207400	19941	1865	53	4447	12690	7496	51002
Haridwar	233506	72475	26320	2044	49	281	2107	5727	124503
Udhamsingh Nagar	278678	93205	24742	1117	18	1022	3653	4897	150024
Hill Districts	*5080177*	*3332767*	*115262*	*29159*	*5228873*	*215730*	*318683*	*67677*	*509590*
%		65.60	2.27	5.74	4.51	4.25	6.27	1.33	10.03
Plain Districts	*512184*	*165680*	*51062*	*3161*	*67*	*1303*	*5760*	*10624*	*274527*
%		32.35	9.97	0.62	0.01	0.25	1.12	2.07	53.60
Uttaranchal	*5592361*	*3498447*	*166324*	*29475*	*6228940*	*217033*	*324443*	*78301*	*784117*
State Percentage		62.56	2.97	5.27	4.09	3.88	5.80	1.40	14.02

Note: All figures are in hectares

Hll districts include Uttarkashi, Chamoli, Bageshwar, Pitthoragarh, Rudraprayag, Tehri Garhwal, Nainital, Almora, Pauri Garhwal, Champavat and Dehradun Plain districts include Haridwar and Udhamsingh Nagar

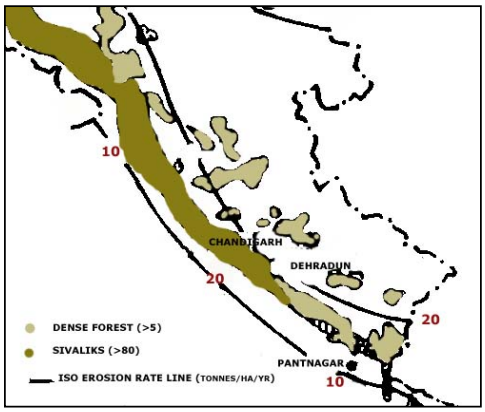
Source: *Uttaranchal At A Glance 2002-2003*, GoUA

E. Soils

The soils in the state are alluvial, riverine, non-calcerous to moderately calcareous soils, and have been carved out by the fast flowing rivers draining the Himalayas. Limited distribution of red soil is also found in the Garhwal region. Forest soils, which occur under coniferous and deciduous forest in the Shiwaliks and lower Himalayas, are rich in organic matter. Himalayan foothill/Terai soil is found along a narrow zone in the foothills. These soils are adversely affected by two chronic factors – heavy and frequent floods that result in an increase in the proportion of micaceous sandy material and frequent spells of prolonged drought. Dabar soils or mountain/hill soils is the collective terminology used for various types of soils occurring at very high elevations, under a wide range of forest types ranging from chir pine to fir, spruce, oak and rhododendron.[8]

Figure IV-7 Soils in the State

8 See annexure for detailed description of soil types.



The iso-erosion map for India indicates soil erosion rate of 20 tonnes/ha/year in Uttaranchal. The maximum erosion - (>80 tonnes/ha/year) occurs in the regions adjoining Shiwalik range. However, observations have shown that the degradation rate in some parts of plains of Udhamsingh Nagar and Haridwar is slightly lower (nearly 5 tonnes/ha/year). Soil erosion is more in regions lying in Himachal Pradesh where mining activities have been taking place from long. Soil erosion rates in the lower and middle hill districts of Uttaranchal are also approximately 5 tonnes/ha/year; in some areas they are lower due to the presence of dense forests.

F. Demographical details

The state and district wise demographic distribution could be summarized as follows:

Table IV-3 Population, decadal growth rate, sex ratio and density – 2001

State/District	Population 2001			Decadal growth rate		Sex ratio		Density	
	Persons	Males	Females	1981-1991	1991-2001	1991	2001	1991	2001
Uttaranchal	*8,479,562*	*4,316,401*	*4,163,161*	*24.23*	*19.20*	*936*	*964*	*133*	*159*
Uttarkashi	294,179	151,599	142,580	25.54	22.72	918	941	30	37
Chamoli	369,198	183,033	186,165	21.97	13.51	982	1,017	43	48
Rudraprayag	227,461	107,425	120,036	17.51	13.44	1,094	1,117	106	120
Tehri Garhwal	604,608	294,842	309,766	16.59	16.15	1,048	1,051	128	148
Dehradun	1,279,083	675,549	603,534	34.66	24.71	843	893	332	414
Garhwal	696,851	331,138	365,713	9.05	3.87	1,058	1,104	124	129
Pithoragarh	462,149	227,592	234,557	14.11	10.92	992	1,031	59	65
Champawat	224,461	110,916	113,545	34.22	17.56	945	1,024	107	126
Almora	630,446	293,576	336,870	9.43	3.14	1,099	1,147	198	205
Bageshwar	249,453	118,202	131,251	14.92	9.21	1,055	1,110	99	108
Nainital	762,912	400,336	362,576	30.01	32.88	881	906	149	198
Udhamsingh Nagar	1,234,548	649,020	585,528	44.46	27.79	863	902	332	424
Haridwar	1,444,213	773,173	671,040	28.44	26.30	846	868	485	612

Source: *Census of India, 2001*

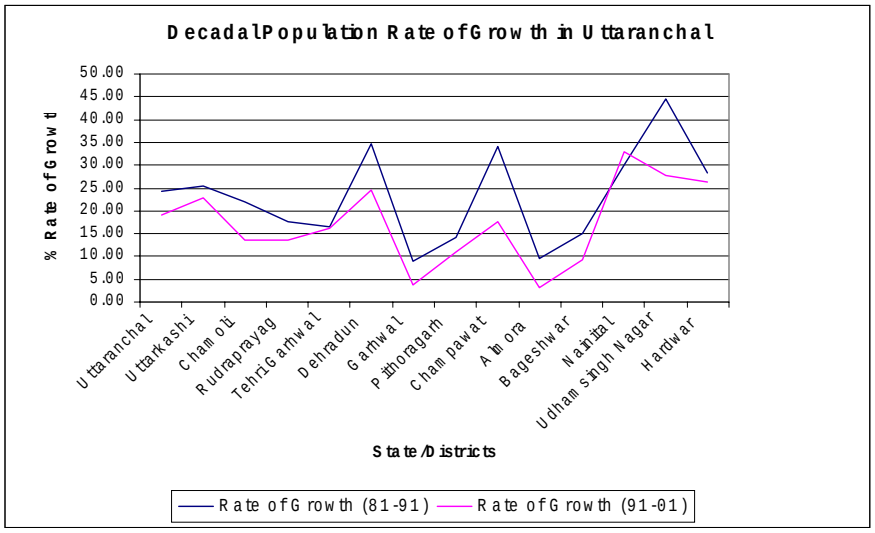
The rural population constitutes 74 per cent of the total population in the State with almost equal percentage of male and female population. 80 per cent of the workforce is from the rural areas, with 42 per cent of the female workforce, which shows that women in this region are prime players in the occupational sector. In the rural sector 35 per cent of females are engaged as main workers and 58 per cent are engaged as marginal workers.

Decadal Population growth

The figures clearly indicate that during the past two decades (1981-91 and 1991-01) the population growth rate has been decreasing, except for district Nainital where a slight increase of 1.5 per cent is observed as compared to the previous decade.

The state figures for the year 2001 also indicate a fall in the rate of growth from 24.23 per cent to 19.20 per cent. This may be attributed to the out migration of people from Uttaranchal in search of.

Figure IV-8 Population Growth in the State

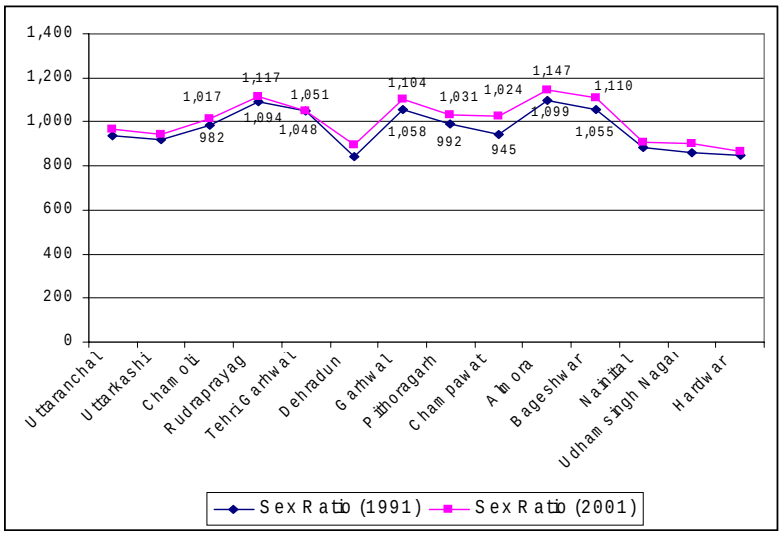


Source: adapted from *Census of India, 2001*

Sex Ratio

It has been observed that many districts in the state have a high number of females than the state average of 936 in 1991 and 964 in 2001. It is interesting to note that eight out of thirteen districts have a sex ratio of more than 1000.

Figure IV-9 Comparison of sex ratio in Uttaranchal - 1991 and 2001



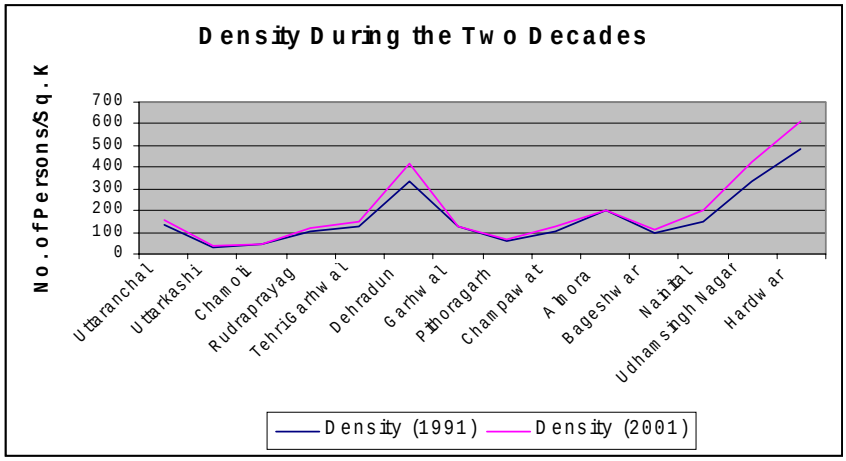
Source: adapted from *Census of India, 2001*

Five districts were found to be below the state average of 936 females per 1000 males in 1991 (lowest being 843 for Dehradun) and remaining eight districts were above the state average (highest being 1099 in Almora).

Population Density

The situation is similar as far as the number of districts above and below the average state level (lowest being Haridwar with 868 and the highest being Almora with 1147).

Figure IV-10 Population Density variation



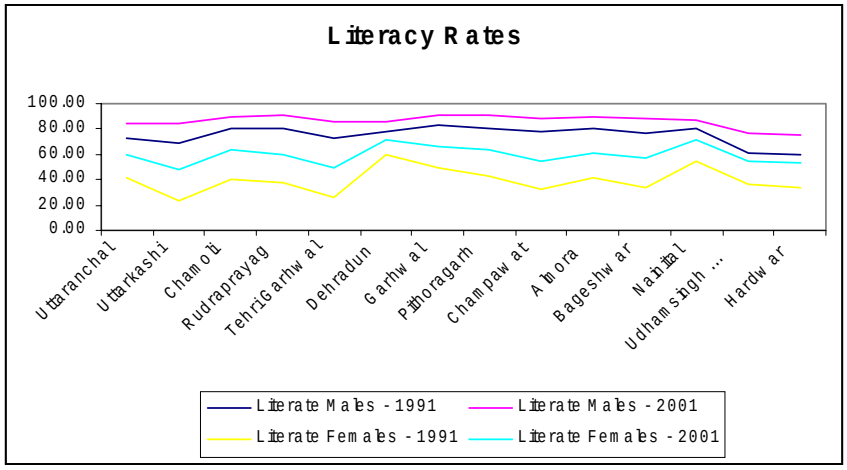
Source: adapted from *Census of India, 2001*

The density of population has increased tremendously in the last two decades in the plain regions of Haridwar, Udhamsingh Nagar and Dehradun, unlike in the hilly regions, where the land is limited.

Literacy

The literacy rate in the state has gone up from 57.75 per cent in 1991 to 72.28 per cent in 2001.

Figure IV-11 Literacy rates



Source: adapted from *Census of India, 2001*

There is a rise in male and female literacy across the districts, with male literacy rising from 72.29 per cent to 84.01 per cent, and female literacy from 41.63 per cent to 60.26 per cent. The comparatively lower levels of literacy rates for women may be attributed to the out migration of male population; as women's workload and responsibilities have increased, they are often forced to sacrifice education.

Remoteness and Isolation

Most of Uttaranchal is hilly, except the districts of Haridwar, Udhamsingh Nagar, and part of Dehradun. The settlements are located in remote and isolated places, as can be seen from the table given below:

Table IV-4 Village Proximity to Roads

S. No.	Distance from Road	Villages (%)
1	< 1 Km	41.51
2	1-3 Kms	17.25
3	3-5 Kms	13.32
4	> 5 Kms	27.92

Around 41per cent of the total villages can be termed as absolutely remote and isolated from the mainstream. Lack of social and physical infrastructure in these locations has been a challenge which the rural community has lived with so far.

G. Rural & Urban Population

Uttaranchal is predominantly rural with only 25 per cent urban population, which is mainly concentrated in the three districts of Udhamsingh Nagar, Haridwar and Dehradun.

Table IV-5 Demographic profile of Uttaranchal

District	Sex Ratio			Rural Population	Urban Population	Urban Population in Uttaranchal
	Total	Rural	Urban	% to total Population	% to total population	District % to Total Urban
Uttarkashi	940	961	727	3.21	0.27	1.06
Chamoli	1017	1070	735	3.77	0.58	2.29
Bageshwar	1109	1120	852	2.85	0.39	1.51
Pitthoragarh	1031	1056	866	4.79	0.66	2.59
Rudraprayag	1115	1127	443	2.65	0.03	0.13
Tehri Garhwal	1049	1108	632	6.43	0.70	2.74
Nainital	906	922	878	5.81	3.18	12.43
Almora	1147	1191	772	6.79	0.64	2.51
Pauri Garhwal	1105	1155	821	7.15	1.06	4.16
Champavat	1024	1056	812	2.26	0.09	0.36
Dehradun	887	910	867	7.15	7.97	31.14
Haridwar	868	879	844	11.77	5.25	20.53
US Nagar	902	915	876	9.79	4.75	18.57
Uttaranchal	963	1006	848	74.41	25.59	100

Source: computed from *Census of India, 2001*

The hill districts are characterized by migration of men folk to other districts and as well as out of the state itself, to look for better employment opportunities. Except for the two plain districts of Haridwar and Udhamsingh Nagar and the hill districts of Nainital and Uttarkashi; the state represents misbalanced sex ratios, specifically high in rural areas and low in urban areas. These have been due to a little sectoral development in these districts in terms of household industries and small-scale industries, where people have got employment as industrial workers.

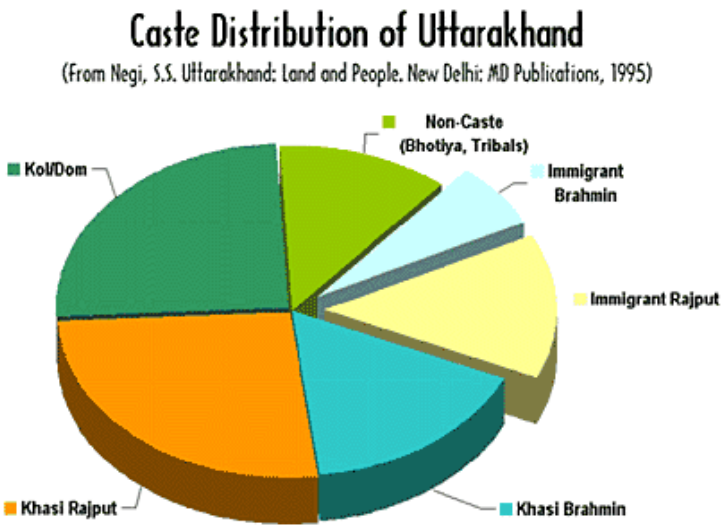
Urban population in the plain districts is 39 per cent. Dehradun is the most urbanized district, followed by Nainital.

H. Caste Stratification of Garhwalis and Kumaonis

Garhwali and Kumaoni Rajputs are generally the main cultivators of Uttarakhand, dominating the villages (45-60 per cent of the population). A few Brahmins also farm. Kols or Doms (collective name for indigenous low-caste groups) generally have little or no land and engage in little agricultural activity, while the artisan castes create traditional implements that farmers use. Artisan and low caste groups provide a diverse array of services to the entire community (e.g., barber, blacksmith, carpenter-mason, weaver, drummer - "Bajgi" or "Auji" - also engage in shamanism, singing, tailoring, and basketmaking). Unlike in the plains, the Rajput (Thakur and Khasi) farmers do no usually employ sharecroppers or tenant farmers as their lands are small and cultivated by single families. As such, the problems of landlordism have not arisen to the extent they have a short stone throw away in the Terai.

There is no indigenous trader class, which also sets Uttarakhand culture apart from those of the plain. However, all Uttarakhand castes and especially the Bhotia migrants (Tibetan-speaking Buddhists) often engage in commerce.

Figure IV-12 Caste Distribution in the State



Tribal communities

Apart from the mainstream populations, Uttaranchal is the home to the following tribal communities. Among these the Van Rajis are among the rare groups in the country, which are threatened with extinction.

Table IV-6 Tribal communities in Uttaranchal

Name of Tribes	Population (1991)	I. Localities in Uttaranchal
Van Rajis	416	Border area of district Pithoragarh, Champavat, Udhamsingh Nagar
Buxas	40167	Udhamsingh Nagar, Terai of Nainital, Haridwar, Pauri & Dehradun.
Jadh		Neelang and Jadhang Villages of Uttarkashi District
Bhotia and Marchas	23410	Border district of Chamoli, Uttarkashi, Bageshwar and Pithoragarh in the NE of Uttaranchal.
Tharu	66123	Udhamsingh Nagar
Jaunsari	66948	Chakrata Block, District Dehradun

Source: Uttaranchal Decentralized Watershed Management Project, Watershed Management Directorate, 2004

Marchas

The Marchas, of mongoloid origin and related to the Bhotias, inhabit the cold and dry Painkhanda tract in Upper Chamoli. Mana, the last village on the Indian side of the border with Tibet, lies in the Mana Valley has the largest settlement of the tribe. The

other important settlement is at Niti, in the Niti Valley, to the east of Mana Valley. Both valleys are almost exclusively inhabited by the Marchas, though some Duryals and Tolchas may also be found there. The Mana and Niti passes were used by the tribe to crossover into Tibet for trade, which flourished till the Indo-Chinese War in 1962.

The Marchas live in an extremely inhospitable environment, particularly in winter when the cold weather forces them to migrate to the lower areas, thereby completely deserting their villages for 3 to 4 months. Their houses are made of stones and roofs of slates resting on wooden members.

Besides being traders, the Marchas are also shepherds by tradition. The shepherd families lead a semi-nomadic life. Their animals graze on the rich high altitude pastures in summer and move down to the shelter of the valleys in winter. They sell wool, meat and milk to earn their living. Their wool is a particularly important item of trade with the rest of the country especially since the closure of trade with Tibet.

Marchas prefer to marry within their own community though in recent times inter-community marriages are common.

Jadhs

The Jadhs, again of mongoloid origins, live in the cold and dry tracts of Uttarkashi mainly in two villages – Nelang and Jadhang, both situated at an elevation of about 3,400 m. Communications being poor, the tract often remains cut off from the rest of the country for long periods in winter.

A semi-nomadic, wealthy people, with between 200-400 animals per family, they graze their sheep and goats in the Upper Jahnvi Valley in summer, and move down to the forests near Rishikesh in autumn, returning to their homes in spring. They are often accompanied by Kolis, a caste of weavers considered lower in the social hierarchy.

Till 1962, the Jadhs also traded in cotton, grains, metal, oilseeds and sugar with the Tibetans, buying from them black salt, wool and borax. Today a few of them are into agriculture and allied activities, trade, business, government service. Some Jadhs work as semi-skilled and unskilled laborers.

Bhotias

Bhotias is the common name given to a semi-Mongolian people belonging to the Himalayan group of the Tibeto-Burman family. They live in the northern valleys of Pithoragarh District, most of which are inner dry valleys lying in the rain-shadow of the Himalayan ranges. The Bhotias inhabit the Munisiari and Dharchula sub-divisions of Pithoragarh district. This tract comprises four major valleys and the Bhotias are known by the valleys they inhabit. The inhabitants of the Johar Valley are called Joharis, those of the Darma valley the Darmis, those of the Byans valley the Byansis and those of the Chandans valley the Chandansis.

Traditionally, many members of the Bhotia communities traded with Tibet, supplying Tibetans with food grains, spices, cotton, tobacco and sugar. As they carried their goods on cattle, sheep, goats, ponies and horses, they were welcomed and often paid for squatting on fields they passed by, for the manure provided by their livestock, which

they grazed in forests along their trade routes. This invited severe conditions for lopping and grazing by the British, which often led to conflict.

When the Bhotias indulge in agriculture, they grow varieties of buckwheat and barley. Wheat and amaranth are also cultivated.

Jaunsaries

Jaunsar-Basar forms the northern half of Dehradun District. Tribal people live there and are called the Jaunsaries. They are a feudal society covering the hill-locked region of Chakarta and Purola, and Ranwai of the Uttarkashi District. This area had links with the ancient cultural waves that swept over the northern part of India, particularly during the Vedic, Mahayan, Kushan and Gupta periods of ancient Indian history. The inhabitants follow the old customs even today, distinct from their counterparts elsewhere in Garhwal, Kumaon and Himachal Pradesh. Their physical features, customs, traditions and dress are distinctly different. Even the art and architecture has its unique features, with profound use of woodwork. Polyandry is still common among these people.

Agriculture is the primary occupation, with millets, wheat and barley being the main crops grown. Animal husbandry and artifacts also provide some livelihood. Women are the backbone of the family economy, since they collect firewood, fetch water and have to bear the brunt of social insinuations after attending to the daily chores of life, while the men normally gossip, sit idle or drink.

Van Gujars

The Van Gujars, many of whom are Muslims, are a nomadic pastoral community of Pauri Garhwal and Dehradun districts. They live in these areas in winter, and migrate to the higher hills, including to Himachal Pradesh in summer.

The exact date of their entry into Uttaranchal (then UP hills) is not known, but documents inform that they they started entering the Jaunsar –Bawar in the late 1870s. By 1880s, they were the centre of a controversy, To one group of British administrators, they were a source of revenue: surplus grass in the pastures would be utilized, and they would provide ghee and milk to towns and villages. To the opposers, they harmed the forests, introduced man eating tigers and cattle disease in Jaunsar. The controversy and debates are still ongoing.

Today, the Gujars continue to move in kafilas to the high hills in summer, taking various paths carefully to avoid potential conflict with peasants. Wherever they find grass, they halt for a day or two. With the conversion of the forest areas of Dehradun – a major winter abode of the Gujars – into Rajaji National Park, conflicts have once more arisen between the community and the forest department.

An interesting aspect of Jaunsari and Ranwalta weddings is that the bride goes to the bridegroom's house where the wedding ceremony is performed. The bride's party is feasted followed by lots of merry-making.

The most important festival of the Jaunsaries is the Magh Mela. The Jaunsari festival is an entirely religious affair connected with the Mahasu Devta. Another interesting fair is the Maun fair that is connected with the catching of fish. Bark of the Tejpal tree is collected, and after grinding into powder form is thrown into the water since it has a stunning effect on the fish.

Buksha

The Bukshas are inhabitants of the Terai, although their locality falls in the Western fringes of Nainital (now Udhamsingh Nagar) and borders that of the Tharus. Though they claim descent from Rajputs (like the Tharus they are of Tibetan descent), the Bukshas have merged all their castes and even today, observe only sects (family names) among their people. Bukshas still worship Hindu gods, though also accept the existence of spirits and eat meat. In addition, a Seyana (literally, "Wise One") also administers to their medical/spirit needs.

Bukshas build their houses in two rows, with the space in between serving as a courtyard. As shifting cultivators, the Bukshas made the best of the protection afforded them by the inhospitable and malarial marshes of the Terai. However, since the inmigration of people post-partition and from other states throughout the 1950s and 1960s, the Bukshas have lost much of their land. Many have ended up as laborers for the new masters who gained their land through foul and unlawful means.

Tharu

The Tharus are a tribal Tibetan-related people who originally inhabited the eastern zone of the Terai, along the border with Nepal. They are divided into many sub-tribes, and a majority of them live in Nainital (now Udhamsingh Nagar). As agriculturalists, Tharus tend to have large families that live communally, and it is traditional for brothers to live under one roof. Tharus observe ancient beliefs and like others in the hills, subscribe to shamanism, but also worship Hindu gods. Tharu women, in claiming they descend from Rajput Ranis of Chittor, enjoy a high position in their society, as they tend to play a dominant role in family affairs.

Van Raji

The Rajis, also know as Vanrawats (forest lords) are few in number and live in the forest. They inhabit the woods around Ascot in southern Pithoragarh (now Champawat district), and hold to a tradition of saluting no one except the Ascot Raja. They once practiced shifting cultivation until it was banned by the forest department. Although their agriculture was never well developed, they subsisted on the products of the forests, from edible roots to fruits to the crafting of wooden utensils to trade for other commodities.

The Raji religion also reflects their unique world view, that keeps them aloof from most others around them. For their own gods and some adopted Hindu ones, the Raji construct simple open-air altars with prayer flags and cloth swaying in nearby trees. Their marriage rites are also simple, without Brahmins or a priest.

With the acceleration of development and communication with the outside world, the Raji have struggled to maintain a way of life they greatly value. Onerous forest laws have also made life difficult

J. Livelihoods

The hill areas are sparsely populated, communication is difficult, and many areas are inaccessible. Natural catastrophes such as droughts and landslides are common. The region lags behind in agro industrial development, and the level of poverty is high. The levels of poverty is very varied and the more inaccessible and higher the district the levels of poverty is higher. While in a majority of the blocks, 20 to 60 per cent of the

families are below poverty line, three blocks – Mori and Purola in Uttarkashi and Pratapnagar in Tehri District have a record of over 80 per cent families below the poverty line. The blocks in the plains and the Raipur block of Dehradun are the only few where the population below poverty line is less than 20 per cent.

The hill economy and sustenance systems are typically dependent on primary sector activities, with high number of cultivators in the hill region and small proportion as agricultural laborers in the plain areas. Women dominate as cultivators, especially in the hilly districts of the state in addition to the duty towards animals. Agricultural labor jobs in the hill districts are very minimal and increase in the plain districts viz. Dehradun, Udhamsingh Nagar and Haridwar. Though less impetus has been on industrial activities/household industries, the districts in the Terai lead with a minor contribution of workforce. The hill district of Pithoragarh also shows significant involvement of women in household industry as compared to other districts largely because of the continuation of the tradition of weaving and wool based activities. Services, trade and commerce also lead in the Terai areas of the state.

Table IV-7 Workforce profile of Uttaranchal

Total	Persons	Total population	Total workers	Main workers	Marginal workers	Non-workers
Total	Persons	8,483,355	3,133,281	2,323,518	809,763	5,350,074
	Males	4,321,041	2,005,858	1,647,759	358,099	2,315,183
	Females	4,162,314	1,127,423	675,759	451,664	3,034,891
Rural	Persons	6,312,415	2,501,791	1,752,827	748,964	3,810,624
	Males	3,146,031	1,446,825	1,135,357	311,468	1,699,206
	Females	3,166,384	1,054,966	617,470	437,496	2,111,418
Urban	Persons	2,170,940	631,490	570,691	60,799	1,539,450
	Males	1,175,010	559,033	512,402	46,631	615,977
	Females	995,930	72,457	58,289	14,168	923,473

Source: *Census of India, 2001*

Undernutrition in Uttaranchal

Hilly terrain imposes a heavy burden on the health of the people and aggravates the problem of undernutrition. A project was carried out between April and July 2000 to assess the state of undernutrition among indigenous people in the Garhwal Himalayas of the State of Uttaranchal. The term "indigenous" in this context refers to the native born people of the Garhwal Himalayas, also known as Garhwali. A total of 854 respondents were studied in 3 agroclimatic situations—the high hills, mid hills, and low hills, also classified by as subtropical (250–1200 m), subtemperate (1200–1700 m), and temperate (1700–3500 m)—as well as in rural and urban settings. The study revealed that over 30% of the population suffers from undernutrition, higher than the average of 20%. However, gender did not appear to affect the level of undernourishment. The agroclimatic situation had the maximum negative impact on the nutritional status of the indigenous population. Rural people were found to be more undernourished than the urban population. It may thus be concluded that the groups identified in the study, namely the people residing in the high hills and the rural population, on whom developmental activities should be focused, are relatively undernourished.

(Source: abstract on nutrition status of indigenous people, www.bioone.org)

K. Women of Uttaranchal

Women are the backbone of the hill farming and related sustenance activities. The selective male migration to join the armed forces and the numerous other service oriented activities in the plains leave them to the harsh topography and the care of their family. Several studies have been undertaken on the workload of women in the hills, particularly Uttaranchal, so much so that it has almost become a cliché that drudgery and women in the hills are synonymous.

Agriculture is the mainstay of the people in the state, and women's contribution to agriculture is at all stages – preparing the fields, sowing, reaping, harvesting, threshing, transporting, sorting the grain. They also look after the cattle, carry headloads of fodder, fuel, manure, flour, rock and clay (in case of house construction). They collect grass, firewood, and often also graze the animals in the forests.

In addition to this, they have to continue with the daily household chores of cleaning, cooking, fetching water (often over long distances), weaving, knitting, stitching, and so on. Thus their daily schedule is over 18 hours.

Increased workload on women – Case Study from Pindar Valley

Women are more emotionally attached to the natural resources than men in the Pindar valley. Their strong attachment to natural resources is reflected in the local fights that women have led over ownership and use of livestock, forest and agriculture fields.

Workload on Women in Village Mundoli

Month	Agriculture	Animal Husbandry
Chait - mid April to mid May	FYM application, terrace repair, potato planting	Collect green leaf for sheep / goat and cattle
Baisakh - mid May to mid June	1st hoeing in potatoes, sowing of chuwa	Collect green grass from forest and private land
Jeth - mid June to mid July	2nd hoeing in potatoes, 1st hoeing in Chuwa, harvest wheat, uwa, barley	Collect green grass from forest and private land
Ashad - mid July to mid August	2nd hoeing in chuwa. Harvest and thresh wheat, uwa, barley	Collect green grass from forest and private land
Sawan - mid August to mid September	Weeding in chuwa, sowing of phaphar	Collect leaf litter, wash wool
Bhadon - mid September to mid October	Digging potatoes	Harvest grass
Asoj - Mid October to mid November	Digging potatoes, harvest chuwa	Harvest grass
Kartik - mid November to mid December	Harvest & threshing of chuwa, sowing of wheat, barley, uwa, sarson	Harvest grass
Margshir - mid December to mid January		Harvest grass, grass stacking in heap, collect leaf litter
Poosh - mid January to mid February		Collect green leaf for sheep/ goat and cattle

Magh - mid February to mid March	Transport and apply FYM in fields	Collect green leaf for sheep/ goat and cattle
Falgun - mid March to mid April	Land preparation for potatoes and chuwa	Collect green leaf for sheep/ goat and cattle

L. People and the Environment

The single most important characteristic of the hill community is the high degree of wisdom and recently the high literacy levels attained despite the testing conditions. The very nature of the Himalayan region has helped the people of Uttaranchal evolve sustainable ways of dealing with their natural resources, especially water and forests. Communities have worked together to utilize natural resources in equitable ways, without destroying the balance either between the individual and the community, or between people and nature. Such wisdom has been translated into some of the towering environmental and social movements that have emerged from the region.

V. FORESTS AND BIODIVERSITY

The forests of Uttaranchal are not only indispensable repositories of important plant species that give food, fuel, fodder and shelter, but are also vital for maintaining the ecosystems in and around the state. It is well recognized that forests play a pivotal role in building the socio-economic structures around the primary relationship with the natural resources. The forests are socially and economically interlinked with the people in the hills and play an important role in the general economy and development of the region.

The recorded forest area of the state is 3.47 million hectares, which is around 64.81 per cent of the state's total geographic area. The forests in the state are spread between a very broad altitudinal range of 300m and 3500m. Eight of the sixteen known forest types in India exist here. These forests have varied vegetation types ranging from tropical deciduous to alpine vegetation. The forests can be broadly categorized into two categories: the hill forests and the lower Shiwalik hill forests, more commonly known as Bhabbar and Terai forests

Grasslands and other grazing resources occupy a very important position in the hill agriculture and the grassland utilization is an important component of the hill farming system. Grasslands are found in plains and high altitude. In the plains they are called *chaurs* and comprise of typical grasses, which grow up to a height of 2 m. These habitats are ideal for predators while providing forage and fawning cover for herbivores. The alpine grasslands, locally called bugyals, occur at altitudes above 1000 m.

The herbage utilized during grazing is the largest fodder resource followed by crop residues, tree leaves, concentrates and cultivated fodder. The land constraint has always guided the farmers to utilize most of the cultivated land for food production. Fodder cultivation is the last priority in the hills. This further strengthens the importance of grasslands for the sustenance of huge population of livestock. Besides grazing, these grasslands are also used for harvesting hay which is essential for maintaining the livestock during lean periods.

A. Forest Policies

In 1823 (Saka Samvat 1880), the historic Year 80 Settlement (*saal assi)* was carried out, which saw for the first time, the demarcation of village borders. Villages' common property rights to grazing, cutting trees and collecting firewood were recognized. However, this was accompanied by impacts that would change forever people's relationship with the forests. Prior to the Permanent Settlement, the people settled in those areas where there was adequate supply of natural resources including water. With the Permanent Settlement, people were denied access to several areas that were suited for human habitation, where their presence would not be a burden on the environment. Instead they were forced to expand in areas that had already been allocated to them, creating the first conflicts between population growth and natural resource use and management.

Forest types of Uttaranchal

In the Shiwalik, Bhaber and Terai tracts the main forest type is deciduous forest, Sal being the main species. As one move higher in the Himalayan zone the forests are mainly coniferous, Chir pine being the main species along with some Deodar and Fir forests. The Oaks and other broad leaved species are interspersed with coniferous forests and occupy more favorable areas with better soil and moisture condition. These forests are vital for maintaining the gene pool, biodiversity, ecological balance and productivity. Based on the Champion and Seth, 1968 classification, the following forest types are typical to the state of Uttaranchal:

Moist Alpine Scrub: this occurs at the tree line around an altitude of 3500 m. The major species are *Betula utilis* and *Rhododendron campanulatum.*

Sub-alpine Forests: This type of forests exists at altitudes of 2900 m to 3500 m above sea level in the middle and upper Himalayas. The forests are characterized by patches of *Abeis-Betula* forests interspersed with shrubby growth and grassy patches or alpine grasslands called *bugyals*.

Himalayan Dry Temperate Forests: This type is found in the inner dry trans Himalayan valleys of the state. Major species occurring in these forests is *Cedrus deodara, Pinus wallichiana and Juniperus* species.

Himalayan Moist Temperate Forests: This type of forest is found between the altitude of 1600 to 2900 m in the Himalayas and is characterized mainly by coniferous species such as *Cedrus deodara, Picea smithiana, Abies pindrow, Quercus spp., Betula spp.*

Subtropical Pine Forests: these forests grow in lower regions of the Himalayas and pines are the dominant species.

Tropical dry deciduous forests: these forests occur in the dry southern faces of Shiwaliks and adjoining plains. The forests are open and mixed with *Shorea robusta, Anogeissus latifolia, Terminalia tomentosa etc.* as the major species.

Littoral & Swamp Forests: this type of forest occurs at a few location in the valleys of foothills. The forests are characterized by the presence of moisture loving species such as *Syzigium cumini, Ficus glomerata, Pterospermum acerifolium and Diospyros embrioptyris.* The undergrowth is characterized by the presence of cane *Calamus tenius.*

Tropical Moist Deciduous Forests: these multi storey forests are found in moist regions of the lower Himalayas and Terai arc. This type of forest is characterized by a top storey of deciduous species such as *Shorea robusta, Adina cardifolia, Anogeissus latifolia, Terminalia tomentosa* and a second storey of many species with some evergreen shrubby undergrowth interspersed with patches of bamboo, climbers and canes.

During the early years of British administration, the forests were, at first, not considered valuable. This view changed with the coming of the railways in the mid 19th century, which demanded unprecedented amounts of timber for railway sleepers. It is estimated that nearly two thousand trees had to be cut for laying of one mile of railway track. Railways and new mines led to clear felling of vast stretches of forest.

The recognition that forests constituted an enormous source of revenue stimulated the British to enact a series of forest acts; consequent policies were framed to focus on acquiring forest wealth. The annexation of forests were based on three distinct provisions:

1. Reserved forests – the people would have only concessions, and the government would manage all the land. All types of land use by the people, other than that

allowed by the forest department, was prohibited. Most forest area and other thinly populated lands not under intensive cultivation were brought under this category.

2. Protected forests – which would be controlled by the district administration, but would involve the Forest Department in protecting the resource; all types of land use, other than those especially prohibited by regulation or otherwise, were permitted in these forests.
3. Unclassed forests – these included all lands containing forest cover, but which could not be classified as either reserved forests or protected forests. Some of these forests also coincided with lands categorized as wastelands.

The first Conservator of Forest in India, a Captain Watson, was a police officer, emphasizing the policing aspects of forest administration, which invariably implied the exclusion of forest-dependent people from forest management.

The forest settlement operations including reservation of forests caused great resentment among the local people leading to revision of settlement through the report of Kumaon Grievances Committee. As a result in Almora, Pithoragarh, Chamoli and Garhwal districts an area of forest, almost equal to the area under the control of forest department was constituted as Civil and Panchayat forest and was kept under the control of Revenue department. Tehri Garhwal state forests came under the forest department in 1949 but the Soyam forests of this region like Civil and Panchayat forests remained under the administration of the revenue authorities.

Early Resistance to Forest Management
Excerpted from Ramchandra Guha's "The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalayas"

The changes in agrarian practices consequent on the imposition of forest management had far-reaching consequences for the life of the hill peasant. With their traditional rights severely curtailed, the villagers regarded state forestry as an incursion not sanctioned by custom or precedent. In the forests leased by the British, where the raja had no control, the 'people [had] become the slaves of the Forest Department, the lowest ranger or patrol having more power for good or evil than the Raja and all his councilors.

While 'powerless' to stop such oppression, Pratap Shah had taken back part of the leased forests in 1885- However, forest management, whether under the British or the aegis of the raja himself, produces uniform results with regard to peasant access to forest produce and pasture. Rationalised timber production can only be ensured-as the preceding chapter argues -by the regulation of traditionally exercised rights. As over time the greater part of the revenue of the Tehri durbar came to be realised from its rich forests, the raja steadily introduced a policy of stricter forest conservancy modeled on the system prevailing in British territory. This met with stiff resistance from villagers who 'began to look on the demarcation boundary pillars with suspicion often developing into 'positive hostility'. From its early years forest restrictions were 'much disliked and utterly disregarded by villagers and led to cases of organized resistance against authority'. In response to the difficulties created by the reservation of forests, 25oo people of Rawain a pargana in the north-western part of the state-marched to Tehri to demand an audience with their sovereign. Meanwhile, Pratap Shah died and, according to one chronicler, the peasants took pity on the widowed maharani. Deeming it unjust to put pressure on her, they returned to their homes. Soon afterwards, during the minority of Kirti Shah, the peasants of Patti Ramoli submitted a long list of grievances to the political agent. These included complaints at the extent of began taken by officials, restrictions on the collection of grass and leaves, and various other taxes levied on land and buffaloes. Elsewhere, resentment was expressed at the policy of allowing Gujars (nomadic grazers) to graze large numbers of buffaloes in forest pastures.

The next recorded dhandak concerning forests occurred around 1904 in the patti of Khujni, lying to the south of the capital, Tehri. This was a consequence of the repeated demands for bardaish made by the conservator of forests, Keshavanand Mamgain, and his staff, and the new taxes levied on cattle for which the forests were the main source of fodder. When villagers refused to meet what they regarded as

excessive and unjustified levies, the forest staff entered their homes, broke vessels, and attempted to arrest the strikers. Peasants resisted and beat up Mamgain's men; meanwhile some men fled to Tehri. In an affirmation of solidarity and their democratic spirit, the village councils of Khujni resolved that whosoever did not join the rebels would be expelled from the community.9 Kirti Shah sent a high minister, Hari Singh, to pacify the rebels, who put him under arrest. Like peasant rebels in Russia seeking the tsar's intervention, they were not satisfied with the king's emissary-they needed an assurance from the monarch himself.10 Ultimately, the new taxes had to be lifted and Mamgain's men were withdrawn from forest work in Khujni.

The man who succeeded Mamgain as conservator, Pandit Sadanand Gairola, was to suffer a worse fate at the hands of enraged villagers. Gairola was directing forest settlement operations in the patti 'of Khas. Subsequent developments have been described by the official report on the dhandak:

On December 27th, 1906, the forests surrounding the Chandrabadni temple about 14 miles from Tehri town were being inspected, preparatory to their being demarcated and brought under reservation. It is reported that the villagers both then and previously had taken exception to the reservation of these forests, but it was not supposed that their objections would extend beyond the refusal of supplies and petty obstructions. On the morning of the 28th December, however, about 200 villagers armed with sticks assembled at the camping ground where the officials' tents were pitched and objected to *any* state interference with forests over which they claimed full and *exclusive* rights. They attacked the Conservator against whom they are alleged to have had a special grudge as *a foreigner* to the state, introduc*ing unaccustomed* forest customs and regulations. It is reported that they beat him, branded him with a hot iron, tore down his tents, pillaged his baggage and took away and broke his guns. He is represented as having escaped with much difficulty into Tehri.

Next day, the Raja sent out his brother, with an armed force to quell the disturbance and arrest the ringleaders. The attempt failed. The people gathered from the villages over a considerable tract of country to a number reported to be about 3000, opposed the Magistrate and began to collect arms. The Raja thereupon applied to Government for assistance.

Unnerved by the strength of the opposition to forest conservancy, the raja resorted to a show of force and, when that failed, asked the British for assistance. Clearly, the recurring dhandaks had forced the sovereign to consider new methods apart from those socially sanctioned-to contain discontent.

Two aspects of the repeated protests against state forestry need mention: (i) their localized nature, and (ii) the total isolation from political developments elsewhere in India. The Khas patti dhandak became especially famous for the act of branding the conservator's face with an iron, an act symbolizing a decisive triumph over the inimical powers of forest officials. The incident has passed into legend and different versions are recounted throughout Garhwal even today.

Table V-1 Forest policies

Forest Policy	Thrust Area	Impact
1865 Forest Act	Facilitate acquisition of forest areas, which were defined as “land covered with trees, brushwood and jungle”.	Exploitation of forests for supply of timber for railways Thousands of trees felled in Kumaon & Garhwal which were never removed. The cordoning off of the so-called crown forests began with the 1865 Forest Act.
1868 Forest Act	Enactment of Forest Act and rules formulated	
1877 Forest Reservation Order	1700 sq. kms of land in Almora & Nainital districts brought under the control of Forest Department	Exploitation of Sal forests for meeting government demand.
1878 Forest Act	Provisions of earlier Forest Act revised in order to provide adequate	Large variations between different regions in terms of

Forest Policy	Thrust Area	Impact
	effective control to State Any land could be designated as forest Treatment of customary rights based on privilege and not on right Bar to accrual of any further rights of people on Reserved Forests Conversion of Protected Forests into Reserved Forests as and when required Constitution of third category of forests as village forests	rights of forest dwellers For the first time, as a result of this Act, records started being maintained. While the third category of village forests was created, no forests were included in this category till the 1927 Act was passed.
1894 Forest Policy	First time resolution on forest policy made with the objective of: Regulation of rights & restriction of privileges of the user in the forest by neighboring population Forests on hill slopes to be maintained as protection forests to preserve the climatic and physical conditions of the country and to protect the cultivated plains below from devastating hill torrents Forest reservoirs of valuable timbers to be managed on commercial lines as a source of revenue for states Demand for culturable land to be met from forest area Low inferior forests used for fuel wood, fodder or grazing to be maintained mainly in the interest of local population	Earlier, the exploitation of timber was primarily for the railways. With the 1894 Forest Act, timber began to be extracted primarily for sale. This led to the rapid expansion of the timber industry. Leases granted for paltry amounts
1927 Forest Act	Redrafting of clauses of the 1878 Forest Act	The first village forests were recorded following this Act.
1952 National Forest Policy	Commercialization of forestry Growth of forest based industry	Mixed natural forests clear felled and replaced by mono-crops Fast growing species selected for replacing natural growth Improved accessibility for better exploitation
1988 National Forest Policy	Underscored community participation in protection and development of forests	

Source: compiled from respective policy documents

The first instances of commercial exploitation of forests can be inferred from the changes brought in the Doon forest working plans, drawn in 1887, and highlighting the

use of forests for industrial purposes. Natural forests were felled and replaced by monoculture of commercially viable tree species.

After gaining independence, India formulated the National Forest Policy in 1952; this was revised in 1988-89. The new policy stressed on protection, conservation and development of forests. It laid emphasis on environmental stability, conservation of natural heritage, and for the first time, looked at involving people in forest management, creating people's movement for forest regeneration and meeting their requirements, and improvement of forest productivity.

The important guideline of this policy is that 60 per cent of the total geographical area in hill lands and overall 33 per cent of the total area of the state should be kept under natural forests for ecological purposes. According to the estimates of forest department a total of 3.47 million hectare of land in Uttaranchal is under forests. The per capita forest area is the state is 0.49 hectares.

B. Area under Forests

The recorded forest area in Uttaranchal is 34662 sq km (about 65 per cent of the state's geographic area); of this, 23827 sq. km. fall under reserved forests and 10673 sq. km. under protected forests. In terms of recorded forest area, the state ranks fourth whereas it ranks ninth in terms of the actual forest cover. Of the 23988.76 sq.km of forest under the control of the forest department, about 31 per cent is under civil, soyam, panchayat and private land; this area is accessible to communities dependent on the forests. Apart from the forests there are six national parks and 6 wildlife sanctuaries in the state covering a total forest area of 6,47,900.00 hectares.

Table V-2 Area under different classification of forests

S. No.	District	Geographical Area sq.km.	Per Capita Forest Area – 1991 (Ha)	Area (sq.km.) of Forests under				Total
				Forest Dept.	Civil & Soyam	Panchayati Forests	Pvt. Forest, Municipal & Cantt	
1	Uttarkashi	8016	2.96	6800.41	141.40	6.49	160.12	7108.42
2	Chamoli	9125	1.15	3639.13	161.76	1402.73	6.78	5210.40
3	Pithoragarh	8856	0.58	1377.98	417.70	1506.75	1.07	3303.50
4	Tehri Garhwal	4421	0.70	2781.16	848.42	429.32	0.00	4058.90
5	Nainital	6794	0.26	2625.07	119.00	280.67	0.00	3024.74
6	Almora	5385	0.47	1471.97	1443.07	1005.92	18.73	3939.69
7	Pauri Garhwal	5440	0.66	2393.80	1569.79	532.61	16.46	4512.66
8	Dehradun	3088	0.21	1512.94	439.41	76.59	87.97	2116.91
9	Haridwar	2360	0.03	375.19	0.00	0.00	0.00	375.19
10	Udhamsingh Nagar	-	-	1011.11	0.00	0.00	0.00	1011.11
TOTAL		53485	0.49	23988.8	5140.6	5241.1	291.1	34661.5

Note: The figures of Bageshwar, Champawat and Rudraprayag districts are included in their parent district

Source: Forest Department, 2002-03

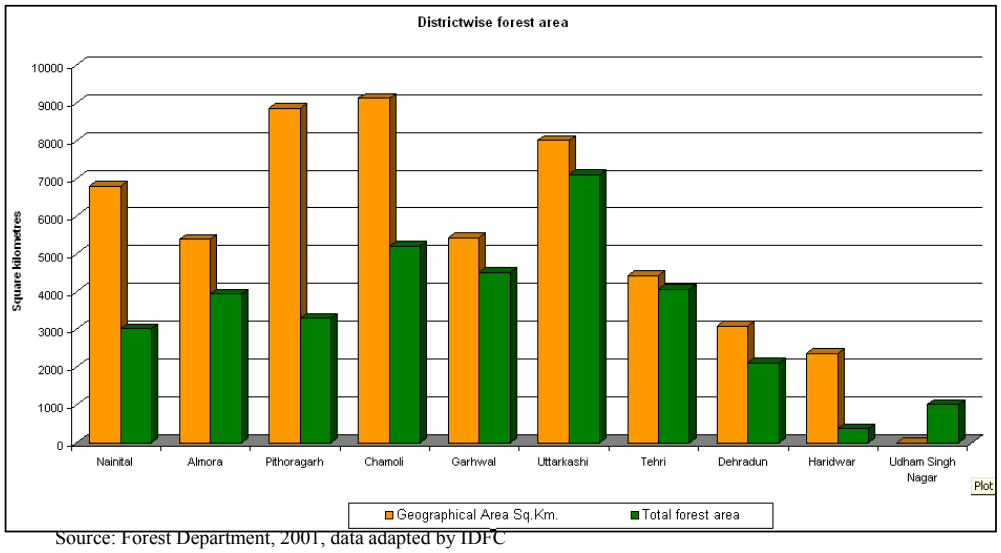
According to the National Forest Policy, 1988, hill states should have a minimum of two-thirds area under forest cover in order to prevent erosion and land degradation and to ensure the stability of the fragile eco-systems. All the districts of Uttaranchal have less than the required forest cover. The deficit is remarkably high for the districts of Chamoli, Pithoragarh and Uttarkashi. This could have a bearing on the fact that Chamoli and Uttarkashi district are known for frequent landslides.

Table V-3 Deficit in forest cover

District	Geographic Area	1999 Assessment		Scrub	Total Forest Cover	Required Forest Cover as per 1988 New Forest Policy (deficit)
		Dense	Open			
Uttarkashi	8,016	2,631	468	41	3140	5344 (-41)
Chamoli	9,125	2,530	622	22	3174	6083 (-48)
Pithoragarh	8,856	2,188	824	141	3153	5904 (-47)
Tehri Garhwal	4,421	1,807	753	132	2692	2947 (-9)
Nainital	6,794	2,920	649	5	3574	4529 (-21)
Almora	5,385	2,071	466	21	2558	3590 (-29)
Pauri Garhwal	5,440	2,198	978	115	3291	3627 (-9)
Dehradun	3,088	1,239	331	90	1660	2059 (-19)

Source: Forest Department 2001 data adapted by IDFC

Figure V-1 District-wise forest area



Source: Forest Department, 2001, data adapted by IDFC

Discrepancies in forest area

According to the Forest Department, the forest area based on the satellite imageries conducted by the Forest Survey of India is 23260 sq. km. The Forest Department's own figures according to their report of 2001 is 34661.52 sq.km. According to the *State of Forest Report 2001,* brought out by the Forest Survey of India, the total forest cover in Uttaranchal is 23938 sq.km. While it is generally agreed that afforestation and reforestation have helped to regenerate forests, afforestation is rarely done in areas that have been denuded. Plantations are counted as forests in the Forest Survey of India. This also includes tea plantations. Thus, these assumptions hide the fact that the land under open forests may be increasing but that under dense forests is not; in fact, forests are becoming less dense.

About 5143 sq. km. of forestland is badly degraded and denuded and demands urgent attention.

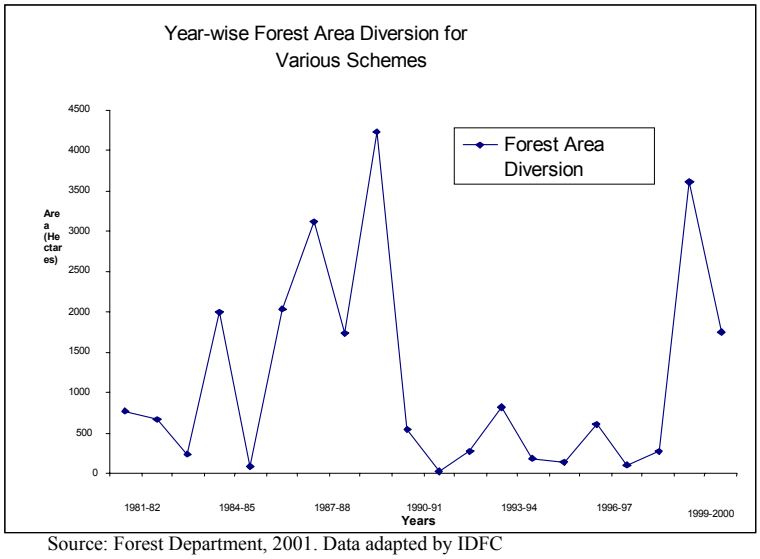
The villagers of Nahin Kalan in Dehradun district fought against a destructive limestone mining and saved a large area of sub-Himalayan forest. The ecological impact of limestone quarrying in the Nahi Kala region was acute because of the mine was located at the origin of water resources and on a steep slope on the hill top. The forest were badly damaged and trees were buried under quarry debris. The land instability generated by quarrying, road construction, and the related landslips obstructed and depleted the natural flow of water in the streams seriously affecting the local irrigation system.

C. Diversion of Forestland

Forests are increasingly being diverted for other purposes such as industry, road building, and for mining. Immediately after the introduction of new forest policy, the year 1989-90 reported maximum forestland diversion towards mining activity.

Since 1981-82, 23099 sq km of forestland has been diverted for various projects including projects related to mining, hydel power, road construction, communication projects, irrigation projects and drinking water project.

Figure V-2 Diversion of Forest Lands



Source: Forest Department, 2001. Data adapted by IDFC

The Himalayan land degradation, not limited to Uttaranchal, can be easily glanced through the following figures:

Total geographical area - 328 m ha.
Land affected by soil erosion and degradation - 175 m ha.
Areas facing varying degree of droughts - 260 m ha.
Annual average loss of soil nutrients - 8.4 mt.
Annual loss of production for not developing ravines - 3.0 mt.

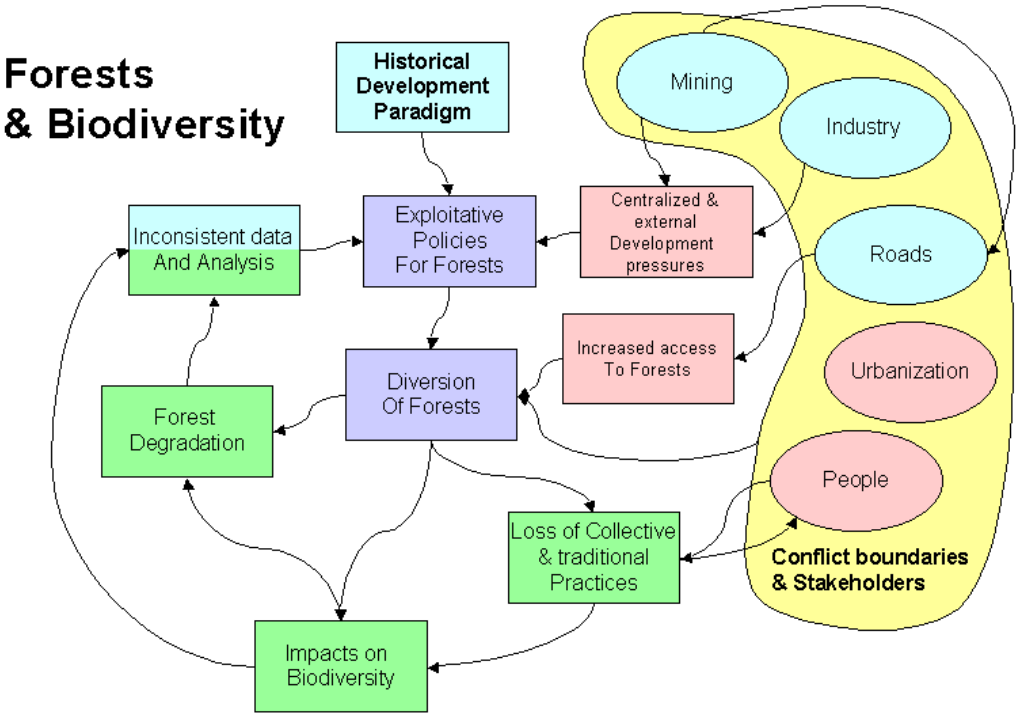
In the recent years visible changes have appeared in the physical and biological components of these Himalayas that is catching the attention and causing concern. These changes include fast receding tree line, recurring floods and periodic droughts, moisture regime, eutrophicating and sedimenting water bodies, deteriorating landscape, landslides, great ornithological changes, variations in the periodicity and cyclic patterns of microclimate of the country as a whole.

Table V-4 Diversion of forests for different developmental activities in the state

Year	Irrigation Projects	Hydro Power projects	Road construction projects	Communication projects	Mining projects	Drinking water schemes	Other schemes	Total (in ha.)
1981-82	4	_	2	_	_	_	768	774
1982-83	14	_	134	111	_	1	414	675
1983-84	11	85	92	32	2	4	6	232
1984-85	7	0	70	39	2	3	1878	2000
1985-86	1	_	61	18	_	_	2	83
1986-87	332	1303	210	49	_	4	137	2035
1987-88	5	3050	4	0	_	0	50	3110
1988-89	7	155	2	3	1547	10	6	1730
1989-90	19	0	88	1	4089	24	7	4229
1990-91	7	3	114	203	209	3	2	540
1991-92	3	2	7	3	_	3	1	19
1992-93	1	_	18	3	_	2	248	273
1993-94	7	_	102	_	_	7	706	823
1994-95	2	_	174	1	_	6	4	186
1995-96	6	0	123	_	_	8	2	140
1996-97	3	449	113	21	_	17	3	606
1997-98	1	_	76	2	_	14	1	94
1998-99	1	_	188	50	_	10	18	267
1999-2000	5	10	308	671	2451	12	147	3602
2000-2001	2	29	423	1	59	18	1210	1742
Total	438	5086	2311	1205	8299	147	5612	23099

Source: State Forestry Statistics, 2001

D. Pressures on Forest Resource Use



Pressures on forest resource use come from the industry as well as from the people and livestock. Wood and timber Forests provide a large number of commodities that are used as raw material in industries. Wood for example, is used for construction of houses, or furniture, by the pulpwood and paper industry, etc. Small timber is used to make agricultural tools and implements. Resin from pine trees is a product that is much in demand.

Disappearing oak forests

The oak forests are degraded due to over exploitation by the local communities who are dependent on oak leaves for fodder, wood for fuel and timber for farm implements. Oak forest soil is rich in humus and is often used as supplementary manure. Agricultural activities frequently extend into oak forests and with increasing demands for fodder and firewood, the trees are repeatedly lopped and seed output is reduced (Rawat, 1999). Natural regeneration of the oak forests are also affected due to pressure from seed predators such as flying squirrel, langur and deer species. Trampling and grazing of young sapling by the livestock also affects natural regeneration of the Oak forests significantly. It was observed in two sites (Kilbury in Kumaon and Akash Kamini in Garhwal) that the young seedlings of different species of oak are not being disseminated leaving only mother trees, some of which are 200 years old (Rawat, 1999).

Source: NBSAP

An important cause for the destruction of the forests is the practice of offering tenders for petty contracts for lifting driftwood from dam reservoirs. For example, the tendering mechanism at the Maneri dam reservoir allows contractors to take trees that have been swept down from higher altitudes. Invariably, trees are felled at higher levels so that they drift down the river for the contractors to pick up. In some cases, when forest fires occur, more trees are felled than necessary, once again benefiting the contractors at the dam reservoir.

Recognizing the ecological impact of depletion of forests, there is an increasing emphasis on avoiding consumption of wood. For example, the practice of using wood for railway sleepers has been stopped because of its deleterious impact on forests. The Ministry of Environment and Forests has directed its offices and institutions not to use wood for construction and furniture, as far as possible.

While very few forest products taken out for industrial purposes benefit the local people, they use timber in house construction. As many as 87.14 per cent of households use wood for making roofs and floors. According to a finding, 5 to 6 trees of 2.5 to 4 meters girth are used by a single household in one time house construction and this is to be replaced every 38 years on an average.

The estimated growing forest stock in the state is about 188.807 million cubic meters (Forest Statistics, 2001).

Himalayan activist takes on Uttaranchal's timber mafia

The multi-crore trade in illegal timber is being challenged by one man whose main objective is to save the hills of Uttaranchal from being denuded in the name of development Jaya Prakash Dabral, a former corporate executive turned social and environmental campaigner, has taken on the notorious timber mafia in Uttaranchal, and has filed a Public Interest Litigation (PIL) in the Supreme Court alleging that, in the laying of a 800 MW transmission line between the Tehri dam and the town of Meerut, for every one tree sanctioned for felling, five were being chopped down. The power lines cut across 36 km of the Rajaji National Park in the Shivalik hills, an elephant habitat and a rich biodiversity spot. According to him, "A full-grown tree is worth Rs 30,000 in terms of wood. So you can imagine the money involved. I alone have evidence of illegal trading (to the tune of) Rs 350 crore."

Dabral's alternatives include using helicopters to fix the power lines from the Tehri site, which would involve cutting down just 300 trees, and raising the height of the towers. Earlier, Dabral's Chipko-style campaign led to the Supreme Court scaling down the number of trees that could be cut, from 60,000 to a much smaller 14,739. The Central Empowered Committee set up by the court to examine the case has further reduced the number to 8,422.

Adapted from an article in *India Today*, February 2, 2004

Fuel wood

The population in the state is heavily dependent on the forests of the region for meeting many of its basic needs. This dependence goes on increases with increasing altitude, as firstly, the increasing cold requires more fuel wood, and secondly, alternatives to forest products start decreasing with altitude.

Fuel wood accounts for 90 per cent of the source of domestic energy in the region and is especially important for rural people. According to Bhatt *et al.* (1994) about 631 kg of fuel wood is consumed per person per year, irrespective of their socio-economic status. 100 trips of an average of 5.30 km are made to collect 56.89 quintals of fuel wood for an average family of 6.6 persons per household. Each trip can take up to 5.5 hours. Latest estimates put the present total demand for fuel wood in the state at 25.04 lakh MT annually while the sustained yield from forest areas is a mere 13.20 lakh MT.

Environmentalists are divided over the impact that fuel wood consumption has on forests. While many claim that this is one of the main contributors to the destruction of

forests, others contend that industrial demand for wood is the primary cause of such destruction, and that a large part of the fuel wood collected consists of dry twigs and branches.

Green fodder

The forests are an important source of green fodder, which supplements crop residues, for livestock.. Livestock are central to maintaining the fertility of the land. In the process, they return manure to the forests and grasslands they feed upon.

Gujjars in Uttaranchal belong to a nomadic tribe of buffalo graziers .They keep buffalo herds which freely graze in the Terai Bhabbar Sal forests where they live in temporary huts, for five to six months every year. During summer and rainy season they migrate to higher altitudes . The continued grazing and lopping of fodder trees for nearly 200 years has adversely affected the biodiversity of both Sal forests and high altitude pastures.

The National Biodiversity Strategy and Action Plan (NBSAP) has estimated that each head of cattle consumes around 8kg of green fodder per day. Women make 215 trips to forest each year, to collect fodder for 4.74 units of cattle per household. They cover an average distance of 3.7 km per day, which takes about 4 hours.

The NBSAP further estimates the requirement for green fodder at 259 lakh MT per annum based on the livestock census of 1993, and the total productivity from forests and pastureland at 43.5 lakh MT. Even estimating agriculture lands contribute annually about 8.5 lakh MT, the deficit is over 200 lakh MT per year, which is met by activities such as heavy lopping of trees, cutting saplings and collecting barks/branches of trees.

Non-Timber Forest Produce

While there is no exact data on the Non-Timber Forest Produce, or the Non-Wood Forest Produce from Uttaranchal forests in particular, it is estimated that there are over 3000 known species of economic plants and a large number of animal products in these forests. During the stakeholders' meetings, participants also listed dyes, insect repellants, pesticides, and *jhoola* (lichens) for tanning as other important products of

Disappearance of cloud forests threatens water supply to millions

Cloud forests, one of the earth's rarest and most distinctive types of forest, are under increasing threat of destruction and their disappearance could have far-reaching effects on millions in the developing world, warns a new global report. The report also found that the total area under cloud forests is about one-fifth smaller than was previously believed.

Cloud forests, 60 per cent of which are in Asia, are found in tropical mountains, and at some point virtually every day they are enveloped in cloud. They sometimes grow as low as 500 m (1,650 feet) in coastal regions, but are typically found at 2,000-3,000 m (6,550-9,850 feet). These forests are of crucial economic importance to millions of people, mainly as a source of fresh water. Constantly wrapped in mist, the trees retain moisture and provide an abundant supply of clean water throughout the year. Many farmers and rural communities, as well as inhabitants of fast-growing cities, depend on this. Wild relatives of many key food crops often grow in cloud forests, making them important gene pools. Apart from their utility, cloud forests are also ecologically important -- they are home to many animal species found nowhere else on earth.

The forests are under threat of clearance from agriculture, poaching, logging, road-building and construction. Their unique ecology and location on mountain slopes makes them particularly sensitive and climate change poses the biggest threat to their existence. It is predicted that changes in temperature and rainfall will drive some forests to extinction and force others to spread to higher altitudes.

Source:*www.scidev.net,* February 9, 2004 w*ww.bbcnews.com,*February 9, 2004

Stripping forests of medicinal plants

Yartsa Gombu :This is an entomophilous fungus belonging to order Hypocreales and family Scolecosporaceae. The fruiting body of the fungus grows on the head portion of moth caterpillars especially *Hepialus* spp. Hence it is also known as caterpillar mushroom. The biological relationships between the fungus and caterpillar have not yet been established. The fungus appears to be facultative parasite. The fruiting body of the fungus, along with the caterpillar, is popularly known as *Yartsa Gombu* in Tibet and Nepal. In Himalaya it is found mainly in higher altitudes of Nepal, Sikkim, Bhutan and Arunachal Pradesh between 3600 – 4500 m It has recently been discovered from eastern Kumaon, Uttaranchal where it is known as *Keeda Ghas*.

Yartsa Gombu has traditionally been used in China to cure impotence, backache, and anemia. It is specifically used for excess tiredness, chronic cough, asthma, to build the bone marrow and reduce excess phlegm. The clinical studies done on Cordyceps in China have been numerous and remarkable, indicating the fungus can improve liver functions, reduce cholesterol, adjust protein metabolism, improve immune functions, inhibit lung carcinoma and has a therapeutic value in the treatment of aging disorders.

The higher altitudes of Pithoragarh District in Uttaranchal have recently become the destination of collectors of *Yartsa Gombu*. The local inhabitants from the district as well as from the adjoining areas of Nepal visit the alpine areas in large number during April – May to collect the fungus, which is locally sold to `middlemen' and traders at a price of Rs. 40,000 – 50,000 per kg. Reportedly it goes directly to the international markets where it fetches to the tune of Rs. 80,000 – 90,000.00 per kg. Since the species has not been listed in any schedule of the Wildlife (Protection) Act, it is difficult to restrict the exploitation of the species. Therefore, there is an urgent need to (i) conduct scientific studies on the effect of over harvesting on the population and environment of the fungus, and (ii) evolve a suitable policy for the extraction and trade of this fungus from the state.

(Source Dr.G.S. Rawat , WII, Dehradun)

the forest trees and plants. Miscellaneous, but important products, particularly for the poor and the tribal people, include honey, beeswax, lac, resin.

The commonly used term "minor forest produce" underplays the importance of one of the most vital roles of the forest – that of supplementing agriculture as a source of food, especially for the tribal populations. Badoni and Badoni (2001) list six types of wild edibles available in the Garhwal forests: vegetables, fruits, seeds/grains, spices and condiments, oils and beverages. Vegetables include tubers and rhizomes, young shoots and leaves, inflorescence and flowers (including floral buds), and unripe or semi ripened fruits. Another vital produce from the forests is medicine. The forests of Uttaranchal have a fabulous wealth of medicinal plants, many of which have now become common household remedies. Badoni and Badoni list 57 such wild plants that are in common everyday use.

In almost all the villages, large areas of degraded civil soyam forest and culturable waste lands are present that can be developed. In case there is no such land in a particular village, common forest areas for a group of villages can be developed. The total requirement of such land for the whole of Uttaranchal Himalaya is estimated to be 1.06 million hectares. At present about 1.0 million hectares, classified as forest, is in revenue records. Another 0.3 million hectares is lying undeveloped as culturable wasteland, 0.22 million as permanent pastures and other grazing land and 0.2 million hectares as land under miscellaneous tree crops and groves. Thus a total of about 1.7 million hectares land is available which can be forested and developed for the sustainable development of forest resources for the hill dwellers. An institution of village forest panchayats exists in some areas but these have not been formed all over the region. The cumbersome administrative formalities discourage people from organizing these Panchayats.

Source : V. Vikram Singh, "Usufruct in Uttaranchal: Some findings". *Yojana* . March 2002. (48-49)

The forests, upto the temperate regions, also yield fiber for preparing ropes, cordage, bags, baskets, mats, etc. While, during the consultative workshops, the people themselves listed the *ringal* (hill bamboo) for basket weaving, other plants used include the *Cryptolepis buchananii* (for making thread used for fishing), species of *Bauhinia, Ischnocarpus, Arundinaria, Dendrocalamus, Morus, Porana* and *Salix*.

The existence of large tracts of forest has made wood carving and turnery an important craft and source of livelihood in the state. The forest is also a place of worship with some trees like the peepal and banayan being far more sacred than others. Many trees that are worshipped are those that have other uses associated with them, eg. Burans, mango, paiyan (used for food, as well as worship),

Forest produce is usually available from reserved and civil-soyam forests. Though the pattern of rights for both these types of forests are different, civil soyam forests are so degraded, that the burden falls mainly on the reserved forests. The pressure is intensified when forests boundaries start shrinking due to urbanization, road construction, agriculture and other developmental activities.

E. Forest Fires

Forest fires generally occur in two phases – late March and early April when the accumulation of fresh litter can burn, and May-June, when high temperatures, extreme dryness and winds turn deadwood and undergrowth into highly inflammable material. Uncontrolled forest fires, especially summer fires, can cause extensive damage to the biodiversity.

Effects of forest fires

Controlled forest fires help in clearing deadwood and allow new growth to come up. However, uncontrolled fires do just the opposite.

Control burning helps proliferation of weeds, maintenance of grasslands, checking heavy and crown fires, regeneration of certain seeds and elimination of certain harmful insects and micro organisms. It also helps herbivore populations. Thus fire can be a tool for biodiversity conservation if properly managed or it can also destroy it if not controlled

Uttaranchal forests are made up of many species of trees – including chir pine, blue pine, ban oak, sal, sissoo, eucalyptus, etc. The most fire prone zone is the ban oak at the higher altitudes and the chir pine zone, which occupies 17 per cent of the total forest area, and its transition zone with sal (11 per cent of the total forest area) at the lower altitude especially in the Terai Bhabbar region. This is also the zone with the maximum habitation in the hills. In other areas, such conditions that are conducive to fires occur at 4 to 5 year intervals. Crown fires are rare, and most of the fires are ground fires with low flame heights.

Some of the effects of forest fires on biodiversity include:

- Change in species composition.
- Loss of micro flora and fauna.
- Loss of regeneration/plantation areas.
- Loss of seeds.
- Change in microclimate resulting in change in floral and faunal patterns.
- Migration of species.

- Loss of bird/reptile eggs and young ones and loss of insects due to break in their life cycles.
- Soil erosion resulting in landslides and invasion by pioneering species.
- Soil desiccation, drying of water springs, increase in air pollution which effects species succession.
- Loss of habitat of particular species.
- Retrogression and checking of succession cycles if the fires are repeated as in Chir pine forests.

Table V-5 Forest area affected by fire and estimated loss 1984-2001

Year	Fire Affected Area (sq. km)	Estimated Loss (Rs.000)
1984	1122	Not Available
1985	714	Not Available
1986	0.27	Not Available
1987	166	Not Available
1988	363	Not Available
1989	490	Not Available
1990	134	Not Available
1991	277	300
1992	359	200
1993	18	400
1994	60	400
1995	6220	139300
1996	55	1400
1997	12	200
1998	20	500
1999	600	1480
2000	2.32	80
2001	11.44	380

Source: NBSAP

F. People and Forests

The hill farmer's dependence on forest resources has given rise to various social and cultural institutions that include management of village grazing grounds and fuel and fodder reserves.

The traditional restrictions on the use of the forests applied over large areas. While there was traditional formal management, practical protection *was* secured by customary limitations on use. For oak forest, there was an unwritten rule that prohibited the lopping of leaves in hot weather, while grass cutting by each family was strictly regulated (Pearson, 1869). Traditionally, many villages had some forest reserved for fuel even on *gaon sanjait* (common village land measured by government), where villagers would cut in regular rotation by common consent. The planting of timber trees was a fairly common phenomenon. The forest boundaries were zealously guarded by nearby villages. In Tehri state peasants strongly asserted their claim to species such as Bhimal *(Grewia oppositifolia),* a valuable fodder tree usually found near habitations

(Raturi, 1910). In British Garhwal, Chaundkot pargana was singled out for its oak forest within the village boundaries, known as *bani* or *banhanis,* where branches of trees were cut only at specified times and with the permission of the entire village community (Stowell, 1907). Today in remote areas, untouched by commercial exploitation of forests, one can still come across well-maintained *ban janis* containing oak trees of a quality rarely observed elsewhere (Guha, 1989).

Table V-6 Traditional and current approaches to Natural resources

Traditional Approach	II. Present day approach
Basic circumstance poor accessibility, isolation, scarce and undependable external linkages and support, subsistence oriented small populations almost total dependence on local, fragile, diverse natural resource base Bottom line: High collective concern for health and productivity of natural resource base as a source for sustenance	**Basic circumstance** enhanced physical, administrative, and market integration of traditionally isolated, marginal areas and communities with the dominant mainstream systems on the latter's terms increased population reduced critical dependence on local natural resource base diversification of sources of sustenance Bottom line: Reduced collective concern for local natural resource base; rise of individual (extractive) strategies.
Key driving forces generated by basic circumstance sustenance strategies totally focused on local resources sustenance – driven collective stake in protection and regeneration of natural resource base close proximity and access-based functional knowledge and understanding of limitation and usability of natural resource base local control of local resources and decisions; little gap between decision makers and resource users Bottom line: Collective stake in natural resource base supported by local control and functional knowledge of it.	**Key driving forces generated from basic circumstances** external linkage-based diversification of sources of sustenance (welfare, relief, trade) disintegration of collective stake in natural resource base marginalization of traditional knowledge and imposition of generalized solutions from above legal, administrative, fiscal measures displacing local controls and decisions wider gap between decision makers and resource users. Bottom line: Loss of collective stake and local control over natural resource base; resource users respond in reactive mode
Social responses to key driving forces evolution of resource-use systems and folk	**Social responses to key driving forces** extension of externally evolved,

Traditional Approach	II. Present day approach
technologies promoting diversification, resource protection, regeneration, recycling, etc. resource use and demand-rationing measures formal and informal institutional mechanisms and group action to enforce rules Bottom line: Effective social adaptation to natural resource base	generalised technological and institutional interventions disregard for local concerns, experiences and traditional arrangements emphasis on supply-side issues, ignoring management of demand pressure formally, rarely enforced measures Bottom line: Natural resource base over-extracted as open-access resource
Consequences	**Consequences**
nature-friendly management systems are evolved and enforced by local communities facilitated by close functional knowledge and community control over local resources and local affairs Bottom line: social system and ecosystem links that protect and regenerate resources	over-extractive resource-use systems, driven by uncontrolled demands externally conceived, ineffective, and unenforceable interventions for protection of natural resource base little investment and technology input in natural resource base Bottom line: Rapid degradation of fragile natural resource base

Source: Jodha, N.S. (1999) Poverty, Environmental Resource Degradation: Alternative Explanation and Possible Solutions, ICIMOD, Kathmandu. Based on interpretation in Smith, Douglas V. and Jalal, Kazi F. (2000) Sustainable Development in Asia, ADB, Manila

People, forests and conservation

Excerpts from Ramchandra Guha's Unquiet Woods: Ecological Change and Peasant Resistance in the Himalayas

The dependence of the hill peasant on forest resources was institutionalised through a variety of social and cultural mechanisms. Through religion, folklore and tradition the village communities had drawn a protective ring around the forests. Across the region covered by this study there existed a highly sophisticated system of conservancy that took various forms. Often, hilltops were dedicated to local deities and the trees around the spot regarded with great respect. Many wooded areas were not of spontaneous growth and bore marks of the hill folk's instinct for the plantation and preservation of the forest; indeed 'the spacious wooded areas extending over the mountain ranges and hill sides [bore] testimony to the care bestowed upon them by the successive generations of the Kumaunies.'" With villages usually sited halfway up the spur, sacred groves had an obvious functional role in stabilizing water flows and preventing landslides. Particularly in eastern Kumaun and around temples, *deodar* plantations had become naturalized, some way cast of the trees' natural habitat. Temple groves of deodar varied in extent from a few trees to woods of several hundred acres."" This magnificent tree, one surveyor remarked, is 'frequently planted by the Hindus in all parts of the mountains, and attains a gigantic size'.'," As late as 1953 it was reported that the finest stands of deodar were found near temples, venerated and protected from injury. Commenting on the numerous sacred places in deodar forests, an official observed that 'such spots are frequently prominent places where a good view is obtained, or a beautiful glade in the forest, or where there is some unusual natural phenomena, as a large rock split with a tree growing between the two halves.' Sacred spots were normally marked with cloth or coins. Nor was tree worship restricted to the deodar; a Swiss geologist expedition found, in a village in the Upper Dhauli

valley in Garhwal, a sacred birch tree remarkable in its size: with a spread of eighty feet and a double trunk ten feet in diameter. In such sacred groves, the 'traditional form of forest preservation', and one found all over India, no villager would injure the vegetation in any way. In fact, the planting of a grove was regarded as 'as a work of great religious merit'. In parts of Tehri, even today, leaves are offered to a goddess known as Patna Devi (goddess of leaves), this being only one of several examples of the association of plants with gods. Cases were not unknown of open land being left uncultivated that were dedicated to fairies of the forests, who were believed to come there at night to play. In the Tons valley, tubers and roots- the peasantry's food during times of scarcity-are used only during culturally, specified times to inhibit overexploitation.

While sacred groves testified to the role played by traditional religious beliefs in the preservation of nature, in other instances it was informal management practices that regulated the utilization of forest produce by the community. A civilian newly posted to the hills in the I920s was struck by the way communal action continued to survive in the considerable areas serving as village grazing ground, and by fuel and fodder reserves walled in and well looked after. Despite official apathy the old customary restrictions on the use of the forests operated 'over large areas'; while no formal management existed, practical protection was secured by customary limitations on users. In many patches of oak forest there were rules that prohibited the lop- ping off of leaves in the hot weather, while the grass cut by each family was strictly regulated. The penalty for the infringement of these rules included boycott and/or the exclusion from the forest of the offender. Traditionally, many villages had fuel reserves even on *gaon sanjait* (common land) measured by government, which the villagers cut over in regular rotation by common consent. With the planting of timber trees a fairly common phenomenon, the jungles preserved within their boundaries were zealously guarded by villages nearby. Thus, Tehri officials observed that peasants strongly asserted their claim to species like *bhinwl,* a valuable fodder tree usually found near habitations.60 In British Garhwal, Chaundkot *pargana* was singled out for its oak forests within village boundaries, called *bani or banjanis,* where branches of trees were cut only at specified times, and then with the permission of the entire village community. In remote areas, untouched by commercial exploitation of forests, one can still come across well-maintained banjanis containing oak trees of a quality rarely observed else-where.

Undoubtedly, this situation was facilitated by the near-total control exercised by villages over their forest habitat. As 'the waste and forest lands never attracted the attention of former [i.e. pre-British] governrnents',"3 the peasant communities enjoyed the untrammeled use of their produce. While the native kings did subject the produce of the forests, such as medicinal herbs, to a small cess as and when they were exported, the products of the forests consumed by the people them- selves were not taken into account.114 In such circumstances, where they exercised full control over their forest habitat, co-operation of a high order was exhibited by adjoining villages. Every village in the hills had fixed boundaries, existing from the time of the pre-Gurkha rulers, and recognized by G. W. Traill in the Kumaun settlement Of 1823 (the so-called *san assi* boundaries). Within these limits the inhabitants of each village exercised various proprietary and other rights of grazing and fuel, secured by long usage and custom.65 Quite remarkably, this co-operation existed even across political boundaries; thus, the adjoining villages in Tehri and Bashar state amicably grazed their flocks and fetched wood from common forest and pasture land without any kind of dispute.

Although the above account consists largely of fragments reconstituted from official discourse, it is apparent that the role of forests in hill life was highlighted by the existence of social and cultural institutions, which enabled the peasantry to re-produce its existence-this notwithstanding the later construction of an ideology which viewed the usurpation of state mono- poly over forests as a logical corollary of the lack of 'scientific' management practices among the original inhabitants of forest areas.'" The intimate and reverential attitude toward the land', which Robert Redfield regards as being a core value of peas- ant society, seems to have incorporated, in Uttarakhand, a reverential attitude towards the forest as well. In other parts of India where forests are closely interwoven with material life, we observe very similar patterns of cultural restraints on resource utilization. Thus, in tribal India even today, 'it is striking to see how in many of the myths and legends the deep sense of identity with the forest is emphasised." In such forest areas not only did the forests have a tremendous influence in moulding religious and spiritual life, the inhabitants also exhibited a deep love of vegetation, often acting 'entirely from a sense of responsibility towards future generations' by planting species whose span of maturity exceeded a human lifetime.

Van Panchayats

In parts of the state, villagers are dedicating forest areas to local deities. The specific protection afforded to the habitats has led to the revival of many traditional practices of sustainable use that have benefited wildlife conservation.

The rights of communities to their forests were limited by the creation of the forest department in 1868 and the subsequent Forest Acts passed by the British government. Conflicts arose, which led to the 1921 recommendations of the Kumaon Forest Grievances Committee, under which forests that contained few trees of commercial importance (Class I) reverted to the Revenue department, while villagers were given access to other forests for grazing, lopping and collecting firewood.

In 1931, the Revenue department organized Van Panchayats with concerned villages, for joint management of the Class I civil forests, which now came to be known as Panchayat forests. The Van Panchayats, with elected members, was expected to look after the forestland falling within its jurisdiction, in return for certain concessions. These concessions were revised and reduced by the Van Panchayat Act of 1971. The current unequal distribution of rights and privileges between the state and the communities is the root cause of the dysfunctioning and ineffectiveness of the Van Panchayats today.

Community Conserved Forest Areas (CCA)

Community conserved forest areas (CCAs) are diverse forests that are maintained and conserved by the people themselves. The forests are often panchayat forests, sacred groves, reserved forests managed by the people, or even privately owned by communally managed forests. These forests adequately meet people's needs of biomass and biodiversity.

Women regenerate forests in Chakdalar

The women of Chakdalar – a small village of 40 households nestling at an altitude of about 1700m. in Nainital district have taken the lead in regenerating the nearby forests.

The Mahila Mangal Dal of the village realized that with the depletion and shrinkage of the nearby civil-soyam, panchayat and reserved forests, collecting just a sack of fodder leaves was taking hours. They decided to "close" the forest for a period of four years. People can collect only dried and fallen leaves and twigs. Stiff fines are imposed for even carrying a sickle, let alone found cutting a tree. Women guard the forests, and no outside "chowkidars" are employed.

Within a year, the impact of the closure is already visible: the forest has become dense, tree sizes and girths have increased, as has the wildlife in the region. But most importantly, for the people, the availability of biomass itself has increased by about 20 per cent, even dry leaves and twigs.

The status of women, particularly widows and single women, has improved markedly as a result of the exercise. The panchayat, which earlier questioned the women's legitimacy for taking decisions is now supporting the women. Even the forest department has stopped being indifferent and has offered free saplings for reforestation. While they are suffering from lack of financial support, the women are determined that forests will not be reforested with trees that are of no use to villagers. The successful regeneration of the Chakdalar forests has made women of nearby villages determined to initiate forest protection drives in their own villages.

A study conducted on 30 CCAs showed that

1. Most CCAs are self-initiated by the people at the local level.
2. Women are integral to effective management in most CCAs, and play an important part in the formal decision making process.
3. While rules differ from CCA to CCA, most have a system of punishing the offenders, usually through fines.
4. Almost all CCAs have successfully met people's biomass needs while protecting the forests.
5. The CCAs have become rich depositories of biodiversity including wildlife.
6. The CCAs have also resulted in improved agriculture – food grain and milk production, as well as improved availability of drinking water.
7. Women's workload has decreased, and their social status has been enhanced.
8. There has been an increase in the people=wildlife conflict, as wildlife has returned to the CCAs.

Marriage and forest conservation

Maiti in Uttaranchal literally means 'mother's home'. The ritual was first conceived by Kalyan Singh Rawat, a zoology teacher at a government school, He formed the Maiti Organisation in 1996 and the Maiti ritual was first introduced in a small town called Gwaldam. In each village or town there is a Maiti group comprising unmarried girls. The eldest among them is called Maiti *didi*. The Maiti group nurtures a nursery of indigenous trees, from which one sapling is given to the groom to plant during the wedding ceremony. The money that the groom customarily gives to all the unmarried girls is collected and used to fund the education of poor girls or to help in the marriage expenses of an underprivileged girl.

The success of this women-centric movement has been spectacular. Within four years it has spread to 500 villages. The state government of Uttaranchal has passed an order to formulate all-women forest *panchayats* to involve an increasing number of women in the management and protection of forests. After the Kargil war, women in Ochati village developed a Maiti forest dedicated to soldiers. Recently, 300 trees have been planted in villages in Bageshwar district. Students from Garhwal University have planted saplings in Nainital, Srinagar and Garhwal to promote the Maiti movement.

Source: Himalayan Action Research Centre

G. Forest Related Conflicts

The forest related conflicts in Uttaranchal are varied. Among the conflicts there are those that affect the local people, the forest users and weaken their own institutional mechanisms for management.

Types of conflict in the region

There are broadly four types of conflicts that directly affect the quality of local community forestry management and weaken them. They are:

Conflicts weakening the Van Panchayat as an institution

These conflicts could be between the Van Panchayat and specific persons or between two Van Panchayats or between two villages. Such conflicts also take the shape of protracted tensions between the Van Panchayat and the Government Officials.

Management issues in Nanda Devi Biosphere Reserve

In Uttaranchal, the Nanda Devi Biosphere Reserve (NDBR), located in district Chamoli, is one of the unique reserves with high ecological, cultural and biodiversity value. It covers a total area of 5820 sq.km. The 5500 population inhabiting the buffer zone belongs to two ethnic groups: Indo-Mongoloid and Indo-Aryan. However, after the establishment of national parks in 1982 and the biosphere Reserve in 1988 under UNESCO's Man and Biosphere programme, and the imposition of conservation policies, all expeditions/trekking, especially in the core zone of NDBR were banned. A ban on tourism to the core zone has eliminated an important source of income for local people and conservation policies have restricted grazing and collection of NTFP here. Villagers have rarely been given an explanation for the curtailment of their rights, and have rarely been provided with adequate alternative resources. The reserve management plan lays more emphasis on legal protection than on the sustainable livelihood of local communities and this has led to conflicts between the local people and reserve managers. Dualism in policy, eg. allowing tourism in Corbett and Valley of Flowers national parks but not in the core zone of NDBR is another dimensions of people protected areas conflicts.

Source: Maikhuri et al, 2000 and 2001

Sainji Civil Forest Vs. Village Musaon

Sainji, is one among the 13 villages constituting a Van Panchayat on the Gairsain-Ranikhet Road. The village is represented by a member in the Van Panchayat Samithi. Apart from this the village has a small area of Civil forest, which it has been managing, at the village level. The villagers of Sainji are equally dependent on the two areas for meeting their needs. Musaon is an adjacent village across the Ramganga river, but not a member of the Sainji Van Panchayat. The people of Musaon have recorded rights to forests close to Syuni Talli village, which they can reach only by passing through Sainji. Historically, the people of Musaon had an agreement with the residents of Sainji allowing them to pass through a portion of the Sainji Civil Forests to reach their forests. In case of dire needs the original inhabitants of Musaon were also allowed to use some resources of the Sainji Civil forests by the Sainji villagers.

However, with the increasing population and the consequent pressure on forests, Sainji villagers began to raise objections to the residents of Musaon passing through their forests and using their resources. The discussions and negotiations among themselves failed both in terms of the use and finding alternative means to resolve this problem. As a consequences the women of Musaon who came from long distances were forcibly obstructed in their collections, the firewood collected was confiscated and in a rush of anger a case was lodged with the Police and the Patwari. Since 1988, this dispute, caught up in the mire of administrative and judicial processes, has cost each village over Rs. 40,000. The cumbersome legal process has led to a piquant situation where both parties abstained from attending the court, and the case was dropped. However, the problem between the two villages still remains unsettled.

The Sainji Musaon imbroglio also highlights the fact that while women are the primary sufferers in such conflicts, they are rarely involved in conflict resolution.

Boundary Dispute between Village Gandiyal and Mehargaon

The confusion over the boundary and the consequent conflict between the Van Panchayats of these two villages are indicative of the weakness of the administrative systems and their incapability in addressing the basic issue of demarcation.

When these Panchayats were formed in 1949 the Government ensured that the boundary between the Reserved Forest and the Van Panchayat was clearly demarcated not the boundary between the two Van Panchayats. The area under contention is about 5 Ha. and the villages of Gandiyal and Ramada-Mehargaon have already spent nearly Rs. 1,70,000 since 1992 on the court case.

Dungri Vs. Matkot

These villages, which are situated about 4 km away from the road, fall under one Van Panchayat, which has 14 villages as members. The villagers also use the Civil Soyam forests to meet their forest and grazing needs and every village has a mechanism for managing this area. Traditionally there has been one area of the Civil Soyam forests jointly used and managed by the two villages. The conflict began during a local election when two opponents got elected, giving gave raise to differences between them. Finally, one group closed the forests to the other.

While the case has gone to High Court, many villagers from either sides have been making an effort to ensure that the conflict does not assume violent proportions, and several local citizens are hopeful of an amicable solution.

Conflicts arising out of impediments to development processes

The second type of conflict are those where the development needs of the local communities are not being delivered largely because of the interpretation of the Forest Conservation Act (1980). Though these conflicts may not directly involve the local people or community forestry institutions, they impact the attitude of the people towards forests and reflect upon the capability of their local institutions in taking a stand. Such conflicts, which are mainly related to Reserved Forests, highlight the poor interaction between the Forest Department and the communities, where the latter often end up viewing the former as villains. implementing nodal agency, as well as the lack of communication between the officials and the community.

Examples

The Kunjakhal-Timlikhal Road, which had not been completed due to the Forest Department's interpretation of the FC Act, was finally laid after the community jointly decided and felled 233 trees that were obstructing it. The Forest Department has lodged a case against them charging them with illegal mining and felling from Reserve Forests. The conflict raises the question of whether the desperate measures taken by a community to meet a long-standing basic need should be treated as a crime under our forest laws?

A similar tug-of-war between the PWD and Forest Department is ongoing in the Gairsain Block of Chamoli district. The Bachwabaan-Talwari road is closed as it supposedly contravenes the FC Act and the Diwalikahal-Kimoli road is stuck because there is a dispute between people aiming to use the funds of the Employment Guarantee Schemes for implementing the programme.

Yet another instance of such conflict involves a case being fought by a villager against the Forest Department since 1989. The Department, claiming that the tree being felled was within the Reserved Forest, confiscated the villager's wood. The wood accidentally caught fire and was destroyed before the villager could prove that the tree was from his private land and he has due permission for the same cutting it. The litigant villager is seeking compensation from the Department for the loss incurred to him.

Conflicts between the Forest Department and individual encroachers

The third category of conflicts in the higher altitude related to the charges of encroachment faced by several villagers who had customary rights in what are now Reserved Forests.

Examples

The charges faced by villagers of Godar, Gadgu, Kalimath in Ukhimath Tehsil, Villagers of Bann, Swar, Kandai, Jhola, Chanial, Benitholi, Rathgaon and Bangali village in Chamoli Tehsil relate to construction of temporary cowsheds or opening up of a terrace. One the one hand, such conflicts create a bitterness with the Forest Department. On the other hand, they encourage villagers to overexploit the forest, as they fear that they soon be stopped from exercising their customary rights.

Conflicts arising out of insensitivity of development interventions

The fourth category of conflicts are those that arise when development related interventions are insensitively undertaken, ignoring the customs of the people, and often leading to the destruction of natural resources.

Examples

Two cases highlight this situation. The village of Gadli Talli and the U.P. Government are locked in litigation since 1989, because of the forced afforestation of 3.5 ha of Civil Soyam Forests, which the local people had been using for meeting their basic needs. . The villagers are demanding compensation for the losses caused by the action of the Government.

The conflict between the villages of Patyon, Majyari and Aali on the Adibadri-Devalkot-Karnaprayag route is another classic example. These villages were jointly managing the forest area from which they met their needs. The conflict erupted when the Government compensated the villages of Patyon and Majhyari (about Rs. 30,000) and left out the village of Aali, which was closest to the forest area. The villagers objected to this as well as to the restricted access of the other two villages. Though case has not gone to the courts, the conflict has led to disappearance of the bonhomie and community feeling among the villages; individualized use is also affecting the forests.

Implications of forest conflicts for women

The forest related conflicts have a number of critical implications for the women, which affect their lives in a very fundamental manner, particularly with respect to their burdens of collecting fuel and fodder, or taking cattle grazing. Women are also often made scapegoats and falsely implicated in the conflicts.

Women are generally under represented in Van Panchayats. When conflicts arise, women are rarely consulted in resolving them, even though such conflicts affect them most. This is particularly true when villages are scattered or in cases of multi-village Van Panchayats.

Forest-related conflicts debilitate local management systems, where people overcome difficulties and resolve differences through democratic processes. When such conflicts go out of the purview of local resolution and get stuck in administrative or judicial process, they become an even more serious cause of concern. The recent efforts by the government on the Van Panchayats will hopefully address these issues to a large extent.

H. Flora and Fauna of Uttaranchal

The floristic analysis of Angiosperm and Gymnosperm in Uttaranchal reveals that there are *ca* 4048 species belonging to 1198 genera under 192 families. Protected areas like Nanda Devi Biosphere Reserve, Corbett National Park, Rajaji National Park, Valley of Flowers, Govind Pashu Vihar are well explored areas while under-explored protected areas include Askot Musk Deer Sanctuary, Gangotri National Park, Kedarnath Wildlife Sanctuary, Mussorie Wildlife Sanctuary, Sonanadi Wildlife Sanctuary.

Table V-7 Floristic distribution in Uttaranchal

Group	Species	Genera	Families
Angiosperm			
Dicot	3320	950	160
Monocot	780	240	28
Gymnosperm	48	8	4
Total	4048	1198	192

Source: NBSAP

Table V-8 Diversity-rich areas other than Protected Areas

Protected Area	Region
Milam Glacier	Pithoragarh
Johar Valley	Pithoragarh
Pindari Glacier	Bageshwar
Panwali Kantha	Tehri
Kedar Kantha	Uttarkashi
Kanchula Kharak	Ruddraprayag
Badrinath - Vasudhara	
Roopkund	Karnprayag
Darma Valley	Pithoragarh
Madmaheshwar	Rudraprayag
Kushkalyany	Uttarkashi
Dayara	Uttarkashi
Khatling	Tehri Garhwal

Source: NBSAP

The floristic diversity reveals that the state harbors 4000 species of vascular plants of which nearly 116 species are endemic to Uttaranchal as they have confined their distribution to the state. The state has 500 algal species, 751 species of mosses, 18 endemic species of pteridophyta, 435 species of lichens,

More than 350 species of plants are threatened and endangered in all forested areas of the state, including 161 species belonging to rare and threatened categories based on IUCN guidelines. Most of these threatened plant species, which grow in the hills, are over-exploited for their medicinal, aromatic or commercial value. Among the tree

species members of the family *Aceraceae* are more threatened. All members of the family *Orchidaceae* are indeterminate, rare or endangered. Species of the family *Woodsiaceae* such as *Woodsia andersonii* and *Woodsia cycloba* are believed to be extinct or highly endangered. The status of more than 80% of plants is either indeterminate or has no information, necessitating long term research for area-wise profiling of plant species of the state.

Table V-9 Faunal diversity

Fauna (No. of species)	Corbett National Park	Rajaji National Park	Nanda Devi National Park
Mammals	50	49	22
Aves	354	168	175
Reptiles	23	49	3
Amphibia	-	10	8
Pisces	-	49	1
Chilopoda	15	7	4
Termites	-	21	-
Odonata	-	38	6
Lepidoptera	-	68	80
Hymenoptera	-	-	24
Diptera	-	-	24
Trichoptera	-	-	2
Hemiptera	-	-	13
Dermaptera	-	-	7
Orthoptera	-	-	14
Collembola	-	-	2

Source: NBSAP

The state is home for many species of birds, mammals, reptiles as also for the threatened and endemic species. The scientists of Northern Regional Station, Dehradun have recently (1995) compiled a baseline data on the faunal diversity of western Himalaya (U.P.). An annotated list of 2248 species of animals, including 1405 invertebrates' species and 843 vertebrates species have been reported.

I. Impact of the Biological Diversity Act, 2002

The Biological Diversity Act, 2002 of India was enacted in February 2003 to promote conservation, sustainable use and equitable sharing of benefits of the country's biodiversity resources, including habitats, cultivars, domesticated stocks and breeds of animals and microorganisms. To facilitate this, it provides for the establishment of a National Biodiversity Authority, State Biodiversity Boards and Biodiversity Management Committees at the level of Panchayats. However, the provisions of the Act itself as well as its status create the potential for confusion and conflict, and may have a deleterious effect on conservation of biodiversity.

While the Biodiversity Act was designed to be an umbrella Act, overriding many of the existing laws like the Forest Acts, it has finally received the status of a complementary act, and will be operated in conjunction with other acts, particularly those pertaining to forests, wildlife, panchayati raj, plant varieties and patents. For example, any biological

resource that is considered to be a commodity is exempted from the Act and is open to patents and other forms of IPRs. IPRs are exclusive ownership rights and the potential for patents allowed by the Act immediately contradicts any claims to equitable benefit sharing.

The Biodiversity Act recognizes only the commercial value of biodiversity as a benefit, thus it ignores the critical role that biodiversity plays in the life of the people, often providing their day-to-day sustenance and livelihood. By reducing the resource to a naturally growing cash crop as it were, the Act paves the way for overexploiting forest resources of flora and fauna through bioprospecting, because trade then becomes the most important use of the biodiversity.

The Act is silent on the issue of people and communities being stakeholders of the resources; only the Central Government, State Governments, panchayati raj institutions, scientific and technical institutions, experts, NGOs, and industries are mentioned as stakeholders.

As a corollary to this, the entire decision-making power is concentrated in the hands of the National and State Authorities. The only right that the Biodiversity Management Committees have is the right to manage conserve local genetic resources and to document local knowledge. They however do not have the right to decide what is to be done with the documentation. The Act specifically (in Chapters II, III, IV V) that the National Biodiversity Authority only needs to "consult with the local Biodiversity Management Committees" when taking decisions related to the biodiversity within their jurisdiction. (Chapter X, Art. 41).

Yet another problem that has not been addressed in the Act is that traditional knowledge about most of the bioresources and their use is not limited to one community. Often it is not limited even to communities within the national boundaries. For example, knowledge of basmati rice is found amongst communities in both India and Pakistan. The matter gets even more complicated as the Convention on Biological Diversity (CBD) recognizes sovereign rights over bioresources that originated in the country, and not over all its bioresources, as is provided in the Indian act. This creates a further potential for international conflicts.

The CBD further only talks of benefit sharing with indigenous communities that hold knowledge, and not all communities. Knowledge in ancient texts like Ayurveda are not recognized; once again, often such knowledge are common to ancient systems of medicines across borders.

The clauses on Biodiversity Heritage Sites (Chapter IX, Art. 37) threaten communities who live in forests, particularly in areas with the maximum biodiversity by refusing the recognize the link between biodiversity and the communities that have been its custodians and who derive their livelihood from the forest. Thus the Act specifies that the state has the right to declare areas as heritage sites and remove all communities from there. This contravenes the implementation of the law related to the Panchyati Raj. For example, in 1999, all chief ministers were requested to initiate measures to implement a seven point plan to energies Gram Sabhas; this included mandatory consultation with the Gram Sabha over management of natural resources including land, water and forests, before acquisition of land for public purpose and other forms of

land transfer. The clauses on Biodiversity Heritage Sites will create new conflicts between the state and the people.

J. The Way Forward

Forests and biodiversity are the wealth of the state; more importantly, they are wealth of the people, whose sustenance and livelihood depend upon these resources. All development and revenue generation plans therefore need to be community-centric.

The Constitution (73rd Amendment) Act, 1992 and the Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996 rest the rights to management of natural resources and decisions on land use and development with the Gram Sabha, or the community, and not just with the Panchayat or other office bearers at the local/district/state level. The state of Uttaranchal has taken this forward by, for example, taking a decision to constitute one Van Panchayat for every village, using all available land under non ZA Revenue Land, and expansion of existing Van Panchayats wherever land is available.

The work of the Van Panchayats could be carried out by Self Help Groups (SHGs) comprising of families below the poverty line, and which could be financed through both the Swarnajayanti Gramin Rozgar Yojna as well as by loans from commercial banks to help create livelihoods for the SHGs and make them financially self-sustaining.

The state should help finance community-based/cooperative medicinal and aromatic plant ventures, managed wholly by the community including the marketing. Where possible, the state should train the community in processing, and help them put up processing plants in minor urban centers in the hills, to both generate employment, and keep the resources and its management within the community.

Annex V-1 Endemic Species in Uttaranchal

Name of the species	Family
Aconitum falconeri	Ranunculaceae
Aphyllorchis gollanii	Orchidaceae
Bulbophyllum rauii	Orchidaceae
Itea nutans	Iteaceae
Pittosporum eriocarpum	Pittosporaceae
Pseudodanthonia himalaica	Poaceae
Microschoenus duthiei	Cyperaceae
Mahonia jaunsarensis	Berberidaceae
Ivanjohnstonia jaunsarensis	Boraginaceae
Poa rhadina	Poaceae
Euphorbia sharmae	Euphorbiaceae
Flickingeria hesperis	Orchidaceae
Oxytropis duthieana	Papilionaceae
Trachycarpus takil	Arecaceae
Meeboldia selinoides	Apiaceae
Gentiana tetrasepala	Gentianaceae

Annex V-2 Some Threatened Flora of Uttaranchal

Name of the species	Family
Angelica glauca	Apiaceae
Michelia kisopa	Magnoliaceae
Berberis-lamberlii	Berberidaceae
Catamixis baccharoides	Asteraceae
Cautleya petiolata	Zingiberaceae
Cerastium thomsonii	Caryophyllaceae
Clarkella nana	Rubiaceae
Dendrobium normale	Orchidaceae
Dioscorea deltoidaea	Dioscoreaceae
Eisholtzia densa	Lamiaceae
Gentiana kurroo	Gentianaceae
Hedysarum astragaloides	Fabaceae
Lactuca filicina	Asteraceae
Nardostachys grandiflora	Valerianaceae
Saussurea costus	Asteraceae
Swertia chirayita	Gentianaceae
Taxus wallichiana	Taxaceae

Annex V-3 Some Threatened Fauna of Uttaranchal

S. No.	Common Name	Scientific name
	Mammals :	
1.	Bharal	*Pseudois nayaur*
2.	Four-horned antelope	*Tetracerus quadricornis*
3.	Himalayan tahr	*Hemitragus jemlahicus*
4.	Himalayan brown bear	*Ursus arctos*
5.	Himalayan palm civet	*Paguma larvata*
6.	Hogdeer	*Axis porcinus*
7.	Hyaena (striped)	*Hyaena hyaena*
8.	Indian elephant	*Elephas maximus*
9.	Leopard	*Panthera pardus*
10.	Leopard cat	*Felis bengalensis*
11.	Musk deer	*Moschus chrysogaster*
12.	Pangolin	*Manis crassicaudata*
13.	Serow	*Capricornis sumatraensis*
14.	Sloth bear	*Melursus ursinus*
15.	Snow leopard	*Panthera uncia*
16.	Tiger	*Panthera tigris*
17.	Wild dog	*Cuon alpinus*
	Birds :	
1.	Black-necked crane	*Grus nigricollis*
2.	Cheer pheasant	*Catrius wallichii*
3.	Lemmergeier	*Gypaetus barbatus*
4.	Himalayan monal	*Lophophorus impejanus*
5.	Mountain quail	*Ophrysia superciliosa*
6.	Pea fowl	*Pavo cristatus*
7.	Western tragopan	*Tragopan melanocephalus*
8.	Satyr tragopan	*Tragopan satyra*
	Reptiles :	
1.	Com. Indian monitor	*Varanus bengalensis*
2.	Dhaman (rat snake)	*Ptyas mucosus*
3.	Indian cobra	*Naja naja*
4.	King cobra	*Ophiophagus hannah*
5.	Russel's viper	*Vipera russelli*
	Insects :	
1.	Carabid beetle	*Amara brucei*

S. No.	Common Name	Scientific name
2.	Fritillary butterflies	*Argynnis altissima*
3.	Fritillary butterflies	*Argynnis clara clara*
4.	The Vanessas	*Vanessa c-album*
5.	Apollo butterfly	*Parnassius stoliczkanus*
6.	Regal apollo butterfly	*Parnassius charltonius*
7.	Keeled apollo butterfly	*Parnassius jacquemontii*
8.	Clouded yellows	*Colias eogenen*
9.	Clouded yellows	*Colias ladakensis*
10.	Argus butterfly	*Erebia mani mani*
11.	Dusky labyrinth	*Lethe yamabutterfly*
12.	Dark wall butterfly	*Parange menave meroides*

VI. AGRICULTURE

Agriculture in Uttaranchal can be termed as a multidisciplinary activity including animal husbandry, especially in the hilly districts. The inputs from animals in terms of manure, and animal power are the key to traditional agriculture in the higher and middle Himalayan pockets. However agriculture in the Shiwaliks, Terai, and middle Himalayas, as well as in the plains is being transformed; in the plains it is fast becoming resource intensive. The agriculture in the plains has also given an impetus to the ancillary industries depending on agro products such as sugarcane mills, rice mills; which in turn has resulted in marketing networks (mandis), especially spread across Udhamsingh Nagar.

Agriculture has a significant impact on the state of the environment. Agricultural practices can contribute to either sustaining the environment and enhancing diversity, or towards its degradation and the loss of diversity. In Uttaranchal the impact of agricultural practices on the environment is even more critical for many reasons. Firstly, the mountain ecosystem is extremely fragile. Secondly the forest is intimately linked with agriculture. Agriculture can create stresses on the forests, which leads to its degradation and destruction. The loss of forests can further threaten the already complex and delicate ecosystem. Thirdly, the state is the source of water for almost half of the country. The impact of agricultural practices here on water resources will affect the availability and quality of water in large portions of the country.

Uttaranchal has land area of 55845 km^2 of which 80 per cent is hilly and remaining 20 per cent is plain land. As in the rest of the country, agriculture accounts for the livelihood of the majority of the people in the state of Uttaranchal, with more than four-fifth of the working population directly engaged in it, even though it accounts for only 12.5 per cent of the total land.

Total cropped area in the state accounts for around 23.5 per cent. The net area sown is around 14.5 per cent. Only 11per cent of the total area is irrigated and almost 64 per cent is fed by natural springs.

The major crops of Uttaranchal include paddy, wheat, maize, soybean, and other pulses. The food grain production in the state during 1991 stood at 1487 million tonnes.

A. Factors Affecting Agriculture

The diversity of landscape in terms of altitude, topography, climate, forest resources, availability of water resources for irrigation and socio-economic and cultural factors have resulted in the evolution of a variety of agro-ecosystems in this region.

Terrain

The topography of the area is mainly steep. Chauniyal (2001) identifies ten types of land found in Uttaranchal:

1. Gad (river channels)
2. Bagar (flood plain)
3. Sera or Taya (river terrace)
4. Talaon (good quality low lands)

5. Upaoti (medium quality upland)
6. Katil or Pkhar (poor quality upland)
7. Bahj Dhaya or Dhar (grazing land)
8. Jungal (danda or dhar)
9. Bugyal (alpine pasture)
10. Hiwali Kantha or Himadri (snow covered land)

The soils in the state are alluvial, riverine, non-calcerous to moderately calcareous soils along its river valleys. Some red soil is also found in Garhwal region. Forest soil occurs under coniferous and deciduous forest in the Shiwalik and lower Himalayas which are rich in organic matter. Dabar is the range of mountain soil occurring at higher regions.

Table VI-1 Suitable Crops according to Soil Types

S. No.	Farming Situation	Soil Type	Dominant Forest Vegetation	Principal Crops
1	Irrigated lower hills (600-1200m)	Alluvial sandy soil	*Shorea robusta, Pinus roxburghii*	Rice, wheat, Onion, Chillies, Peas, Potato, Radish, Cauliflower
2	Rainfed lower hills (600-1200m)	Residual sandy loam	*Shorea robusta, Pinus roxburghii*	Finger Millet, maize, rice, wheat
3	Mid hills south aspect (1200-1700 m)	Sandy loam	*Pinus roxburghii, Grewia optiva, Celtis australis*	Rice, Finger Millet, wheat, potato, tomato
4	Mid hill north aspect (1200-1700 m)	Brown Forest Soil	*Quercus leucotrichophora, Rhododendron arboreum*	Rice, finger millet, wheat, potato, tomato, peas, cole crops
5	High hills (1700 – 2500 m)	Red to dark	*Q. leucotrichophora, Q. floribunda,Rhododendron arboreum, Dendrobenthmedia capitata*	Amaranth, finger millets, French bean, cole crops, potato peas
6	Very high hills (2500 – 3500 m)	Red to dark black clay	*Q. Semicarpifolia, Abies pindrow*	Amaranth, buckwheat, peas, loam cole crops, potato
7	Alpine Pastures (>3500)	Heavy textured meadow soil	*Danthonia caonymeriana, Juniperus spp*	Alpine flora

Source: Chauhan V.S. & Bhatt J.C., "Agriculture in Uttarakhand: from subsistence towards self-sufficiency" in *Uttarakhand Statehood*, ed. M.C. Sati & S.P. Sati, 2000, IPC, New Delhi

Given the lack of level land, the people of the region have over millennia developed a complex farming system suited to the ecosystem in which they live and sustained with

***Char* system: management of grazing land**

Management of pasture and grazing land is undertaken under the *char* system. The grazing land commonly owned by the village is divided into blocks which are alternately closed for grazing or sharing under the common authority of the village community, for designated periods. The practice prevents overgrazing and allows regeneration and conservation of resources, both the grazing land and the produce, that is, the grass. The *char* system as a matter of fact is a traditional roster system, where periodic grazing and sharing is allowed in the interest of protection and management.

- R.S. Negi, "Subsistence strategies and environmental management"

organic matter and nutrients derived from the forests. The forests often surround cultivated land. In Garhwal, for example, there are three broad ecological zones-

- the intensive agricultural zone in the outer Himalayas – the Duns and Terai, where wheat, rice, especially wet rice and sugarcane are intensively cultivated.
- agro-pastoral zones in the middle Himalayas, where mandua (finger millet) based subsistence agriculture is practiced. Rice, though not a dominant crop is grown in river and rivulet basins, where natural irrigation facilities are available.
- pastoral zone in the inner Himalayas, where herding, together with growing barley and some millet is the main subsistence strategy. Occasionally, in some places, wheat may be grown.

The agriculture in these zones is not exclusive, but is conditioned by environmental constraints such as soil, aspect, slope, temperature, rainfall, etc.

Agro-climatic factors

The climate plays a critical role in determining the kind of agriculture that is practiced. The basic patterns of summer and winter monsoon are governed by the Asian continental mass. Summers at an elevation of 3000 mts are mild with an average maximum temperature of 30-32° Celsius. In the Siwalik hills and the lower Himalayas, the temperature can even reach 40° celsius particularly in the valley. The rainfall is high (1200-1600 mm). However, as the soil does not hold water for very long, the percolation losses are high. Some special features of the cycle of seasons in these regions are:

1. Monson season shorter; annual rainfall varies between 1000 and 2000mm.
2. Pre-monsoon showers last for short duration
3. Abrupt arrival of monsoon in the state
4. Lowest line of snow line is in the region of 2500 mts in winters
5. Line of perpetual snow is low

Table VI-2 Physiographic zones of the state and agricultural diversity (on the basis of altitude from sea level)

S. No.	Zone	Regions & Area	Agricultural Diversity
1	Zone A (upto 1000 m)	Tropical Zone: Plains, Terai, Siwalik hills, Valleys	Paddy, Wheat, Sugarcane, Maize, Mango, Litchi, Pulses, oilseeds, soyabean etc.
2	Zone B (1000 - 1500 m)	Sub-tropical Zone: Largely un-irrigated area	Paddy, wheat, Mandua, Pulses
3	Zone C (1500 – 2400 m)	Cool temperate Zone	Kharif crops, Horticulture, Floriculture, Medicinal and aromatic plants
4	Zone D (> 2400 m)	Sub-Alpine, Alpine Zone	Pastures, rare herbs, pine, Ringal, etc.

Source: Agriculture Policy Document, Uttaranchal

About 90 per cent of agriculture practised in the state is rainfed. Farmers commonly grow three crops in two years. Other characteristic features of rainfed agriculture are— infrequent use of high yielding varieties and chemical fertilisers, mixed cropping patterns, and leaving lands fallow to restore soil fertility.

Irrigated agriculture is confined to fertile valley areas where HYVs and chemical fertiliser are used. Quite often, more than two crops in one year are grown.

The Rajpur canal

The earliest of all the Dun canals is the ancient Rajpur Canal, taking off from the Rispana river and bringing its water along the crest of the water parting as far as the town Dehra. The construction of this Canal has been attributed to Rani Karnavati and her consort, Ajbu Kaur, who administered from the ancient capital at Nawada, the Sub Himalayan territories of the rajas of Garhwal. Later, the work of maintaining and repairing this canal was entrusted to the Mahants of the Temple of Guru Ram Rai in Dehra. In 1817, Mahant Har Sevak claimed full proprietary rights over the canal, a claim which the Board of commissioners, accepting the old tradition, disallowed on the ground that the Rani had lived previous to the existence of Nanak Shah to whom the temple was originally dedicated. Captain Cautley submitted a project in Nov. 1840 to make the water course "pucca" and work was commenced in 1841 and completed in the rains of 1844, when water was first admitted into the canal. Originally, the Rajpur Canal was designed to convey drinking water to the town of Dehra though later improvements so increased the supply that it was used for irrigating a few villages.

www.uttaranchalirrigation.com/canals/rajpur.htm

Irrigation

Irrigation facilities are mainly present in the outer Himalayan plains – the Duns and the Terai regions.

Traditional irrigation methods have made use of the topography of the region – the steep slopes and have relied on gravity for watering the fields. These irrigation canals, dug along the contours of the fields to maintain the flow of water, are locally called *Guls*.

Table VI-3 Irrigation - area and infrastructure

Net and Gross Irrigated Area (1998-99)	Ha.
Canals	101867
Tubewells	180945
Wells	18475
Tanks/Ponds	91
Other Sources	42029
Net irrigated area	343407
Gross irrigated area	551054
Irrigation infrastructure (1999-2000)	**Number/ km**
Length of canals	7808 (km)
Tubewells	13905
state	653
private	13242
Pumpsets	45998
ground level	1301
Borings	44697
Pucca wells	43
Rahat	6
Hauj	26397
Gul	11543 (km)
Hydrum	1027

Source: *Uttaranchal At A Glance 2002-03*, GoUA.

Agro-biodiversity

Crop diversity & food security

Both cultivated and wild diversity exists in the state offering number of edible products. For instance a total of 127 food providing plants are found in Henwal valley of Garhwal Himalayas which include 24 wild fruits, 14 wild varieties and 32 cultivated types of vegetables, 18 types of fruit species, 9 spices and condiments, 12 types of cereals, millets and pseudocereals, 10 types of pulses, 8 varieties of oilseeds, 15 species of fodder among others.

Interestingly, in 1930 Vavilov identified this region as one of the world's most important centres for cultivated plant origin. The sub-continental centre, China centre, South East Asia Centre and a part of Central Asia Centre of the famous Vavilovian Theory of cultivated plants original centres of the world are included in this region. One-fourth to one-fifth of the 666 species of the world originated here.

Uttaranchal is one of the three sub-centres of biodiversity in the country. It is an important centre of diversity for many varieties of food crops, vegetables and fruits, including amaranth and many millet varieties. This biodiversity has contributed to the development of the mixed cropping systems in the state, and towards ensuring food security.

Mixed cropping produces food during every season, and is an insurance against crop failure. It also makes use of the micro-ecological niches available and confers fertility to the soil. It reduces input costs, as it reduces the need for external high cost inputs, and helps the farmer retain her/his self-reliance.

Mixed cropping as a farming system has evolved as a subsistence farming system and is central to the farmer's existence in the hills. In mixed cropping, plant varieties are selected so that almost all their parts have some important use, and not just the seed as seed/grain. The chaff produced by the field is used as fuel for cooking, and its ashes as a dye and for washing clothes. The chaff is also often used as fodder for the cattle, which provide milk and draught energy.

Withering crop diversity and deteriorating agriculture base

The hill agriculture of Uttaranchal is the repository of large number of traditional crops and cultivars whose economic and ecological potentials have not yet been fully utilized. However, this diversity is fast vanishing. This is leading to monocultures in the place of mixed cropping. One of the survey in 150 villages of located along the altitudinal gradient of the Alakananda catchment of Garhwal hills reveals declining diversity of traditional crops during a very short period of two decades (1974-94). Reduction in crop diversity is partly due to newly introduced high yielding varieties particularly in irrigated conditions and partly because of increased emphasis on cultivation of traditional cash crops, change in food habits and socio-economic conditions.

Source: Mailkuri et al, "Changing scenario of Himalayan agroecosystems: loss of agrobiodiversity, an indicator of environmental change in Central Himalayas, India", *The Environmentalist*, 21, 23-25, 2001

Because agricultural diversity is central to this system of farming, mixed cropping plays a critical role in conservation. Over the last few decades, the small and marginal farmers of the hills have conserved 250 varieties of rice, 170 varieties of rajmah, numerous indigenous varieties of millet and vegetables through their regular use. Many of these varieties are drought resistant, wind resistant, and yield large quantities of grain and straw. For example, *Ramjawan Safed* and *Aalaknandya*, varieties of paddy grown in Garhwal Himalayas, yield upto 60 and 54 quintals per hectare respectively under rainfed conditions. *Jadakhya, Jakhdya, Jarjaru, Radha Sati Ukhadi,* are some of the other high grains yielding rainfed paddy varieties grown in the region[9].

B. Land Holding Patterns

Unlike the situation in the rest of the country, the majority of the farmers of Uttaranchal are owners-cultivators. Tenant farming and sharecropping is rare. Landing holdings are small, and the zamindari system of big landholders is limited to the plains.

Among the cultivated land about 50 per cent of the landholdings are sub-marginal and further 21 per cent are between 0.5-1 hectare. About 70 per cent of land holdings are less than 1 hectare in size and cover about 27 per cent of the area under

Baranaja system of mixed cropping

In traditional fields, twelve crops are grown together, giving the name of baranja to this system. The crops are

1. Phapra (*Fagopyrum tataricum*)
2. Mandua (*Eleusine coracana*)
3. Marsha (*Amaranthus frumentaceous*)
4. Bhat (*Glycine soja*)
5. Lobia (*Vigna catiang*)
6. Moong (*Phaseolus mungo*)
7. Gahath (*Dolichos biflorus*)
8. Rajma (*Phaseolus vulgaris*)
9. Jakhia (*Cleome viscosa*)
10. Navarangi (*Vigna umbellata*)
11. Jowar (*Sorghum vulgare*)
12. Urad (*Phaseolus mungo*)

Source: *The Seed Keepers*, 1996, Navdanya, New Delhi

[9] *Nature's Harvest,* Navdanya, (2002) Dehradun.

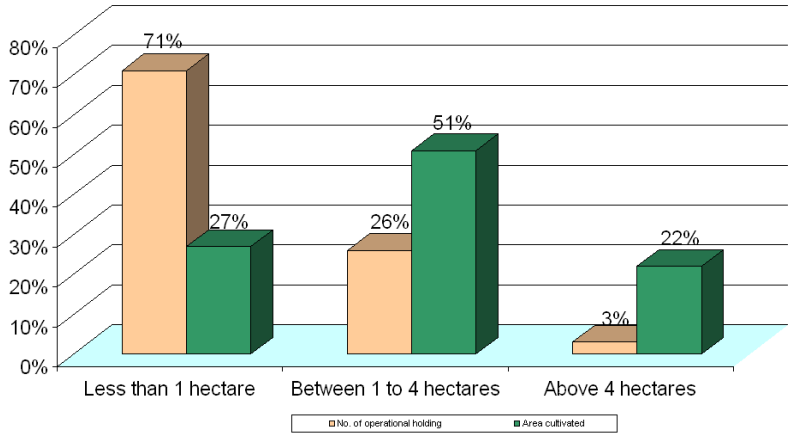
cultivation. About 26 per cent of land holdings are between 1 to 4 hectares in size covering about 51 per cent of the total cultivated area. Over 3 per cent of land holdings are above 4 hectares in size and cover about 22 per cent of the total cultivated area.

Another important aspect of agricultural land holding in the state is that it is highly fragmented and scattered. In Garhwal region, maximum land holding is in the semi-medium class followed by small and marginal. While in Kumaon maximum landholding is represented by marginal class which is followed by semi-medium and small classes. The average landholding in Uttaranchal is 0.2 ha/ capita.

C. *Land Use Patterns*

The terrain, altitude, aspect, topography, etc. determine the land use patterns in Uttaranchal.

Figure VI-1 Operational holdings in Uttaranchal



Source: Data from *Uttaranchal Statistical Diary 2001*

Agriculture in Uttaranchal is complex as it is interlinked with crop husbandry, animal husbandry and forests to form a production system. In the north-eastern Himalayas, shifting cultivating linked with swine-poultry husbandry is the most extensive landuse. However, the settled agriculture on terraced slopes coupled with milch cattle, goat and sheep husbandry predominates in Uttaranchal.

Table VI-4 Landuse in Uttaranchal (1998-99)

Land Use in Uttaranchal (98-99)	Garhwal	Kumaon	Uttaranchal
	Area in Hectares		
Total Geographical Area	3245000	2103500	5348500
Total Reported Area	3530378	2061983	5592361
Forests	2374439	1124008	3498447
Barren & Unculturable Land	230477	64279	294756
Land put to non-agri use	99091	67233	166324
Culturable waste	175788	148655	324443
Permanent pastures & grazing lands	79538	149402	228940
Land under misc. tree crops not included in	105717	111316	217033

Land Use in Uttaranchal (98-99)	Garhwal	Kumaon	Uttaranchal
area sown			
Current fallows	6001	5256	11257
Other fallow lands	38875	28169	67044
Net area sown	420452	363665	784117
Area sown more than once	220738	254536	475274
Gross copped area	641190	618201	1259391
Kharif	399416	357854	757270
Rabi	226127	249616	475743
Zaid	14239	10726	24965
Area left for sugarcane	1408	5	1413
Total cropped area	641190	618201	1259391
Cropping intensity	152.5	169.99	160.61

Source: *Uttranchal Statistical Diary 2001*

D. Crop Rotation

Crops are rotated regularly in traditional Uttaranchal agriculture to make full use of the land, raise diverse crops, as well as regenerate the soil's fertility. Crop rotation is of three types, each adapted to different types of land.

Two year rotation of four crops

This type of crop rotation is found in the Duns and Terai region, where two harvests are gathered in a year. A Kharif/Rabi rotation of rice and wheat in the first year is followed by maize and mustard or potato in the second year. If sugarcane is being grown, it is grown continuously for three years, followed by wheat or mustard in the fourth year.

Yet another type of rotation followed, especially in *talaon* land, to maintain high yield in rice is to grow different varieties by rotation.

Two year rotation of three crops

This kind of rotation, which is practiced on permanently terraced rainfed *upraon* lands in the middle mountains of Garhwal, requires the community to act as a whole, with the village headman playing a pivotal role in decision making. The village is divided into two contiguous blocks called *sar*. Rice is grown in one block – *satyara sar* (rice block), and mandua and kodo millet is grown in the second block – *kodara sar.* In winter, after the mandua is harvested, the block is left fallow for cattle to graze on, while wheat is sown in the other block after harvesting rice. The block is now known as *gyunwara sar* or wheat block. This is followed by mandua, when the block becomes *kodara sar.* The fallow land is planted with rice, turning it into *Satyara sar*, and the cycle is repeated. If the land is too stony, jhangora and barley are planted in the two blocks, and the same cycle is repeated.

In the higher regions, the lower temperatures and shorter growing periods necessitate a different rotation. In lands that border human settlements and are regularly manured, the rotation is of amaranth followed by barley in the northern villages, and buckwheat followed by barley in the southern villages. In mountain agriculture, there is no clear dividing line between the field and the forest. The field, the forest and livestock are integrated into a sustainable whole, each complementing and sustaining the other. yet higher villages, amaranth (April-September) is followed by barley (October-June), followed by mustard (August-December), after which the land is left fallow till the following April, when the cycle starts again.

Six to nine-year rotation on katil land

This kind of rotation is practiced on unterraced katil land at even higher altitudes, where the land lies far away from human habitation. The first summer mandua is planted, followed by wheat or barley for the first winter, followed by mandua again the second summer. Then the land lies fallow for the second winter. The third summer, Gahat, or buckwheat is planted, and then the land lies fallow continuously for three years. The whole rotation takes five years to be completed, and is known as *tisali.* Sometimes the fallow period is extended for six years, when the whole cycle takes nine years.

E. Agricultural Inputs

The dominant agriculture practiced in the hills of Uttaranchal is Low External Input agriculture. As the steep slopes lead to high percolation losses of water, farmers have traditionally overcome this by adding large quantities of farmyard manure to the fields, more for its contribution to soil texture than for its contribution to increased fertility. For the farmer of Uttaranchal, increasing the soil's capacity to retain moisture is the single most important function of farmyard manure.

Fertilisers

Uttaranchal is one of the lowest users of chemical fertilisers. On an average, the consumption of chemical fertiliser is at 69.10 kgs per hectare. The consumption is however, not uniform across the districts. It is highly skewed with Haridwar, Nainital, Udhamsingh Nagar, Dehradun accounting for maximum fertiliser consumption. The fertiliser consumption in Udhamsingh Nagar and Haridwar is even higher than the national average. In the rest of the districts, fertiliser consumption is negligible.

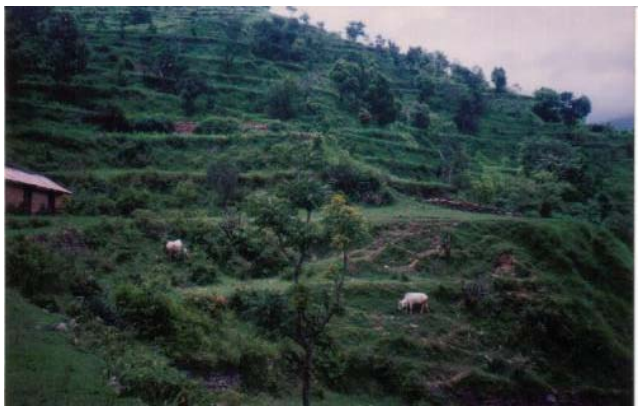
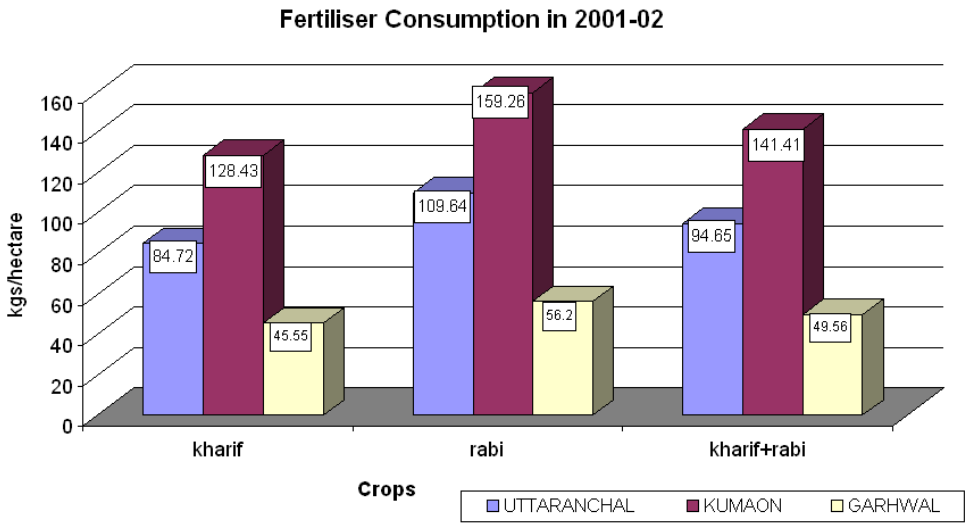
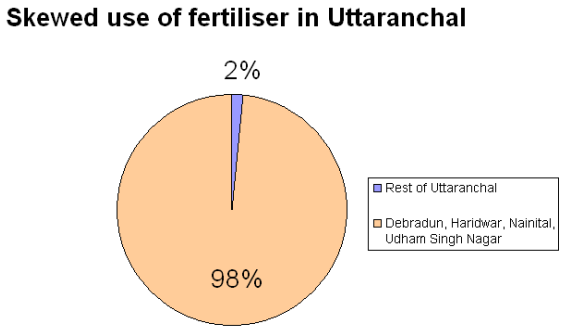


Figure VI-2 Fertiliser consumption figures



Source: Adapted from *Uttranchal Statistical Diary 2001*

Figure VI-3 Skewed use of fertilizer



Source: adapted from *Uttranchal Statistical Diary 2001*

An agricultural survey conducted in villages *Galani, Lawand, Khewrala and Malli* in Okhalkhanda Development Block in the hilly areas during 1980-81 revealed that the villages are totally rainfed and whatever cultivation that can be undertaken was best done during the rainy season. The agricultural produce from a total of 13.85 hectares of land through application of 130 kilograms of chemical fertilisers in these villages for various crops is given below:

Table VI-5 Cropwise production in Okhalkhand development block

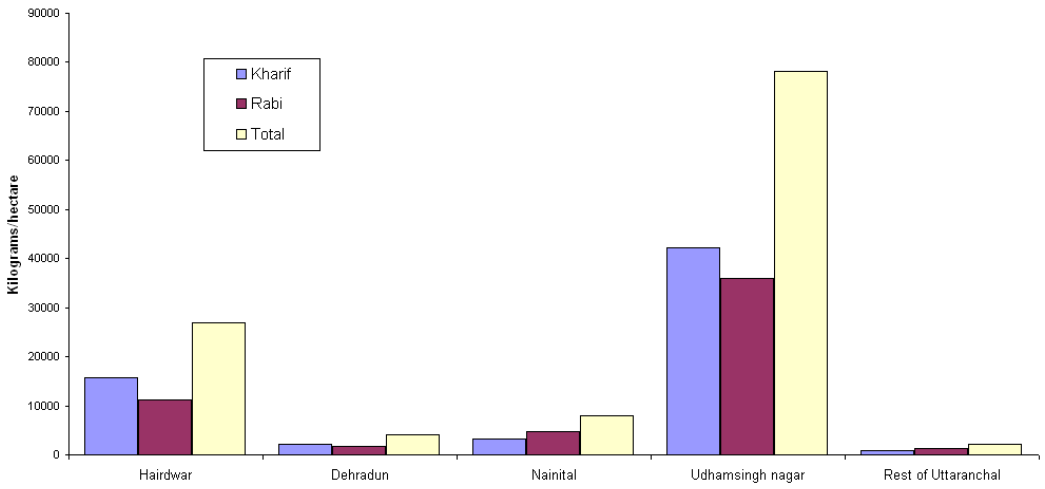
S.No.	Crop	Production / hectare
1	Wheat	4.6
2	Barley	2.2
3	Paddy	7.46
4	Maize	8.00
5	Mandua	3.90
6	Ghaut	25.28

7	Urad	15.28
8	Sem	6.85
9	Matar	2.85
10	Soyabean	10.91

S.No.	Crop	Production / Kilogram seed
11	Pinalu	10.06 kilograms
12	Kaddu	1000 Quintals
13	Louki	900 Quintals
14	Muli	800 Quintals
15	Brinjal	500 Quintals
16	Onion	50 Quintals
17	Potato	2.5 Kgs
18	Chillies	1.5 quintals
19	Turmeric	5.06 kgs
20	Others	5 quintals

Source: *Nainital Samachar, 2003*

Figure VI-4 Food production and chemical fertilisers



Source: adapted from *Nainital Samachar*, *2003*

Given the flow of water, it is impractical to use chemicals for fertility in the hills. Biomass is the manure of choice. There are many forms of biomass used:

1. Recycling of natural nutrients

Organic farming: a high-income potential for Uttaranchal

Uttaranchal has one of the lowest use of synthetic fertilizers and pesticides in agriculture and this provides the state with the opportunity of looking into the potential of organic farming as a means of generating income. While organic farming may affect productivity, it has been also recognized as a unique strength for taking advantage of the current trend of consuming chemical-free food. The state has declared organic or green farming for export as a priority thrust area. The specific pockets for growing basmati or *japonica* rice is a natural advantage and provides opportunity of export.

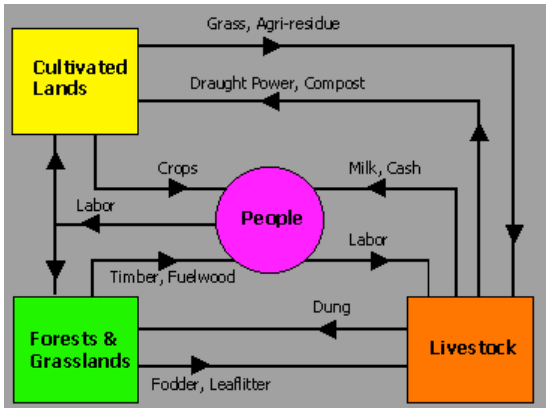
2. Gathering leaf mould from the forest floor
3. Gathering cattle bedding made of dry leaves and pine needs, which is then soaked in cattle urine and dung
4. Composting the gathered material
5. When the fields are far from the home, the manure may be prepared in the field itself. Cattle are also penned there in summer, and shifted from field to field, so that their urine dung can fertilise the fields.
6. The stems of crops and grass are left to dry in the fields, and later burnt. The ash is then spread all over the field.
7. Green weeds that grow in the harvested fields are ploughed back into the soil as green manure.

Thus, in the hills, the farming systems are heavily dependent on livestock for manure, on grasslands that provide fodder for the livestock, and the forest for both fodder and leaf litter.

Studies of energy transfers between agriculture, livestock and forests and other non-cultivated lands have shown that each hectare of agricultural land requires 7 to 14 ha of support lands. However, the forest and support lands available today in Uttaranchal per ha of agricultural land are in the ratio of only 1:2 or 1:3.[10]

The flows between cultivated lands, support lands, livestock and the people of the region are graphically depicted in a flowchart in the figure below.

Figure VI-5 Mountain farming systems



Source: "An introduction to the mountain farming system"

Pesticides

In the higher hills, the system of crop rotation and mixed farming does not allow pest buildup to occur. Thus there is hardly any use of chemical pesticides. Again, as the concept of weeds does not exist, and all weeds are treated as either green manure or fodder, there is little use of herbicides.

[10] *Source: "An introduction to the mountain farming system"* mountaintechnology.tripod.com/intro/mtnfarmsys.html

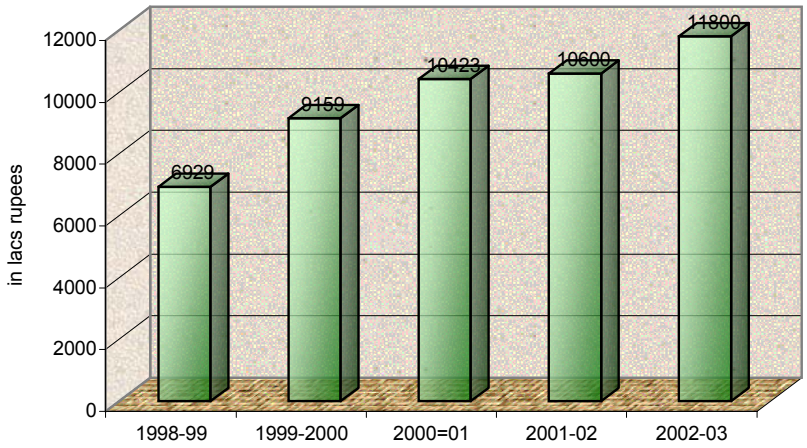
In the lower plains, pesticides and other chemical plant protection methods are used on crops.

Seeds

Uttaranchal farmers, like farmers in the rest of the country, have traditionally exchanged and bartered seeds amongst themselves. Seed saving and seed storage have been a vital part of women's cultural heritage. A study by CUTS has shown that in Uttaranchal in 2003, over 80 per cent of the farmers used saved paddy and wheat seeds. Only 7 per cent farmers purchase paddy seeds, and 11 per cent wheat. The rest exchange seeds with one another. For other crops, more than half the farmers get their seeds through exchange with other farmers[11].

The series of National Seed Projects the UP Seeds and Tarai Development Corporation Ltd. established first in 1969 by the GB Pant Agricultural University, the GOI and the farmers of Terai and restructured in 1978, have made a significant dent in the farmers' seed supply system. Both the NSPs and the UPS and TDC were set up with World Bank financing. Though farmers in the hills continued to use indigenous seed in their mixed rainfed cropped farms, in the Duns and Terai regions, irrigation facilities were made available and HYVs introduced.

Figure VI-6 Turnover of seeds 1999-2003



Source: adapted from data given in uastdc.com/turnover.htm

The CUTS study has also shown that farmers feel prohitbited from purchasing seed because of its high cost, the unreliability of purchased seed and the unavailability of seed suitable to local conditions.

[11] "IPRs, Access to Seed and Related Issues", *CUTS Briefing Paper No. 6/2003*

F. Agricultural Performance

Productivity and availability of food

Compared to the national average, agricultural productivity of Uttaranchal is low. An NGO (Inhere) has estimated that the average agriculture yields foodgrains in a range between 3000kg and 5500 kg against 40 kg. of seeds in rabi and kharif crops. This provides four to six months food grain supply in the upper hills, and six to ten months of supply in the irrigated plains.[12] The Uttaranchal government gives the following productivity figures for the year 1998-99.

Table VI-6 Agricultural productivity for different crop categories 1998-99

Crop category	Crop	Productivity (Qtl/ha)
Cereal		16.31
	Rice	18.29
	Wheat	17.11
	Barley	11.26
	Jowar	6.25
	Bajra	11.55
	Maize	11.12
	Mandua	12.84
	Sanwan	12.73
	Kodo	1.75
Pulses		6.00
	Urad	3.00
	Moong-Moth	6.10
	Masoor	7.09
	Beans	8.83
	Peas	10.08
	Arhar	0-1
Oilseeds		7.21
	Rapeseed/Mustard	8.24
	Sesamum	1.38
	Groundnut	8.31
	Sunflower	12.51
	Soyabean	4.37
Other crops		566.95
	Sugarcane	614.19
	Potato	227.05
	Tobacco	69.22
	Cotton	1.93

Source: *Uttaranchal At A Glance 2002-2003*, GoUA

[12] www.inhereindia.org/general.htm

Table VI-7 Production of major crops

Major crops	Average grain yield (Qtl/ha/year)	Total net sown area (ha)	Total production (MT)
Cereals	20	437031.10	87406
Millets	25	206523.90	51631
Pulses	10	22651.00	2265

Source: Maikhuri et al, "Agriculture in Uttarakhand: Issues and Management Prospects for Economic Development" in Sati and Sati's *Uttarakhand Statehood: Dimensions of Development*, 2000, Indus Publishing Company, New Delhi

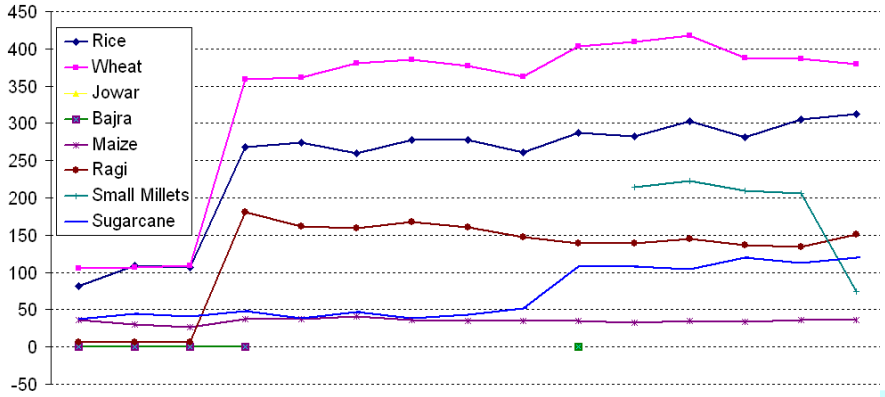


Figure VI-7 Changes in acreage under different crops('000 ha) (1997-2000)

Source: adapted from CMIE data

The per capita availability of cereals in the state is 147.36 kg. as compared to 202.33 kg (2000) for the country as a whole. The per capita availability of millet in the state is 87.12 kg. However, millet consumption is on the decline, as the Green Revolution and the Public Distribution System have given a boost to the consumption of fine cereals – rice and wheat. This change in food habits is the primary reason for the apparent food scarcity in the state, which is otherwise food secure. Many food scarce areas of Uttaranchal are forced to buy large quantities of food from outside to meet local production shortfalls of fine cereals. Payment for food imports is a big burden to the regional economy.

Causes for Agricultural Deterioration

The main causes which are directly and indirectly responsible for creating imbalances in traditional agriculture of Uttaranchal are:

- Lack of appropriate policies and planning
- Lack of specific programmes and incentives
- Deterioration of traditional agri-eco-systems because of introduction of modern high yielding crop varieties and replacement of mixed cropping by monocropping
- Abandonment of traditional agro-ecosystems by the indigenous population
- Socio-economic and cultural changes
- Migration of hill population to the plains in search of employment
- Illusion about quality of coarse and fine grains
- Aspiration for off-farm employment of the local inhabitants
- Lack of institutional arrangement, mechanism and human capacity building
- Deterioration of natural habitats caused by man-induced environmental changes
- Lack of scientific interest in traditional crops

Source: Maikhuri et al, "Agriculture in Uttarakhand: Issues and Management Prospects for Economic Development" in Sati and Sati's *Uttarakhand Statehood: Dimensions of Development*, 2000, Indus Publishing Company, New Delhi

G. *Agricultural Policies*

Agriculture policies over the years strived towards self-sufficiency in food production; nevertheless they also created considerable economic inequalities and vulnerabilities, and have had long term consequences for the environment. They completely overlooked diverse traditional agro-ecosystems with diverse crops and cropping patterns and only focused on monocrops thereby threatening the ecosystems. The policies favoured centralised control, provided benefits to the farmers with large holdings growing *few* crops and penalised farmers with small holding that often cultivate *many* crops. This encouraged uniformity of crops and made farmers dependent on expensive and often unreliable sources of agricultural inputs. This did not merely threaten the ecosystems, but made agriculture unremunerative for farming communities.

Figure VI-8 Value of Agricultural Production (1998-99)

Crops	Value in Lakh Rupees
Cereals	1000.89
Pulses	4258.00
Oilseeds	10119.00
Other crops	41783.00

Source: *Uttaranchal At A Glance 2002-03*, GoUA

At the same time, the policies ignored traditional food crops such as buckwheat and amaranth, which have comparative market advantages. Potential economic returns from amaranth and buckwheat are over two to four times of the returns from HYVs of paddy and wheat. The net result of the negative pressures on agriculture has been migration from rural areas to urban areas or out of the state migration, leaving a reduced work force for farm labour. This has resulted in a gradual decrease in the net sown area in the state.

Figure VI-9 Changes in net sown area

District	Five-year average				% change
	1974-79	1979-84	1984-89	1989-94	1974-94
Uttarkashi	33512	30495	33081	30519	-8.93
Chamoli	43195	46264	43463	46463	7.57
Pithoragarh	72251	72700	72882	72494	0.34
Tehri	74568	73182	70898	70925	-4.89
Nainital	201417	205979	203091	204383	1.47
Almora	111598	117367	105605	111184	-0.37
Pauri	102914	101079	98511	89568	-12.97
Dehradun	56067	57006	55718	53461	-4.65
Uttaranchal	695523	704072	683249	678997	-2.38

Source: K.S.Rao and S.N.Nandy, GBPIHED

The cultivation of mushrooms, a high value crop, is quickly becoming popular with the farmers of Uttaranchal.

The Pauri district has shown a decrease of approx. 13 per cent in the net sown area over the last two decades, followed by Uttarkashi district. It indicates non availability of land for agricultural activities due to lack of irrigation facilities.

While the long-term impacts of such policies that promote water and chemical intensive moncropping have not been assessed for Uttaranchal specifically, some findings from other parts of the country, including UP can be extrapolated here.

Deforestation.

Traditional mixed agriculture does not require large sized landholdings; monocropping does. Intensive agriculture in the Duns and the Terai region has been one of the principal causes of deforestation, leading to loss of habitat for animals, plants and forest dwelling humans leads to salt accumulation, changes in the pH values of the soil, and reduction of its carbon content, which is essential for retaining moisture. According to Abrol and Bumla (1971), about 2.5 million ha. of alkali soils in the Indo-Gangetic plains is salt affected.[13]

Water-logging due to surface flooding is a problem in areas where the water table is high; in Uttaranchal it affects the Terai region in particular.

Biological degradation occurs when monocropping leads to increased incidence of pests and diseases including soil borne disease. This leads to increased used of pesticides, which in turn reduce microbial activity and biomass, as well as in the inhibition of nitrification for a prolonged period after their application.

Soil erosion.

Soil erosion, primarily caused by deforestation, is a leading cause of siltation of rivers. Soil erosion also leads to flooding due to the reduced capacity of the drainage systems.

Loss of biodiversity.

The farmers in the state cultivate different crops for different purposes like productivity, drought resistance, taste, nutritive value, rituals etc. Simple, less complex ecosystems and monocultures threaten to erode the genetic diversity of these crops. They are also are extremely prone to various kinds of damaging agents and hence threaten the security of farmers.

[13] Abrol IP and Bhumla DR (1971) "Saline and alkali soils in India – their occurrence and management", *World Soil Resources Report*, **41**:42-51, FAO, Rome.

Extension of cultivation to marginal lands.

As the high potential fertile agricultural lands were already brought under cultivation, the need for more land demanded by intensive monocropping led to the widespread use of lands only marginally suitable for farming, which are less fertile or more prone to degradation. Such lands include steeply sloping lands, shallow or sandy soils, etc.

Over exploitation of groundwater resources.

HYV seeds are thirsty seeds. While mixed cropping and rainfed agriculture makes use moisture retained in the soil itself, without the need for extra water, HYVs as well as inorganic chemicals require inordinately large amounts of water. This has led to a serious shortage of water in a state that is considered the water reservoir of the northern part of the country.

Pollution of groundwater resources

When chemicals are used in agriculture, only a portion – 23 per cent - is consumed by the plant[14]. The rest leaches beyond the root zone or is lost by volatisation. The leached salts reach the groundwater, contaminating it. Residues of agricultural chemicals, including pesticides, have been increasingly found in river waters as well as drinking water.

- The development of sustainable agriculture in Uttaranchal needs the following priority interventions:
- Drastic reorientation is required in agricultural policies while keeping marginal societies and rainfed conditions of Uttaranchal in mind.
- Improvements in scientific knowledge on the ecological and socioeconomic functions of agriculture.
- Empowerment of women as the main conservationists and managers of traditional agriculture.
- Improvement of traditional technologies of soil fertility management and agronomic practices to enhance yield in their natural habitats.
- Strengthening traditional agro-forestry through cost-effective water harvesting tank technology.
- Promotion of organic recycling, integrated pests and nutrient management
- Exploration of value addition to the traditional crop-products and research into their potential market demand.
- Promotion of village marketing cooperatives for biodiverse agricultural products so as to avoid exploitation by the middlemen.
- Irrigation facilities need to be increased to enhance the agricultural productivity.

Source: Maikhuri et al, "Agriculture in Uttarakhand: Issues and Management Prospects for Economic Development" in Sati and Sati's *Uttarakhand Statehood: Dimensions of Development*, 2000, Indus Publishing Company, New Delhi

H. *Marketing of Agricultural Produce*

The development of regional linkages in the Terai and Bhabbar zones by rail and road led to the creation of strong movement zones for the goods and produces, resulting in the numerous mandis established during the past three decades. The mandis have been classified as A, B,C class mandis as per their product arrival and dispatch to their market destinations.

[14] TERI, *Looking Back to Think Ahead: Green India 2047* (1977) TERI, New Delhi, pp. 78-79

There is a concentration of big mandis in the plains. The local markets in the hills lack basic facilities of cold storage, stocking, transportation etc. These small markets mainly contribute to the big mandis in the plains, while some of the goods are transported to higher hills. The lack of infrastructure has also led to low valuation of products like vegetables, horticulture crops. The hill districts are also suitable for off-season vegetables required in the surrounding states.

The major markets and mandis are located in Udhamsingh Nagar due to better connectivity to the railways and hence are able to cater to far off places. The main crops which are sent out are rice, paddy, wheat, potato, onion, peas and some fruits.

Figure VI-10 Overview of agricultural produce markets and products

Mandi	Major Products	Destinations
Kashipur	Paddy, wheat	Assam, Delhi
Rudrapur	Paddy, rice, potato, wheat maize, green peas, cabbage, reddish, onion	Assam, Delhi, Kerala, Haryana, Gujarat
Haldwani	Paddy, rice, wheat, potato, mango, litchi, bananna, ginger,	
Khatima	Paddy, rice, wheat, potato, onion, green peas, tomato, pear, cabbage	Dharamnagar (Assam), Delhi, Kolkatta, Cochin
Sitarganj	Paddy, wheat,, potato, masur, groundnut, jaggery, onion, tomato	Trichur(Kerala), Karimgaj(Assam)
Gadarpur	Paddy, rice, wheat, oats, potato, onion, cabbage, raddish,	Delhi, Trichur(Kerla), Haryana, West-Bengal, U.P,
Kiccha	Paddy, wheat, watermelon, potato, mango,	Delhi, Trichur(Kerla), Karimgaj(Assam)
Ramnagar	Paddy, rice, wheat, potato, ginger, lichi, bananna, mango, wood	
Bazpur	Paddy, rice, wheat, potato, wood	

Source: www.uamandi.com

I. Horticulture and Floriculture

Uttaranchal's wide diversity of climate creates a unique potential for growing almost all horticultural crops in the state. The agro-climatic conditions are also suitable for floriculture and for growing certain specialised export oriented high value crops such as mushrooms, olive, asparagus and spices.

Over the years, farmers have shifted from subsistence farming of traditional crop varieties to higher value horticultural crops, with off-season vegetables fetching

attractive prices. On an average, the net income per hectare cultivation of off-season vegetables such as onions, radish, cauliflower, cabbage, leafy vegetables, sweet pepper, carrot, turnips, etc. ranges from Rs. 8000 to 15000. Potato is another increasingly popular crop of the hills. India occupies the fifth place in terms of area and production of potato and is the largest potato producing state of India.

While high value horticultural crops and floriculture appear to be the answer to both the state's and the farmer's financial requirements, their long-term sustainability – both in terms of the environment as well in terms of a high volatile market dependent upon international fashions – needs to be carefully looked into.

Figure VI-11 Horticulture: acreage and production (2001)

Fruits	
Area	191790 ha
Production	541005 MT
Vegetables	
Area	82757 ha
Production	626945 MT

Technology improvisation for ecological benefits

The tract adjoining the Himachal State, the Tons Valley and the Yamuna Valley has over the years been a significant area for the expansion of apple crop in Uttaranchal. The apple crops, often in the fetched very poor revenues because of the high costs involved in packing and carting of apples particularly in Yamuna-Tons valley. Apples were packed in wooden boxes and transported by mules. The boxes were hung on either side of the mule and use of card-board boxes would have meant that the boxes would e deshaped and not acceptable to the market besides damaging the apples. The extensive use of wood invited attention of Janadhaar, a organisation working in the region. Janadhaar with the support of the Department of Science and Technology found an innovative solution to this problem.

Janadhaar, a small but effective environment, disability and people's rights organisation in Uttarakhand developed a simple technology adaptation, which made the use of card-board cartons possible. The adaptation comprised of a openable wooden frame to hold the carton which could be handled just the same way as the earlier wooden boxes. Janadhaar also enabled the apple growers to brand their hand-sorted apples now packed elegantly in card-board containers using the traditional name of the region `Rawain'. The branding enabled fetching relatively higher prices.

Source: *Uttaranchal At A Glance 2002-03*, GoUA

The state is also the centre of diversity for many high value crops growing naturally – amaranth, buckwheat, soyabean, rajmah, rice bean, etc. However, the difficult terrain where these crops grow create problems of transportation.

Impact on environment

Erosion of agro-biodiversity- Uttaranchal has a tremendous diversity of vegetables and fruits. Growing HYVs as monocultures will destroy the vast biodiversity.

Forest degradation - Horticultural crops require much higher input of nutrients than the traditional crops they replace. As chemical fertilisers are not suitable for the slopping rain-fed fields, compost manure continues to be used. However to generate more compost, a larger amount of leaf litter needs to be gathered from the forest. This leads to depletion of nutrients from forest soils and damage to regeneration of young trees. In addition, larger amounts of dung are required to make the compost and hence more cattle are kept. As a result, the primary function of many hill cattle is now to produce cow dung and not the milk. There is little incentive to improve cattle strains. With cattle of poor quality, stall feeding remains uncommon and cattle are allowed to graze in the forest thereby damaging hardwood regeneration. Also, despite the higher nutrients inputs the nutrient status of the soil tends to get depleted after many years of these crops.

Unlike the traditional cereals, horticultural crops yields little or no residue that can be used to feed cattle thereby further exacerbating the fodder storage and increasing dependence on the forest. Horticulture adds yet another variable in the farmers' life, as it is entirely dependent on the market and price fluctuations can be quite sharp.

J. Livestock

Animal husbandry plays a crucial role in the rural economy of Uttaranchal. The livestock population in the state stands at over 46 lakhs.

Figure VI-12 Livestock and poultry in Uttaranchal (1997-98)

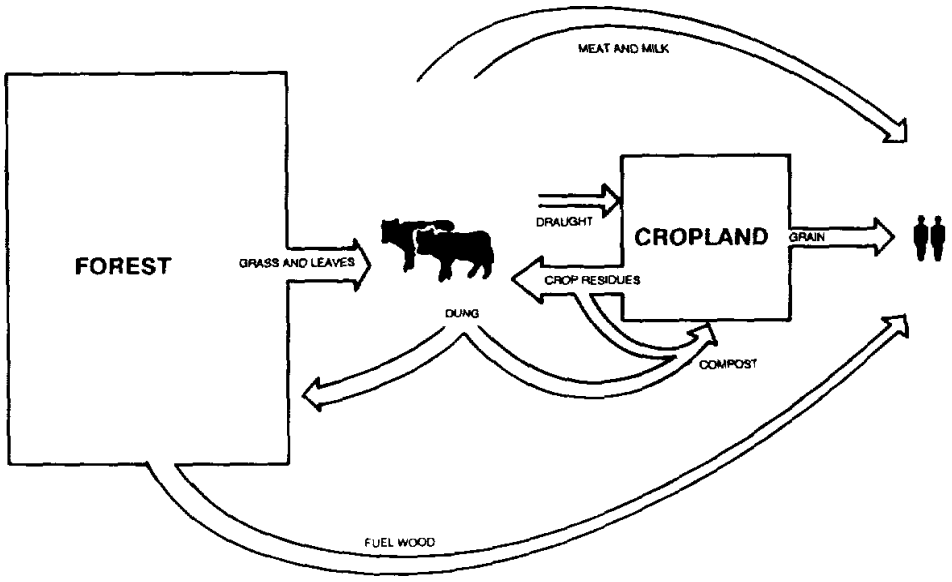
Livestock	Numbers
Cows (desi)	3125651
Cows (crossbreed)	1927405
Buffaloes	104031
Other Livestock	
Sheep (desi)	1094215
Sheep (crossbreed)	48667
Goats	1084790
Horses and mules	23830
Pigs (desi)	27136
Pigs (crossbreed)	4415
Other animals	33824
Total	4611351
Poultry	
Hens/cocks/chicks	965012
Other birds	17257
Total	982269

Source: *Uttaranchal At A Glance 2002-03*, GoUA

The huge livestock population of the state is central to maintaining the soil fertility. The close integration of livestock, available forest resources, and crop production allows this local subsistence system to have many advantages over more modern systems in

which livestock and crops are separated into watertight compartments. As long as the subsistence system is in proper balance it is efficient in terms of the ratio of food and fibre output to total solar energy captured, and there is almost no wastage. It is also a self-reliant system.

Figure V-9 Traditional interaction between livestock, pastures and agriculture



Source: Ives JD & Messerli B, 1989 [15]

However, with only 13 per cent of the total land in the state available for cultivation, combined with deforestation and increasing human, the huge livestock population can cause severe stress to the environment. Grazing in particular is destructive as the saplings are trampled underfoot and vegetation cannot regenerate. The 1993 census estimates that 259 lakh MT of green fodder is needed annually to feed the livestock population. Forests and pasture land in the state provide around 43.5 lakh MT, and agricultural crop residues account for an additional 8.5 lakh MT. In spite of this there exists a deficit of 200 lakh MT. To meet this gap people resort to illegal activities like heavy lopping of trees and cutting of saplings.

Among the livestock, the goat population has swelled across the state and, in the last few years, has become a major threat to the environment. The grazing pattern of goats disturbs the timely regeneration of vegetation/fodder. This also impacts the grazing pattern of other livestock population in the pastures.

Besides the progressive decline in the density of the vegetative cover and the severe depauperation of the forests, the species composition changes toward a predominance of useless species such as chir pine, while rates of precipitation runoff and soil erosion increase. Chir pine forests do not provide any grazing for animals. The productivity of the livestock itself falls as the animals obtain less and less green fodder, which in turn reduces crop yields because there is less available animal manure.

[15] Jack D. Ives and Bruno Messerli, *The Himalayan Dilemma: Reconciling Development and Conservation, The United Nations University Press, http://www.unu.edu/unupress/unupbooks*

GENDER CONTRIBUTION TO SMALLHOLDER DAIRY PRODUCTION IN UTTARANCHAL

In mountain areas of India, women's contribution to agriculture (including cropping, forestry, animal husbandry, and all land-related activities) is far greater than that of men. With household chores, virtually, to her responsibility, women, in essence, are the backbone of mountain agriculture. They are the real subsistence farmers and their role in food-chain activities is so crucial that without their participation no dimension in the sustainability of mountain agriculture can be imagined. Unfortunately, their role in mountain agriculture in general, and in dairy production in particular, is not appreciated as much as it really deserves.

The contribution of a mountain woman in dairy production system is enormous as compared to men. Quantitative information on gender role in smallholder dairy farming based on a joint study by ILRI-ICIMOD reveals that woman, on an average, devotes as many as 1779 hours to different dairy operations annually as compared to man, who devotes only 315 hours. Thus, women's contribution to dairy farming in Uttaranchal, is as high as 85 per cent. However, in all the conventional development programmes and projects in dairy production in Uttaranchal, it is observed that the project officials and beneficiaries of the projects are mostly men. Women are almost always marginalized.

The male head of a family, however, takes important decisions relating to dairy farming. It is always a male who participates in the activity where cash economy is involved. For instance, a male member will collect the money the sale of milk fetches. It is also the male member who will take decision to sell or purchase a dairy animal. Loans under various government agencies are sanctioned mostly to the male members. Only a male member of a family participates in a dairy farming-related training occasionally organised by concerned government institutions under a 'development project'.

Gender Contribution to Smallholder Dairy Production at a Dairy Farm in Uttaranchal*

Dairy Operations	Hours Devoted Per Head Per Annum		
	Women	Men	Total
Milking	183 (100)	--	183 (100)
Milk processing	183 (100)	--	183 (100)
Milk marketing	61 (33)	122 (67)	183 (100)
Collection of bedding, fodder; and feeding animals	730 (100)	--	730 (100)
Tending to grazing animals	547 (75)	183 (25)	730 (100)
Tending to calf	12 (100)	--	12 (100)
Tending to sick animals	4 (33)	8 (67)	12 (100)
Taking cows and buffaloes to service	3 (60)	2 (40)	6 (100)
Cleanliness of dairy shed	56 (100)	--	56 (100)
All Operations	1779 (85)	315 (15)	2094

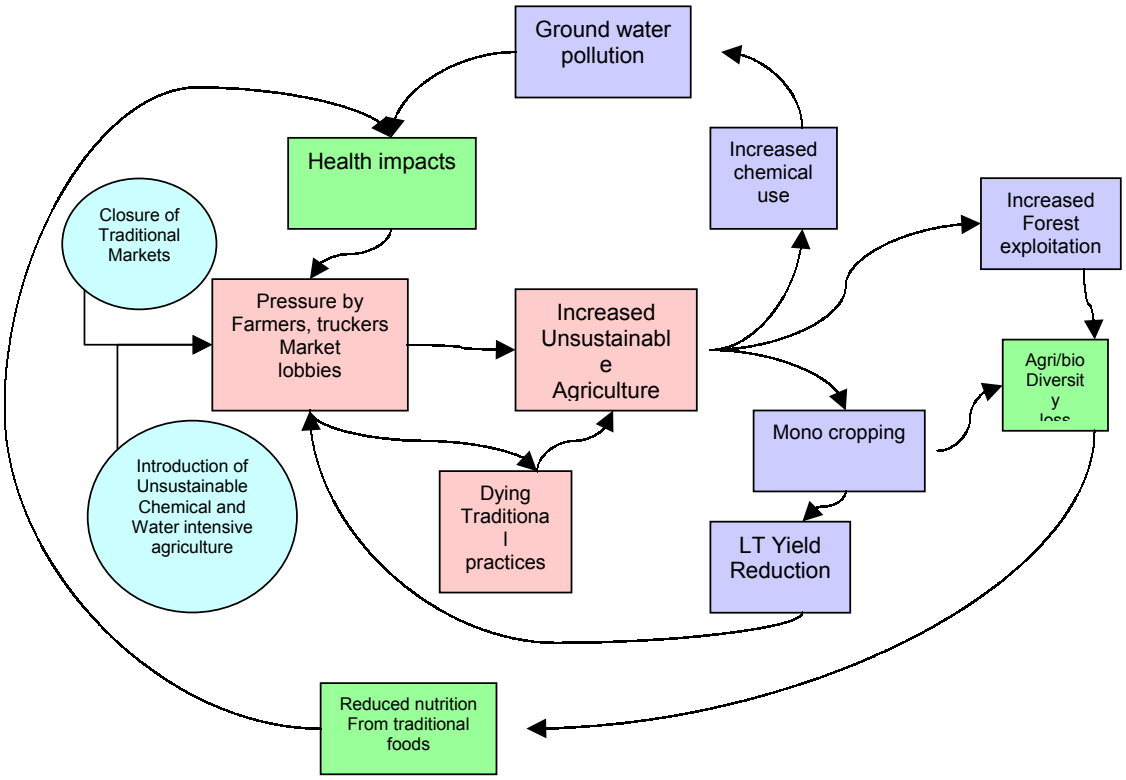
Figures in parentheses are percentage of the total hours devoted to an operation.
*Based on a study of 12 villages at different locations in four Community Development Blocks in the two milk sheds of Almora and Nainital in Uttaranchal

In many households, particularly in areas where there is a situation of male out-migration to the plains in search of jobs, the women are the de-facto heads of their families. Here, the women are not psychologically prepared to take important decisions regarding the improvement in dairy production systems. They, for instance, would not be ready to become a member of a Village Dairy Cooperative (VDC), or take advantage of loan schemes, dairy training, *etc*.

There is, therefore, a need to identify and analyse various constraining factors (natural, institutional, as well as socio-cultural) particularly relating to dairy production sector in order to understand the ways and means to improve the smallholder dairy farming sector through upgradation of the knowledge and skills and ensuring effective participation of the real smallholder farmers in dairy development in the Hills – the women.

Source: Vir Singh & Pradeep M Tulachan, ICIMOD

K. The Way Forward



Uttaranachal, with its difficult terrain as well as its need for financial resources, needs to look at sustainability for both agricultural production as well as food security. Sustainability in terms of agricultural inputs and farmers' livelihoods makes chemical-free, water prudent agriculture imperative. While this is already being practiced in most of the hilly regions, the state needs to create the necessary conditions in a time-bound phased manner for reducing the use of chemicals and water intensive crops and seeds in the plains. As an immediate step, Uttaranchal can follow the lead of the Meghalaya, and declare itself an organic state.

In order to ensure that agriculture becomes organic and that farmers' livelihood is not threatened, the state must not depend entirely on exports, but must enable the organic produce to enter the local food supply system. The state can purchase farmers' organic produce at either the MSP or a slightly higher price (if they can raise the resources) to channelise it into the local public distribution system.

To give further impetus to organic agriculture as well as to locally based food security, the state needs to widen the food basket to include nutritious locally grown organic food crops such as millet (jhangora, cheena, mandua), buckwheat, amaranth, etc. This would probably need the state to first create an awareness campaign amongst the public which has got used to rice and wheat as staples.

Simultaneously, horticultural crops can be also grown organically for niche markets both in the country, and abroad.

The state can further use self help groups to create cooperative marketing units in minor urban centres to both distribute agricultural inputs like organic manure, vermicompost, and plant based pest control agents as well as procure the produce. The cooperatives can both distribute the produce locally, as well as supply to large cities, and meet export needs.

Self help groups, particularly women's groups at village level can be trained and given financial assistance for processing and preserving the horticultural produce locally, which the cooperatives can also market domestically and internationally, with an equitable distribution of profits.

Annex VI-1 Case Study

Bhararisain Cattle Breeding Farm[16]

Issues, Responses and Nucleus of the Future Capital

Background

In the early seventies a programme for improving local livestock breeds was conceived by the State government and under this programme cattle and sheep breeding centres were established in different parts of the region. The Bhararisain cattle breeding farm was one among these projects. Bhararisain is on the Diwalikhal ridge dividing the Ramganga and Atagad watersheds and was selected as an ideal site as there were natural grazing lands and oak forests. Bhararisain is thus situated directly over the settlements of Sarkot, Parwari, Sarengwar and Marora on the Ramganga watershed and Chorara and Sirana on the Atagad. The process of establishment was initiated in 1974 and the construction activities continued till 1977. However, the actual function of breeding began only in 1981-82 with the import of a mother stock of Jersey cows from Denmark.

The cattle breeding centre at Bhararisain has been brought up in several discussions and it has become the source of several conflicts and problems in the region. The breeding farm was established in the region ostensibly to provide for better breeds of cattle. Over its decades of operation the centre has not been able to deliver any positive inputs in animal husbandry for the local communities. Today, the project raises several questions on the basic efficacy of exotic cattle breeds and cross breeding in the development of livestock in the region. The process by which the whole project has been established and continues to adversely affect the local population is actually the matter of current litigation.

The area has dense forests and pasture lands. The region has also been the sources of very good quality slates, which were used for roofing purposes in village constructions and provided limited income from sale to adjoining settlements by the roadside. Oak moss and other NFTP were other resources the forest area provided, which could be converted into cash. The land acquired for breeding farm from the local villages is as follows :

1. [16] (From Hem Gairola, R.Sreedhar et al: People's Forestry Management – From Conflict Resolution to Policy Perspectives, Report for Centre for Development Studies U.P Government, 1998)

Apart from these 500 acres of land the farm has further encroached upon 85 acres of land belonging to the Parwari Van Panchayat, which has become a source of ongoing litigation. Despite legal action initiated by the villagers and protests at site, the farm has and continues to encroach upon lands.

Village	Van Panchayat Land (Acres)	Civil Lands (Acres)
1. Sarkot	0	60
2. Parwari	200	4
3. Marora	60	
4. Chorada	106	
5. Sirana	70	
6. TOTAL	436	64

The problem of breeding farms is not isolated to Bhararisain. There are several such breeding farms in the region and each one of them has become a nuisance to the local communities and their environment. Bangali village at the head of the Chipalgad Watershed in the Ghat Block of Chamoli district has a Merino sheep breeding centre and the problems created by this is as serious as the Bhararisain Farm.

The Conflict between Parwari Van Panchayat and the Farm

The history of conflict dates back to the initial process of establishing the farm. The promises made to the people about the benefits they would derive from the farm were overstated. At the same time, information about the resources the farm would take away from the local communities was left ambiguous and understated. The the farm was to acquire 100 acres each from the five villages of Sarkot, Chorara, Parwari, Marora and Sirana to make up the 500 acres of land that was needed. In the case of Parwari, this constituted twice the area initially suggested by the authorities. In addition, the farm has encroached upon an additional 85 acres of land of the Van Panchayat.

Land Acquisition

The villagers was asked to give blanked consent for land acquisition; they were not informed of the possible impacts of the farm. The Van Panchayat registers do not carry the signatures of the members. According to the villagers, important resolutions of the Gram Panchayat were also obtained by calling the Pradhans over to the Block Development Office rather than at the Gram Sabha.

Environmental, Economic and Social Impacts

Since the establishment of the breeding farm, there has been no evaluation carried out of its impact. However, according to the villagers, the indiscrimate use of wood by the farm workers has contributed significantly to the degradation of the ridge forests. Villagers have strengthened their boundaries due to both fear of encroachment by the farm, as well as the pressure of grazing. This has resulted in several conflicts among villages, such as the ongoing litigation between Malsi and Sirana, and Sarengwar and Parwari villages.

The multiple environmental impacts of the farm are briefly described here.

Impact on Water Supply

The polluted water from the farm has greatly diminished the productivity of the Sera lands were irrigated crops were grown until a few years ago; today, villagers have had to abandon agriculture here. The farm discharge has also polluted streams, and thereby sources of drinking water. Though villagers have begun to use alternate sources, cattle are forced to drink from these polluted sources.

Impact on People's Access to Forests

The land acquired by the farm consists mostly of dense oak forests and meadow lands. While there has been no attempt to quantify the total value of the forests handed over to the breeding farm, the litigation on 85 acres of encroached land informs that this area alone contains 3,20,000 recorded trees. In contrast, the Van Panchayat records, which were apparently not written by the villagers, show a far lesser number of trees. Such misrepresentation and wrong recording associated with privatizing common property and negating common property rights, have given rise to conflicts in all the villages with settlements near the farm. When the grazing lands were being handed over to the breeding farm, the Sarkot village earmarked areas and dug deep trenches around them. These trenches have contributed to severe soil erosion.

Animal Husbandry

The loss grazing lands and oak forests has resulted in reduced support for the cattle population of the villages. In a specific resolution, the Van Panchayat of Parwari indicates that the area acquired by the breeding form has affected 1400 cattle in the village. The farm also takes away village cattle that stray on to its lands, while at the same time, it allows its own cattle to graze on common property lands. The impact of this additional grazing is already visible.

Social Life

The social life of the villagers has been disrupted by the fam in many ways, as the grazing practices and lopping zones have been distinctly modified with the acquisition of such vast area. The Van Panchayat registers have also recorded instances of direct harassment of villagers by the farm employees, and these have been notified to the District Administration. The most intense impact has been caused by the prolonged litigation with the farm. Villagers have to make indivudal contributions, whereas the farm is represented by the government. This imbalance is clearly visible by the way the case has proceeded and finally been dismissed on frivolous grounds despite repeated investigations and proof of encroachment.

Employment

The villagers had expected the farm to provide employment to the local people. However, the farm has only employed a few local persons as lowly paid graziers. This strategy helps them to avoid everyday conflicts as the local people know the grazing sites and are tolerated by the other local community members.

Specific Legal Provision Violated

The establishment of the farm has violated several legal provisions in force. More deeply it has denied the basic rights guaranteed by the constitution. The specific list of violation and the context of violation provides an insight into the potential for redressal.

Land Acquisition Act:

The provisions of Land Acquisition Act have been violated totally by considering that the land did not belong to the villagers but was State Property. Therefore no proper notice on the acquisition nor compensation for the land was provided to the people. The Land Acquisition Act 1894 as applicable to U.P. clearly states that the persons who have a stake in the forest are its trustees and beneficiaries. The members of the Van Panchayat are the true trustees and beneficiaries of the area acquired. They also have been denied foot-tracks and other easement benefits without any compensation.

Forest Conversation Act:

The farm has violated the FC Act by destroying parts of the forest while laying the road and constructing the buildings, all of which have been specifically recorded by the Van Panchayat. The provisions of compensatory afforestation have not been applied in the case of the farm. The damage to trees, particularly felling green trees is an ongoing activity of the farm which is not being charged with such offences.

Environment Protection Act:

The activities of the farm violate the provisions of the Environment Protection Act in several ways. The foremost among them in the discharge of effluents into the stream, polluting water resources, destroying productive agricultural fields and affecting the health of the people and cattle.

Other Violations:

Land encroachment, over the above that which is has completed some nominal procedure, could attract proceedings on the provisions of land acts. The activities of the farm in disposing carcasses and attracting other wild animals could invite injunctions under the Wildlife Act. The farm also grossly violates the provisions of

the Labour Acts by employing local people on daily wages despite several years of service.

The violation of the specific legal provisions also denies the local people the fundamental rights guaranteed under the Constitution. The Right to Life is denied when people's fundamental source of livelihood is negatively impacted. The breeding farm also denies the people the Right to Development, which is also emphasised by several Supreme Court decisions in recent years. The people have been also restrained from performing their fundamental duties, particularly the protection of the environment, as no notice is taken of their complaints regarding the environmental impact of the farm.

Redressing the Situation

The nature of the conflict and the differences in the nature of the parties involved calls for a comprehensive range of efforts by both the communities and the government agencies to resolve the issues and find a way to maximise the effectiveness of the development intervention. Without going into the efficacy of the programme of cross-breeding with exotic cattle, it is clear that some specific measures need to be taken.

Eviction from the encroached area must be an immediate response from the farm as it has taken up unduely large areas from a single Van Panchayat thereby affecting the specific population very intensely. The farm has been arguing largely from the perspective of contiguity of its property. This is clearly untenable, as the nature of the tasks performed by the breeding farm does not need this condition. The farm can develop and effectively use its 500 acres to perform all its functions.

The Government must ensure that compensation is paid to farmers whose land has been directly affected by the discharge of effluents from the farm.The farm should devise appropriate means for discharging its effluents in future. The quality of water in the streams must be improved and maintained and the farm must be made responsible for this.

The activity of the farm is in some measure overlapping with the resources use of the adjoining villages. In order to become sustainable, the farm needs to involve the community. The impacts of the farm, particularly due to its geographical position, have wide ranging consequences and therefore the management of the land should be brought under the purview of a larger constituency of people and institutions. The farmland may be treated as a Van Panchayat and the adjoining villages made members to oversee its use and management along with the representatives of the farm.

The farm must actively involve itself with the local communities in extending whatever infrastructure or services it can offer. The farm also earns significant income through the sale of milk, using resources that rightfully belong to the local communities. Therefore provisions must made for sharing this income with the local communities through investments in soil conservation, afforestation and forest

management, fodder development and other activities relevant to the developmental needs of the local people.

Closing the Farm and Creating Infrastructure for State's Capital

In the creation of the new State an important issue has been the location of the capital city. Gairsain has been proposed as an ideal location considering its geographic centrality and this has been an important element in uniting various groups involved in the agitation for a separate state. Infact, Dehradun continues to be called as an `interim capital'. Recently the Town and Country Planning Organisation estimated the total land requirement for the Capital to be about 500 ha, which is a generous estimate. Even considering this, the Bharaisain Farm itself could provide for one-half of the land requirements for the Capital.

VII. WATER

Uttaranchal is the source of the water for most of northern India. Despite the immense availability of water in the state, water is scarce for local people both for drinking and domestic use as well as for irrigation. Of the 63 urban locations in the state only a third have near adequate supply of water. There are 15165 villages in the state and nearly 20 per cent of them have a varied range of problems impeding the availability and provision of drinking water. At present, officially, 189 villages do not have any designed source and 1108 villages are only partially covered.

A. Concern over water resources

The concerns over water resources in the state emerge at various levels;

1. Significant variations in glacial melt volumes and the lack of information to estimate reliable quantums of water availability;
2. Lack of a water management policy that reflects on the intimate relationship of water resources and forests;
3. Poor water supply systems in urban and rural areas with ever changing systems of management;
4. Lack of development of irrigation facilities and languishing of proposed major irrigation projects and
5. Inadequate information on water quality and mechanisms to ameliorate pollution.

B. Water Resources in Uttaranchal

Varying estimates of water resources in the Himalayan region have been made. Murthy (1978) estimated Himalayan water resources around 245 km^3 per year, Gupta (1983) and Kawosa (1988) estimated the total amount of water flowing from the Himalayas to the plains to be around 8643 km^3 per year. Bahadur (1998a) re-evaluated his earlier estimates of 200–500 km^3 per year as 400-800 km3 per year to include melt water contributions from the snow and glacier fields in the high mountain region. Despite these widely differing estimates of the water resource of the Himalayan region, the water output could be the highest from any single mountain range in the world (Stone, 1992).

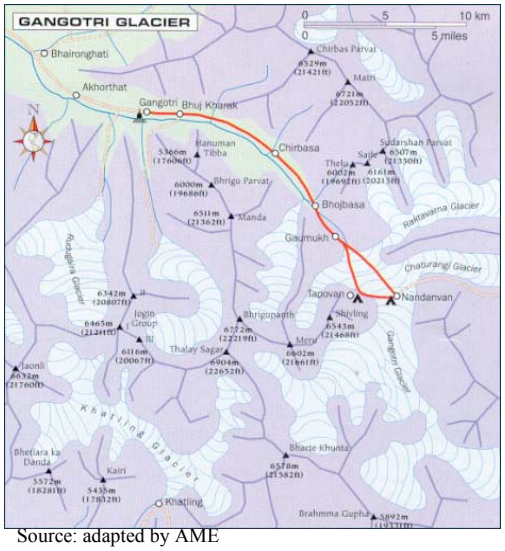
Glacier melt

The measurement of quantity of glacial melt waters is a very complex task and only estimates are available.

The Himalaya, covering about 17 per cent of total mountainous area of the Indian subcontinent, comprises several important glacier systems. Himalayan glaciers form a unique reservoir of fresh water, which support mighty perennial river systems such as the Indus, the Ganges and the Brahmaputra. Their combined annual runoff amounts to about 1.19 X 10^3 km^3. The Himalayan proglacial streams carry about 70-85 per cent of the total annual river flow, which is derived from snow and glacier ice melt, which in turn is related to the radioactive energy input, variation in air temperature etc [17].

17 S.N.Rai-Indian National Submission to IUGG,

Figure VII-1 Retreat of the Gangotri glacier



Source: adapted by AME

The information on glacier melt and its implication on the quantum and distribution of water flow has now been recognised as an important element. In order to constantly monitor the status of glaciers, a new institution for Himalayan Glaciology is being established with the Snow and Avalanche Research Establishment of

Climate Change and People in the Glacial Margins

Academy for Mountain Environics and The Indian Network of Climate Change (INECC) conducted a workshop in the historic Chipko village of Reni to understand the implications of climate change to people living in the periphery of the glaciers. The workshop clearly brought home the fact that the communities have to constantly adapt in order to overcome the erratic climate conditions in the glacial margins. The local communities articulated how the local impacts such as heavy vehicular movement with increased defence presence and pressure on forests as well as the larger changes globally is causing uncertainty. The lack of sensitivity of the administration in addressing the problems was also brought out, for example when extended periods of snow did not allow cropping, there was no mechanism for State support as it did not constitute either a drought or a flood!

Uttaranchal is home to 238 glaciers[1] spread over 735 sq. km. The Gangotri glacier1 is also among the most studied glaciers in the Himalayas and its recession is a cause for severe concern as it reflects the larger scenario of snow-melt conditions.

Gangotri glacier is one of the largest glaciers in Himalayas and extents over a length of more than 26 kms. It is a NW trending glacier which is presently fed by seven lateral glaciers namely: the Raktvarn Bamak, Chaturangi Bamak, Swachhand Bamak, Ghanohim Bamak, Miandi Bamak, Kirti Bamak and Meru Bamak, merging into the Gangotri trunk glacier. The snout of Gangotri glaciers is the holy "Gaumukh". This is a vertical wall of ice, 45-50 meter in height at an altitude of approx. 4000 m. The melt waters give rise to Bhagirathi river which descends down the western Uttaranchal Himalayas to meet the Alaknanda river at Deoprayag, forming the mighty Ganga river.

The total discharge volume in the proglacial stream draining the Gangotri into the Ganga throughout the ablation seasons between May and October 1999 and 2000 was estimated to be 581.87 $X10^6m^3$ constituting 0.5 percent of the entire Himalayan glacial melt.

The Gangotri glacier has now shrunk to about 20 km. The Dokriani Bamak glacier (3 miles long) of the Gangotri system has receded half a mile. Research indicates that glaciers in the Himalayas are retreating at an average rate of 30 m a year, compared with earlier rates of 18 m a year between 1935 and 1999, and 7 m a year between 1842 and 1935. Snow and Avalanche Study Establishment (SASE) of the Ministry of Defence has established a full-fledged snow and meteorological station, consisting of a manual observatory and an automatic weather station (AWS) near Gangotri to provide continuous snow-met data, throughout the year. The data, which includes atmospheric parameters viz., wind speed and direction, temperature, humidity, pressure, albedo and snow is remotely accessed by the centre at Manali. The longitudinal information from this station is likely to improve our understanding of the glacial retreat phenomenon in the region.

Scientists from the Birbal Sahni Institute of Paleobotany have used tree-ring studies and have confirmed the estimates that the glacier was receding at a rate of 10.16 m/year between 1935-1956 and rapidly increased to a high of 30.44 m/year between 1971-1977 and it was receding at a rate of 28.08 m/year in the period between 1977-1990. A study conducted by the International Commission on Snow and Ice (ISCI) has observed that Himalayan glaciers are receding faster than glaciers in any other part of the world and if the present rate continues, the likelihood of them disappearing by the year 2035 is very high.

the Ministry of Defence. This would bring together the present piecemeal work of several institutions and provide a more comprehensive picture of the glacial phenomenon in the Himalayas as well as detailed information on the glacial melt contribution to the rivers. Hopefully this effort will translate the need for continual monitoring into a mechanism whereby data on snow melt is no longer sporadic or speculative. The variations and the depletion of glaciers, through retreat in area and reduction in depth is a much larger phenomenon linked intricately to the issues of global climate change. While there are measures to ensure that local environment in the glacial margins are not disturbed, the uncertainity of the climate in the region has been a cause for concern for people living in the glacial margins.

Surface water

The Uttaranchal Himalayas which act as catchment for the entire North Indo-Gangetic Plains, receive an average annual precipitation of 1240 mm in form of rain. The total annual rainwater received over the state area of 53,484 sq.km is estimated at 66.320 billion cubic meters.

The discharge measurements of all the streams of the state are not available for the point where they leave the state and hence the total quantum of water that the state provides to lower riparian states is estimated from the location specific discharge measurements for the major rivers

Table VII-1 Annual flow and discharge of main rivers in Uttaranchal

Rivers	Av. Annual flow Million m^3	Discharge recorded at
Yamuna	3038	Haripur
Ganga	27000	Rishikesh
Kali	4099	Tanakpur

Source: CWC and Nedeco, Nepal

Thus the minimum water resources flowing down the State is roughly 35 billion cubic meters - approximately one half of the rainfall, which goes directly as run-off downstream.

It is a paradox that the local people of this extremely water-rich state and their lands are facing shortage of water for domestic consumptive uses in the remaining period of the year"[18]. The total water requirement of the human population, animal population, agriculture and industry of Uttaranchal is estimated as only 3 per cent of the annual rain precipitation received. However the rain precipitation is available in about 100 days, which flows out swiftly from the steep slopes constituting the major part of the state.

Groundwater

The Central Groundwater Board has estimated the total annual replenishable quantum of groundwater resources in Uttaranchal to be nearly 0.28 million hectare meter. The estimation of groundwater in the mountainous terrain is very complex and very little empirical data exists. The groundwater occurs often in pockets, depending largely on the secondary porosity developed due to fractures, joints and faults and is restricted in

18 Draft Water Policy, 2003

extent due to topographical features. In the Bhabbar zone the groundwater is very deep, though often in artesian conditions, while in the terai it is shallow and causes water logging.

Table VII-2 Groundwater in Uttaranchal

Ground Water Situation in Uttaranchal	Mham/yr
Total Replenishable Ground Water Resource	0.28411
Provision for Domestic, Industrial & other Uses	0.04262
Available Groundwater Resource for Irrigation in Net Terms	0.24149
Utilizable Ground Water for Irrigation in Net Terms	0.21734
Gross Draft Estimated on Prorata Basis	0.09776
Net Draft	0.06843
Balance Ground Water Resource for Future Use in Net Terms	0.17306

Source: Central Ground Water Board, 1998

Springs

Springs have been an important source of water for people in the mountainous terrain. In fact, springs and stable land were the twin criteria for selection of a settlement site until roads and other infrastructural facilities changed the situation, and government supports became an important component of local development. Springs are of varied nature and reflect the complex geological controls that determine their location and yield. Very few detailed investigations for delineating the numerous spring catchments have been undertaken and little is known about the yield. TARU[19] developed a methodology which combines satellite based information and field geological and geophysical methods for identifying small hilly acquifers which support springs. A detailed study on springs in the village of Sabli indicated that there are 14 springs in and around the village with flows ranging from 37 lph to 2250 lph with a nodal discharge of about 800 lph.

Springs have been the basic source of water in the Uttaranchal before the state started making attempts to provide drinking water. The springs were also used for protective irrigation, a practice now almost forgotten by the society. Some of the spring catchments were sacred and springs were strictly not tampered with by the local communities. Some attempt at creating `spring sanctuaries' in Kumaon have been successful, reflecting the high social value of this resource.

Traditionally, serving the recharge of springs and providing a variety of other benefits were a series of ponds, many of which have become silted because of the breakdown of community initiatives as a result of the intrusion of the state into the local resource management issues.

19 Report of the DST Project on Aquifer Delineation in Chamba Block, TARU, 1994

Water: whose responsibility?

In India, water seems to be everybody's turf but nobody's responsibility. Drinking water for the villages is the responsibility of the Ministry of Rural Development (MoRD) while drinking water for cities and towns belongs to the Ministry of Housing and Urban Development (MoHRD). The Ministry of Water Resources (MoWR) is concerned with surface and underground water for irrigation and now also with the supra project for the inter linking of rivers. But problems of irrigation are equally a concern for the Ministry of Agriculture, which runs programmes for drought proofing (DPAP) and desert development (DDP). Mega hydroelectric projects are the responsibility of the Ministry of Power (MOP) while development of the micro and mini hydel potential has been entrusted to the Ministry of Non-Conventional Energy Sources (MNES). In recognition of the importance of natural resource management for the environment, the Ministry of Environment and Forests has a long standing grants programme for watershed management which is now matched by similar programmes in the Ministries of Rural Development and Wasteland Development respectively. The total financial allocation for all these very well intentioned efforts runs into billions of rupees but all of them are about water, a finite resource that impacts on the everyday life of the local community in a village or watershed or river basin .Two questions arise: are all these efforts synchronized and to what extent does the community have a voice in the management of this resource.

Ashok Jaitly, Distinguished Fellow, TERI

There are also numerous hot springs in Uttaranchal. Along all the Yatra routes there is at least one, such as in Gaurikund, Gangnani, Badrinath, Tapovan.[20]

Chaal, Khaal and Taal

The traditional method of "rainwater harvesting" in our (South Asian) region was very simple and practical - retaining water from top to bottom with the help of various kinds of water bodies - chaal, khaal, and taal. Every mountain village would construct few of them above the village, in the village and down the village. This would enhance the moisture in the forest, which would help the regeneration and maintenance of the forest all through the year. It would also recharge the springs, rivulets, and other water bodies. And then the most important bonus function - it would be the best fire brigade without spending a single penny. It would protect the forest from top to bottom against fire. This was the best insurance against fire without paying the premium.

Source: Shubham Mishra, Mountain Forum Communications

Lakes

Lakes (tal) are another important and fascinating aspect of Uttaranchal, and the high lakes are a great attraction for trekkers. Nainital district has earned the epithet of being a lake district; these include Nainital, Bhimtal, Naukuchiya Tal and Saat Tal. However, the most famous lake, Nainital, is overwhelmed by problems caused by rapid urbanisation around it; the lake has been a issue of litigation between various agencies for its protection and upkeep. While the state has taken some measures to address problems of the Nainital lake, the other lakes have been being neglected. Society for Appeal for Vanishing Environments (SAVE) filed a petition in the high court, but despite court rulings the situation is not any better.

In the Upper Bhagirathi Valley, the Gangotri Glacier itself has a number of glacial lakes within its ablation zone. **Kedar Tal**, a spectacular and enchanting lake is situated at a distance of about 18 kms. from Gangotri. The lake is crystal clear with the mighty Thalaysagar (sphatikling) peak forming a splendid backdrop.

20 Appendix 2 Thermal Springs of Garhwal

Saat Tal meaning seven lakes, is situated just above Dharali, 2 kms on the route to Gangotri. The trek of about 7 kms. is rewarding as this group of lakes is situated amidst beautiful natural surroundings.

A little south is the **Dodital** Lake. Situated at an altitude of 3,307 metres, about 31 km north of Uttarkashi, Dodital is surrounded by dense forests of oak, pine, deodar and rhododendrons. 12 km from Uttarkashi, on the banks of the Assi river, is Kalyani, the base camp for Dodital. Dodital is hexagonal in shape. The deep clear lake, full of rare fish such as Himalayan Golden Trout, and surrounded by tall deodar trees, is the birthplace of about 80 rivers. "Dodi" is the local name of the trout.

Nachiketa Tal. Chaurangi-Khal, on the Indravati watershed, tributary of Bhagirathi with confluence at Uttarkashi is a place 29 kms. from Uttarkashi. Just 3 kms away by trek through lush green forests takes one to Nachiketa Tal, a tranquil spot. There is greenery all around and a small temple at the bank of the lake gives a serene look.

Citizens' fight to save the lakes

The lakes of Saattal, Naukuchiatal and Bhimtal lie at almost the same elevation and only a few kms separate them. Yet, they are all of very individual ecologies, as can be seen from the fact that each lake has a different diatom species. Intensive studies have been conducted on these lakes by researchers from Kumaon University and the Department of Science & Technology. Over the last 25 years or so, it has been observed by the local residents that the entire valley (Bhowali – Naukuchiyatal) is slowly, but surely heading for drier and hotter conditions. The occurrence of typically plains birds, butterflies, insects and plants points to this fact. Once a literal paradise for temperate fruits like peaches, plums, pears etc., and this valley now grows lichis, mangoes, guavas etc. The temperate fruit have dried out almost completely, and the tropical fruit face a whole new army of pests- from fruit flies to swarms of parakeets form the plains, and plant diseases.

The vast deforested areas have been taken over by *Lantana camaris* ("Kuri") and other undesirable weeds. *Parthenium* is also encroaching these areas. Out of season (usually premature) flowering and fruiting of indigenous plants, trees and shrubs points to the serious disruption of the eco-system and the plant communities. Many ground level herbs, lichens, mosses, fungi etc are almost extinct, and repeated forest fires have badly damaged the natural regeneration process. The entire eco-system is under attack from all sides and it is a matter of time before it fades away and collapses forever, if the present state of apathy and disinterest continues. The damage will be irreversible and permanent.

Around the 1980's there was an absurd proposal to bring waters form the Shyamkhet- Bhowali Nala to fill up the Sattal Lake. The irrigation department undertook this project and as is normal started building the canal from the bottom up, that is from Ramtal of Sattal lakes and they managed to get this canal to the northern end of gram Bhaktura. When these brilliant engineers realized that they could not make the water from the Bhowali valley climb over the hill and then flow down to the valley, they promptly abandoned the project. As was bound to happen, this canal, an empty one, became a danger to humans and cattle and also seriously disturbed the water regime in the Sattal valley. Later in the 90's a massive de-silting programme was undertaken which resulted in a marginal increase in the storage capacity of Sitatal. However, no attempt, whatsoever, was made to prevent the causes of siltation in the form of check-dams and other minor engineering works.

Identically very little engineering work has been done to control the flows of the perennial and the seasonal nalas in the area from Bhaktura, Kanwal Gaon and Chauriya. In their own right these nalas send a considerable volume of water to the Bhimtal Lake. A proper water conservation strategy must necessarily include all such nalas and streams in that particular catchment area. The entire region needs to be hydrologically mapped using remote sensing technology. This will enable future planning for development and other purposes.

It is necessary to point out that the forest cover of this entire water shed needs to be greatly improved and the mountain known as June Estate Pahar must come under very strict protection and afforestation. Most of this forest land is vested with the VanPanchayat June Estate and the remaining area of about 600 acres belongs to the Forest Department and private owners. Subversive attempts have been made by land sharks and the building mafia to set up townships, resorts and other commercial establishments right on this vital forested mountain. To put an end to this highly destructive and illegal activity it will be very necessary to declare this area as a Reserved Forest Area. This is not only necessary to stop buildings and constructions for ever but to also stop the illegal felling and quarrying that continues to take place despite a High Court Order banning such activities.

Nevertheless a graphic and intensive ground – truth study will provide the necessary base data for future action plans.

Source: Ms Meenakshi Kandpal and Fredrick Smetacek (Jr.) SAVE, Bhimtal

Vasuki Tal is 6 km from Kedarnath. At 4135 mtr above sea level, this lake is surrounded by high mountains and offering an excellent view of the Chaukhamba peaks.

Deoria Tal is an km trek from the Ukhimath Chopta road. It is situated at a height of 2438 mtr above sea level. This lake is surrounded by forest. The reflection of Chaukhamba Peak in the lake creates a beautiful effect.

Hemkund or Lok Pal, a holy place for the Sikhs, is situated at the head of the Laxman Ganga, 17 km from Govindghat on the Badrinath route.

Roopkund – the mystery lake

Roopkund is situated in the eastern part of Chamoli district (in the lap of Trishul Massif, 7122 mtr.). The

high-altitude (5029 mtr), kund is on the Nanda Jat route to Hemkund. It is not a very large kund and is rather shallow, having a depth of only about 2 mtr. The edges are snow covered for most parts of the year. When snow melts, one can see human and equine skeletal remains, sometimes with flesh attached; well preserved in the alpine conditions. It has been estimated that about 300 people died here about 500-600 years ago. While many theories abound, not one of them is satisfactory. Hence the lake is also known as the 'Mystery Lake'. According to the local people, Raja Jasdal of Kanauj undertook a Nanda Jat along with the Rani Balpa, some 550 years ago. The Rani, being the princess from Garhwal, was revered as a sister of goddess Nandadevi. Near Roopkund she gave birth to a baby. Goddess Nandadevi considered it a sacrilege in her domain and sent down a snow/hailstorm, in which the Raja's people perished. The skeletal remains belong to them.

Source: http://chamoli.nic.in/roopkund.htm

C. *Efforts by Central Government*

The Planning Commission, since its inception, has been grappling with the problem of drinking water. The Sixth Plan stated "Although a national water supply programme was launched in 1954 during the very First Five Year Plan, and progressively larger allocations were made for water supply and sanitation in the succeeding Five Year Plans, the progress made so far in the provision of safe water supply and basic sanitation can hardly be called satisfactory. The available statistics relating to the status of rural and urban water supply in India present a discouraging picture especially in the rural areas. By March 1980 about two lakh villages in the country with a population of some 160 million were yet to be provided with potable water supply facilities. The situation in the urban areas is relatively better but here too, particularly in the hundreds of smaller towns, water supply and sanitation arrangements are far from adequate. The statistics in fact do not fully portray the hardship and inconvenience that is experienced by the poor, particularly the women and the children, in areas where water is scarce, inadequate or polluted. In terms of man days lost due to water-borne or water related diseases which constitute nearly 80 per cent of the public health problem of our country, the wastage is indeed colossal."

In keeping with the growing demands the Planning Commission has been consistently addressing the problem of rural drinking water. The seventh Five-Year Plan stated "although the major areas of the rural population have been now provided with potable water supply as a result of the massive effort during the Sixth Plan period, there are still a sizeable number of problem villages. During the Seventh Plan, in line with the objective of International Drinking Water Supply and Sanitation Decade (1981-91), the aim would be to provide adequate drinking water facilities for the entire population and to provide sanitation facilities to 80 per cent of the urban population and at least 25 per cent of the rural population. Although the task ahead is of a stupendous magnitude, an earnest endeavor would be made to fulfill the objectives set out in the 31st UN General Assembly Resolution in regard to the provision of water supply for the total population."

A variety of Central Government programmes have been introduced and implemented, initially as a Minimum Needs Programme and subsequently as a Mission-mode Project for Accelarated Supply of Drinking Water to rural communities.
The Tenth plan has targeted total coverage for drinking water supplies within the first two years and detailed re-assessment and filling of gaps before the end of the plan period.

D. Water management systems in the state

Watershed development

The state government has taken several measures to address the problems of water resources management.

The most widespread and expansive measure is the Integrated Watershed Development Programme. In terms of the convergence of sectors it is an excellent example of bringing together hitherto divergent administrative structures into an terrain based approach. The process by which the watershed programmes have evolved demonstrate key elements of democratic decentralisation and community participation. The completed and ongoing projects together extend over nearly half the state.

The Growing concern at the international level

The 31st General Assembly of the United Nations adopted a resolution to provide safe drinking water for the all the people of the world. United Nations Millennium Assembly in 2000 recognised the continued existence of the problem and the global ability to address the issues and set a more moderate goal - "To halve, by 2015, the proportion of people unable to reach or to afford safe drinking water." Most recently an International Conference on Freshwater Resources – Water, a key to Sustainable Development stated, `The need for action is more urgent than ever. Water is a key resource for a sustainable development and for a just and more peaceful world. The declaration adopted by the ministers states: "Safe and sufficient water and sanitation are basic human needs." When the poor have no access to water, it denies them the decent standard of living to which they are entitled as a human right.

Good, professional, integrated water resource management is important and we need to work hard on all levels and in the various sectors to improve it. But this is not enough. Providing water security is a key dimension of poverty reduction. This is the over-arching goal for our international co-operation. We know better now what it takes to reach that target, how much we need to expand infrastructure, how much money we need to finance it.

The year 2003 was been designated the International Year of Freshwater Resources to bring a greater impetus on addressing issues of drinking water worldwide.

Table VII-3 Watershed projects in Uttaranchal

Name of the Project	Sub-Watersheds	Area
Doon Valley	65	2409
South Bhagirathi – 1	6	192
South Bhagirathi – 2	18	542
Himalayan IWMP	75	2867
Bhimtal	8	216
IWDP –II	17	1270
Benalgad	17	453
Kuchgad	35	1103
Ecorestoration Project	324	14790

Source:Watershed Management Directorate

Despite the immense quantum of water resources available in the state, there are nearly 30 blocks that are drought affected. The Drought Prone Areas Programme(DPAP) has so far sanctioned 452 watershed development projects in the State.

Table VII-4 DPAP watershed projects sanctioned in Uttaranchal

District	Number of Projects sanctioned								
Batch	1st	2nd	3rd	4th	5th	6th	7th	8th	Total
Year	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	
Installments that have become due	7	7	7	6	5	3	2	1	
Almora	27(7)	0	0	0	0	19(2)	24(1)	24(1)	103
Bageshwar						9(1)			
Chamoli	22(7)	0	0	0	22(4)	0	12(1)	16(1)	72
Pauri Garhwal	40(7)	0	0	0	40(2)	30(1)	30(1)	30(1)	170
Pithoragarh/ Champawat	15(7)	0	0	0	15(1)	0	15(1)	15(1)	60
Tehri Garhwal	13(7)	0	0	0	13(2)	0	9(2)	12(1)	47
Total	117	0	0	0	90	58	90	97	452

Note: -1. A Watershed Project is of an average size of 500 hectares.

2. The total Project cost is released in 7 installments over a period of 5 years

3. .Figures in bracket indicate the number of installments claimed

Source: http://dolr.nic.in/dpap.htm

Over the years the Watershed Management Programmes have evolved solutions to the sustenance of the project by creating village level institutions and confederating them for financial resource management. As with any large development programme, the results are mixed. Some areas which have had the benefit of strongly motivated initial groups have results that are visible and which have been sustained even after the completion of the projects. In other areas which have lacked such an involvement, there is no tangible evidence of the project.

Chuni is known locally as a water-abundant village. The ancient *Jal Devi* (Water Goddess) temple located in the village is said to keep the waters in the traditional irrigation channels, or *guls*, flowing, as well as bestowing other blessings on Chuni residents. The traditional water springs or *Naulas* used by the 'upper castes' are also said to be the abode of the *Jal Devi* and are therefore revered and worshipped. The *Naula* is built by constructing a stone wall across a groundwater spring. Throughout mountain villages, '*Naulas* are traditionally held in deep reverence and rituals are conducted while constructing these systems. Water from the spring is used daily in ritual worship at home. Springs are also ritualistically important during marriage, and in local customary and traditional Hindu festivals.

Source: Deepa Joshi, Mary Lloyd and Ben Fawcett – IIDS, University of Southampton

Apart from the state, several NGOs have also been involved in development using watershed as a basis for intervention. The People's Science Institute has been involved in running training programmes for small community based organisations and NGOs in planning and implementation of Watershed programmes.

Doon Valley watershed project – some lessons

The broad objectives of the project are:
a) To arrest and reverse the ongoing degradation of the Doon Valley ecosystems;
b) To improve the living standards of the villagers living in the valley;
c) To ensure positive involvement of the rural people in the management of their own environment.

The project has taken up mainly two types of activities:

i) Activities which improve the health of the natural resources, like forests, grazing grounds, cultivable wastes, ground water, soil, etc.;
ii) Activities which indirectly reduce the pressure on natural resources by improving the existing production systems and creating subsidiary occupations for some extra income.

Accordingly, the components for project activities have been identified as: forestry, horticulture, minor irrigation, agriculture, energy conservation, animal husbandry and community participation. These activities have overlapping cycles through which they influence each other. It has been observed that in the past the development programmes could not be sustained because of the absence of local initiatives. To fill the gap and to encourage the local entrepreneurship, the project has earmarked a considerable part of the total budget for community participation. The aspirations and initiatives of the villagers have been kept as the central focus of the project. To achieve this all the activities starting from planning to implementation of the programmes and subsequent maintenance of the assets created are to be done through active participation of the village communities.

The programme is basically land-based and the present planning does not enable the project to attend to the problems of the landless class, particularly for the landless women who depend on natural resources for their livelihood.

Though the primary concern of the project is eco-restoration, the villagers' options differ greatly. As is revealed from the various village plans, irrigation, animal husbandry, agriculture and, in certain cases, the infrastructures such as roads and hospitals are some of the primary priorities of the villagers and environmental concerns get a back seat. The villagers are more interested in individual gains rather than being concerned for the management of the common resources. The project thus has to conduct some sort of bargaining with the villagers to achieve environment-related goals. So, a major task of the project is building village level organisation. The project opts for merging users' groups with the Panchayati raj system. At present one of the elected members of the village self-government is nominated by the Village Head (Pradhan) as a member of such users' group. But the *modus operandi* of the future merger of the users' group into the Panchayati raj system has not been clearly spelt out, in the absence of which the strategy for the withdrawal of the project from a village, once all the activities of the village plan have been completed, cannot be framed. As a result, every year the number of villagers under the supervisory control of the project staff increases, creating real management problems.

Excerpted from Dr S.K.Dutta and Malavika Ray, WMD

E. Irrigation

Irrigation systems are well developed in the plains districts, the oldest of them being the Upper Ganga Canal which serves the Haridwar District, irrigating a quarter of the area. Canals are also an important source in the plains of Nainital district, serving almost two-thirds of the agricultural area, and in the district of Udhamsingh Nagar, irrigating a third of the area. Tubewells are an important source of irrigation in the Terai districts with the individual farmers making significant investment.

The flood irrigation systems and the shallow groundwater table (as low as 10ft in parts of Udhamsingh Nagar) combined with water instesive crops like sugarcane and paddy have induced waterlogging and salinity in some parts of the Terai region. If adequate measures are not taken the problem could aggravate and cause losses as noticed in adjoining districts of Uttar Pradesh.

There is very little irrigated area the hills, the lowest being Champavat District with only 4 per cent of the net sown area under irrigation and the highest being the Bageshwar district with just 23 per cent.

Table VII-5 Irrigation in Uttaranchal

Districts	Reported area	Net Sown Area	Percent NSA	Net irrigated area	Percent Irrigated
Haridwar	233506	124503	53.3	101956	82
Dehradun	NA	14956	NA	1631	11
Dehradun (P)	NA	36046	NA	20830	58
Dehradun (H+P)	304894	51002	16.7	22461	44
Pauri Garhwal	752728	98767	13.1	9351	9
Chamoli	644395	32903	5.1	2244	7
Rudra Prayag	202682	18519	9.1	1999	11
Tehri Garhwal	574542	63783	11.1	9627	15
Uttarkashi	817631	30975	3.8	6241	20
Nainital (H)	NA	21032	NA	1967	9
Nainital (P)	NA	28454	NA	28196	99
Nainital (H+P)	411073	49486	12.0	30163	61
Udhamsingh Nagar	278678	150024	53.8	143269	95
Almora	585219	83511	14.3	4916	6
Bageshwar	138913	23286	16.8	5429	23
Pithoragarh	480089	39702	8.3	3869	10
Champavat	168011	17656	10.5	758	4
Uttaranchal (H)	NA	445090	NA	48032	11
Uttaranchal (P)	NA	339027	Na	294251	87
Uttaranchal (H+P)	5592361	784117	14.0	342283	44

Source: State Agricultural Statistics, 2001, GoUA

Table VII-6 Status of ongoing major and medium irrigation projects as on 18.9.2003

(potential in '000 ha, costs in crore rupees)

Project name	Plan of Start	Approval status	Original est. cost	Latest est. cost	Cummulative expenditure till 9th Plan	Likely expenditure 2002-2003	Balance amount as on 1.4.03	Ultimate potential	Potential created upto 9th Plan
Jamrani Dam	V	Approved	61.25	433.25	23.50	0.10	409.65	60.60	0.00
Lakhwar Dam	V	Approved	140.97	1446.00	229.60	1.00	1215.40	40.00	0.00
Kishau Dam	IX	Unapproved	3455.11	3455.11	11.49	0.00	3443.62	211.00	0.00
Total major Projects			3657.33	5334.36	264.59	1.10	5068.67	311.60	0.00

Source: Ministry of Water Resources, State Projects GoI, 2004

The major irrigation projects have been a non-starter. Three projects have been long underway: two approved by the Planning Commission during the Fifth Plan and one during the Ninth Plan. After having spent Rs 264 crores, there is not one cubic meter of water available for irrigation. The case of the Lakhwar Dam is classic – approved during the Fifth Five year plan, over 150 per cent of the original project cost has already been spent and now the revised costs are over 10 times the original estimates. This project is now being offered for private participation.

Raulikhet is a village, where women are not comfortable using the piped water supply., built at a cost of rupees nine lakhs. They rarely use it, and instead, use river water. The traditional naulas were considered sacred, as were the springs. While the people do not believe taps to be sacred, they feel that using the water flowing rapidly from the taps would result in the water flowing out to the village lowlands, where the temple of the powerful village Goddess is located. If women use taps during their menstrual periods, this may pollute the sacred spot. During these periods, women use water sparingly so that it is absorbed in the soil and does not flow down to the temple. The traditional stone masonry used helps retain the soil moisture and the material is locally available in abundance. Across most of the villages such religious beliefs are attached to the management of water resources, and springs, as the main sources of water, are not tapped without a system of checks and balances. In current development, the springs are being tapped to give piped water supply to the villages, destroying the local systems of water management, including ensuring that water is not wasted.

" The communities have been living since generations in such realities, which is one of the DESI but effective form of understanding and management. The hygiene is well defined within the community structures.

Source: Deepa Joshi, Mary Lloyd and Ben Fawcett – IIDS, University of Southampton

F. Drinking Water

The 10th Five Year plan allocations and thrust nation-wide[21] focuses on complete coverage by the end of the plan period. The new state accords a very high priority for drinking water and sanitation. The 10th Plan for Uttaranchal has earmarked nearly 14 per cent of the total outlay of Rs 7630 crores.

21 10th Five Year Plan Document

The current rural drinking water delivery systems demonstrate the historical evolution of various programmes implemented by Uttar Pradesh, when the region was part of it. Over its history, the region has witnessed varied approaches to the issue of enabling access to drinking water for its population.

Proir to Independence, water was managed through traditional self-management. Local communities made intra-and inter-village arrangements. After Independence, occasional investment was made by district agencies to construct drinking water schemes, which were handed back to village community for management.

After 1975, construction and management of piped water supply schemes were the prerogative of the government, with no participation of local institutions in their implementation. In a few cases, completed systems were handed over to Gram Panchayats for management. Traditional drinking water and irrigation systems (guls) and gharats or water mills continued to be managed by villagers themselves, through their own formal or informal institutions.

NGOs have, in the last two decades, assisted village communities to enhance water availability, repair and maintain traditional sources, or introduce new technology such as hand pumps in certain conducive areas. NGOs were also instrumental in promoting a District-level Task Force for Drinking Water in Almora District in the early nineties.

The current situation of drinking water for rural communities in Uttaranchal presents a diverse picture of availability, management and control. In general, the supply of water has evolved from a stage of being the preserve of the local communities to being an issue for a complex network of institutions from local user groups to international agencies. The variety of philosophies which govern the operating principles, such as on humanitarian considerations to market opportunities, as well as the sources of their legitimacy – ranging from local laws to multi-lateral agreements on drinking water - make it more complicated.

Today, there is activity at all scales and levels. A significant portion of the rural population in the state still struggles to get appropriate water and sanitation services. While official statistics for water and sanitation show relatively high levels of coverage of 90 per cent water supply and a dismal less than 10 per cent sanitation, these numbers mask a less comforting actual situation. The actual coverage refers to “access to water”, defined as 40 lpcd, within a distance of 1.6 km from the centre of the village and 100mt height, thus implying that many water users need to travel long distances daily to fetch water. Also, according to recent state data, about 30 per cent of schemes (about 9000) are partially or totally inoperative, including most of the schemes previously transferred to the Gram Panchayats (GPs) and require some sort of rehabilitation or augmentation. While the sanitation data shows that 10 per cent of households are covered by latrines, it does not reflect the household behavior, as most of these are not being used.

According to the Government of Uttaranchal, there are 31008 habitations in the state of which 107 habitations are not covered by any drinking water scheme while 908 habitations are only partially covered[22].

22 Source:GOUA, 2003

Table VII-7 Status of drinking water in habitations of Uttaranchal (01.04.2002)

District	Fully Covered	Not Covered	Partially Covered	Uninhabited	TOTAL
Chamoli	2379	1	27	1	2408
Rudraprayag	1171	2	15	0	1188
Tehri	3915	31	324	12	4282
Dehradun	1810	3	104	1	1918
Pauri	3818	18	22	2	3860
Uttarkashi	1037	0	0	0	1037
Haridwar	530	0	0	0	530
Pithoragarh	3899	5	74	0	3978
Champawat	1481	13	45	0	1539
Almora	4736	22	138	1	4897
Bageshwar	1885	8	83	0	1976
Nainital	2302	4	75	0	2381
US Nagar	1053	0	0	0	1053
TOTAL	29978	107	908	17	31008

In terms of the number of villages, there are 15165 villages in the state. About 11000 of them have some stamp of the state's conscious attempt to provide drinking water. Village Panchayats and local communities would be continuing or perhaps have regained the depleted assets and mandate for provision of drinking water in nearly 2500 villages. The Government of India states that 189 villages do not have any designed source and 1108 villages are only partially covered[23].

While there is this discrepancy with the Central and State Government statistics (some of these arise out of the differences in delineation of villages and habitations), Academy for Mountain Environics[24] estimates that nearly 20 per cent of the villages have a varied range of problems impeding the availability and provision of safe drinking water. These are due to physical, social and economic constraints faced by the state and the local communities. Further, there are seasonal problems in several locations, which are not adequately mapped

The Kumaon and Garhwal Jal Sansthans have operated the majority of the water supply systems. The status of the schemes as of 2002 presents a picture where the need for reviving or establishing new systems is imminent in nearly 2000 villages.

23 Reply to RAJYA SABHA UNSTARRED QUESTION NO.1166 ANSWERED ON 28.11.2001

24 Estimated from various datasets collected over last decade

Table VII-8 Status of drinking water schemes in Uttaranchal, 2002

Jal Sansthan	Total Schemes		Functional		Partially Functional		Non-Functional	
	Schemes	Villages	Schemes	Villages	Schemes	Villages	Schemes	Villages
Garhwal	3063	5626	2726	4935	268	586	69	105
Kumaon	2807	5495	2234	4161	436	1128	137	206
Total	5870	11121	4960	9096	704	1714	206	311

Source: Government of Uttaranchal,2003

The current WSS institutional setup is centralized, with Payjal Nigam and Jal Sansthan as the State water institutions in charge for project implementation and operations respectively. These state institutions are responsible for all rural and urban schemes, except for those under the previous Bank assisted project (Swajal I) and about 40 per cent of rural single-village schemes which were devolved to the Gram Panchayats. Rural and urban water and sanitation services are in general inefficient and dependent on substantial state subsidies.

The World Bank, which is a major supporter of the drinking water programmes of the state considers the efforts of the Uttaranchal to be significant and states "Government of Uttaranchal (GoUA) can take credit for being at the front of sector reform in India. In fact, Uttaranchal was one of the first states in India to prepare and adopt a consistent RWS policy, within the framework of an earlier Bank financed Uttar Pradesh and Uttaranchal RWSS project (named Swajal I) which was successfully evaluated (both by the GoUA and the Bank). Even though the GoUA component was of pilot nature (entailing about 857 single village schemes), it actually introduced and showed key policy elements including demand responsive approach, high level of community participation and financial contribution and operations via village level water and sanitation committees (VWSC). These same principles are now included in the recently issued (Sept. 2003) Government of India's (GOI) Swajaldhara program and central policy, which is now a national vehicle for reform and is being institutionalised via a MOU with the states."[25]

The Wor1d Bank SWAJAL Project was a major exercise in terms of financial investment, experimenting on a different programme approach in 600 villages in the State, by-passing state agencies initially and setting up a Wor1d Bank/Project Management Unit-NGO-Village Committee partnership. In the second phase, state agencies are again in the picture.

The Swajal Project showed up numerous shortcomings, which need to be paid attention to, if the project has to become a genuinely successful one. The chief driver of the project is the funding. As the funding is substantial, simple, cost effective, community based schemes are often neglected and more costly schemes are devised, which need outside supervision. For example, in Kataldi, a seetlement with 22 houses, water is

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being brought from 7 km. away, in spite of the existence of a spring within the settlement.

With funding being the chief driver, the skills within the village (necessary for future maintenance) are not being utilised, nor is capacity being built. As the village is in any case not being made a party to decisions, once the finances are over there is no guarantee that the scheme will continue to be maintained and financed by the villagers themselves.

Swajal – an appraisal

SWAJAL has the following main objectives:

To assist the State Government to identify and implement an appropriate policy framework to promote the long term sustainability of the Rural Water Supply and Environmental Sector
To deliver sustainable health and hygiene benefits to the rural population through improvements in water supply and environmental sanitation
To improve rural incomes through time saving and income opportunities for women
To test alternatives to the existing supply driven delivery mechanisms and
To promote sanitation and gender awareness.

A study conducted of the SWAJAL projects in five villages of two districts in Uttaranchal between December 2000 and February 2001 by PRIA a prominent NGO has brought some extremely interesting and significant results about partnership, management of water and local governance. Apart from the World Bank which provided financial assistance and the State Government which is responsible for the policy framework, the four key stakeholders were the District Project Management Unit (DPMU) a bureaucratic group, the Support Organization (SO) a locally based activist NGO, the Village Water and Sanitation Committee (VWSC), an elected body and the community at large. After a rigorous and transparent process the DPMU selects the SO which conducts pre-feasibility studies to select villages on a set of criteria like demand (willingness to share 10 per cent of the capital cost and pay 100 per cent of the O&M costs), need (insufficient water supply or poor water quality) and technical feasibility (adequate water source). Once the villages are selected, the SO mobilizes the community to elect the VWSC, which must have 20 per cent representation of the lower castes and 30 per cent of women.

The good news is

Delivery of water supply and sanitation services has been achieved to the satisfaction of the community in two out of the five villages with the active participation of the community
In these villages the water supply systems are functional and people are paying the charges determined by the VWSC.

The VSWC is perceived as a representative body working for the interests of the community and is looked upon to take initiatives in improvements of roads and providing employment opportunities
Women have started a drive for using latrines and eliminating the use of polythene bags
Levels of awareness have generally increased

The not so good news is

Water reached the community in only two out of the five villages within the prescribed timeframe. In two others work was delayed while in the fifth it came to a halt because of a local conflict.
The respective roles of different stakeholders are not easily definable particularly in a differentiated community with low levels of education and awareness.
The full involvement of the community could not be sustained even after the delivery of service stage as it requires effective management in revenue recovery, maintenance of transparent accounting systems and technical back up. There is a traditional belief that water is a free resource and therefore an innate suspicion about new systems. And yet there is no hesitation to pay if the delivery system is effective. Thus capacity building albeit with relatively simple and innovative tools at the local level is critical.

This raises an important question whether the existing formal institutional infrastructure is equipped to meet the requirements of an emerging rural community that is far more aware of its needs.
Wherever participation of women has been effective, the aspects of environmental health and hygiene are given much greater importance and leadership skills have been enhanced yet, the process of building up the strength of women's empowerment is treated as a separate activity rather than linked organically linked to the mainstream project activity.

There is no doubt that the concepts and philosophy underlying an initiative like the SWAJAL programme is very significant step in the direction of strengthening partnerships towards sustainable management of an essential resource like water. Nevertheless we still have to address the question of legitimacy in an open society and a democratic polity. In India the 73rd and 74th Amendments to the Constitution have provided statutory authority to popularly elected bodies at the sub-national level right down to the village. These institutions like the Panchayats in rural areas and Municipalities in towns are the legal custodians of all matters that affect the well being of the community. There is clearly a common consensus that this decentralized structure is the only effective and fair way to provide good governance to a large, amorphous, diverse nation like India. It could well be argued that, in fact, this would apply with equal validity to any nation however small, as is the case in many parts of the world. However, in the case of India, this also raises serious issues for equitable and sustainable development that can neither be wished away nor trivialized under the twin mantras of decentralization and devolution. The hard social and political realities and conflicts at the cutting edge, particularly as they impact on the poor and underprivileged have got to be faced and indeed resolved in order to come up with an acceptable road map.

Whereas, the positive and negative lessons are important indicators for making corrections in programme design and project management, there is also a very fundamental question of governance that needs to be squarely addressed. One of the reasons for the lack of success in two of the villages was the conflict that arose between the Panchayat, a constitutionally elected body and the VWSC also an elected body but a user group without any statutory mandate. In one of the villages the VWSC accepted it's role as a sub-committee of the Panchayat, a but in another village this led to an unresovable conflict situation resulting in the denial of water to the entire community. It is therefore essential to build conflict resolution mechanisms into partnerships right from the initial stage. And this becomes even more important when dealing with the ownership, use and management of natural resources in a developmental scenario.

Excerpted from India's Water Crisis, Ashok Jaitly, Distinguished Fellow, TERI

Most recently a new programme called the water-sector reform project has been initiated with a pilot in the Haridwar district supposedly aimed at the peripheral villages on the Shiwaliks.

Good quality and adequate supply of water is a basic need. If the rural scenario in Uttaranchal for water is disheartening, the urban water scenario is quite appalling. Of the 63 urban locations, 31 settlements have provision for only 30 lpcd; another 10 have upto 70 lpcd. Considering the fact that sanitation has not extended to all the settlements, the improvement in sanitation will demand increased availability of water.

Given a swath of implementation mechanisms, an analysis of the efficacy of the systems with respect to its financial and social viability needs to be assessed before Uttaranchal embarks on any programme that will enable it to meaningfully address the problems of people who still lack access to clean drinking water.

Doon valley has immense water resources. It has perennial streams and its porous gravel formations allows for plenty of storage underground. Depth of water level in pre monsoon period in the upper parts of the valley varies from 60 –80 mt to around 10mt in the central part of the valley. The plains have such shallow reservoirs that to maintain a twenty-four hour supply is only an issue of management rather than of resource inadequacy.

G. Water Quality: Ganga Action Plan

The following cities have been covered under the National River Conservation Plan. Pollution abatement works in Haridwar-Rishikesh under the first phase of Ganga Action Plan (GAP) have already been completed. The expenditure incurred by the state till 1.7.2001 on works in these 10 towns is as under:

Table VII-9 Expenditure under GAP

S.No.	Town	Expenditure (Rs. Lakhs)
1.	Badrinath	10.52
2.	Joshimath	6.14
3.	Gopeshwar	8.00
4.	Srinagar	56.32
5.	Karanprayag	5.14
6.	Rudraprayag	14.14
7.	Deoprayag	21.16
8.	Uttarkashi	74.15
9.	Ranipur	29.16
10.	Haridwar-Rishikesh	1880.28 (including GAP phase I)
	Total expenditure	***2105.01***

Source: Press Information Bureau, GoI (pib.nic.in)

The water quality of rivers and tributaries of Ganga reflect a critical need to address excess coliform, which has been identified at all the monitoring stations. The coliform count increases as one goes downstream, indicating violation and mismatch in the desired class of water at all the observation points. The other primary parameters like BOD, DO, pH seem to be under the recommended desired norms for surface water bodies.

The total coliform per 100 ml ranges from 1070 at Laxman Jhulla at Rishikesh to 5500 at Lalita Rao at Haridwar (see figure below)

As per the estimates under Ganga Action Plan, the total wastewater discharged in Ganga river flowing through Uttaranchal is 113.4 mld.
Three sewage treatment plants were installed and monitoring for the year 2001 gives the following indications:
All observations are in mg/l

STP	COD		BOD		TSS	
	Raw	Treated	Raw	Treated	Raw	Treated
Rishikesh-Muni ki Reti	369	83	162	15	214	61
Rishikesh Swargashram	676	319	357	133	317	125
Haridwar -Kankhal	323		131	66	278	147

STPs have not met the prescribed standards laid down by NRCD. The BOD after treatment should be 30 mg/l and TSS 50 mg/l. The operation & maintenance of STPs would be critical in determining the treated wastewater in river Ganga, which is undertaken by jal nigam.

Figure VII-2 Water quality (various parameters)

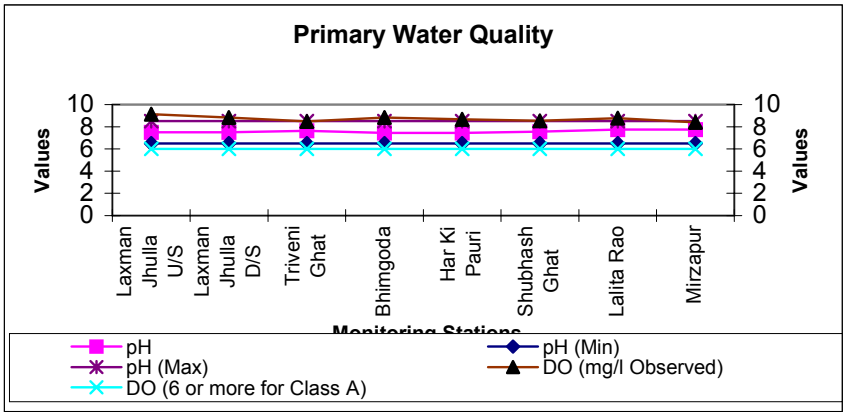
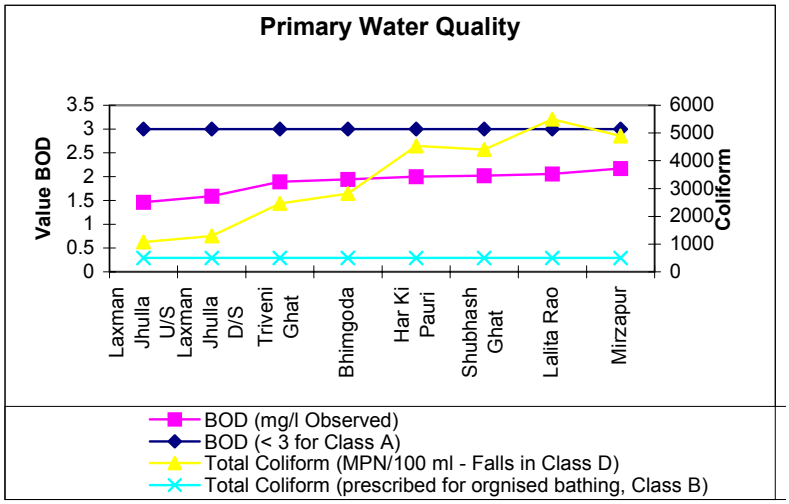


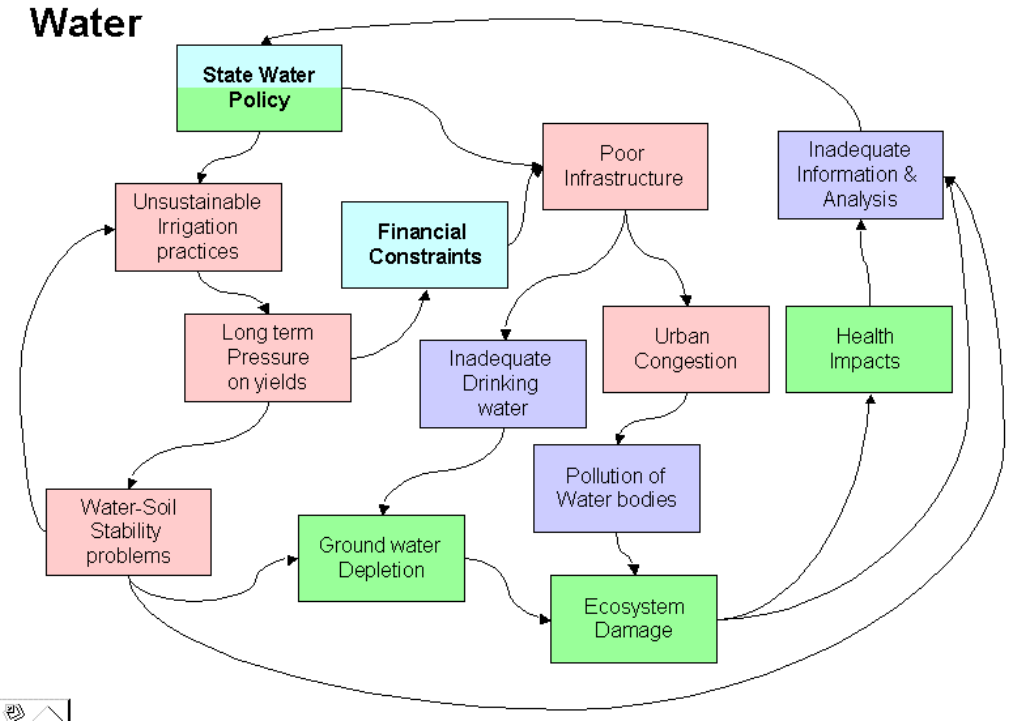
Figure VII-3 Water quality : BOD



Total coliform concentration is attributed to discharge of raw sewage in the river streams, since most of the towns along river Ganga and its tributaries have partial or no sewerage systems. Yet another reason is the most of the bathing is unorganised with wastewater being disposed off in the stream straightaway. Appropriate measures have to be taken for bringing down the total coliform concentration. The other tributaries of Ganga like Mandakini, Bhagirathi, Alaknanda also indicate total coliform as the critical parameter with rest of the parameters within acceptable limits.

The high coliform count assumes special importance as surface water is the main source of drinking water in mid and high Himalayas, except a few pockets in Terai of Udhamsingh Nagar, Haridwar, Doon valley where ground water is also used to a certain extent. Conventional treatment and disinfection has to be ensured in order to provide people with safe drinking water.

H. The Way Forward



The terrain and geological conditions of Uttaranchal demand an effective and continuing watershed management programme as the prime basis for water management. However it has been recognized that the watershed programmes themselves have to be comprehensive and demand convergence of all other sectoral activities. While a semblance of convergence is brought about in the Integrated Watershed Development projects, the administrators and the practitioners recognize that the convergence also requires a significant understanding of the sequencing of tasks to obtain optimal benefits. The principal sectors that would need convergence and proper sequencing are the forestry, agriculture, horticulture, soil conservation, irrigation and animal husbandry. This would demand considerable political and administrative will and involve negotiating with the Central Government on reorganization of the schemes supported by it.

The Government of Uttaranchal (GoUA) has prepared a Rural Water and Sanitation 2020 vision plan, which has been formally adopted. The vision entails universal sustainable coverage of water and sanitation, with higher standards and with most costs to be borne by the community. To achieve this, the proposed strategy elements include decentralization of WSS services to Gram Panchayats and Urban Local Bodies, fully scaled up demand driven and participatory approaches, and an integrated approach to water, sanitation, environment and health. Other key strategies include the adoption of common institutional and financial sector policies (independent of sources of funds), and transforming the current institutional framework to match the renewed state's role as a facilitator, rather than a constructor and operator.

The immediate strategy of the GoUA for the RWSS sector includes the following key elements:

1. Scale up the Swajal project (single village schemes) statewide, including the setting up of a new institutional arrangement, i.e., the Panchayati Raj Institutions (especially the Gram Panchayats) as the key responsible institutions for overseeing the RWSS sector development, including project preparation, implementation and operation.
2. Prioritize interventions, beginning with non or partially covered schemes along with strong emphasis on improving sanitation coverage.
3. Refine and consolidate the new sector policy by signing the MOU with GOI and establish a state-wide sector policy framework. This includes reorganization and eventual restructuring of sector institutions.
4. Study institutional arrangements for multi-village schemes on an experimental basis.

Among the several concepts advanced by the Planning Commission an important window of relevance to the state is the Agro-Climatic Regional Planning Programme. This programme which was launched in the eighties has made some progress throughout the country and highlights the efficacy of area and resource based planning as compared to the sectoral, target driven approach. Tehri district has been one of the pilot districts with some focused efforts undertaken in the Chamba Block. The Zilla Panchayat's lead role and the involvement of the Panchayati Raj Institutions and the local community in drawing up the plans for each village and the priorities for development in the village helps in building a coherent Block and District level strategy.

ARCP programming will need the state government to take up specific measures such as:

1. Enact legislation, which accede full right over planning, design, implementation and O&M to the Panchayats with provision for collecting taxes and user charges not only on water but also on the entire range of sectors identified in the 11th Schedule of the Constitution.
2. Create legislative provisions for the Panchayats to enable them access finances for creating their infrastructure;
3. Transfer existing funds for the 10th Plan to Panchayati Raj Institutions on the basis of the Agro-Climatic Regional Planning Framework and priorities identified by the local communities.
4. Provide all support including assistance in institution building to the village and block Panchayats to address the issues of drinking water provision.
5. Dismantle existing institutions and create conditions for their merger with the Panchayati Raj Institutions.

Pragmatic solutions to meet urban water needs: the scenario for Dehradun

Technical and managerial failure is primarily responsible for making water supply a nightmare and continuous water supply unimaginable. The present piped-water systems in urban India largely rely on municipal utilities that do not provide a continuous good quality water supply. Many slum dwellers do not have access to clean water at any point of the day and even those in better localities, who receive piped-water, find it intermittent, low pressure and occasionally mixed with dirty water. In order to cope with the intermittent supply and poor quality of water or low pressure, domestic and commercial user express their willingness to pay in term of investment and current cost at household level.

In the current form of intermittent supply, when the water supply is stopped all the water rushes to the lower level main from the higher level creating a vacuum. Foul gases enter through taps that are left open. Foreign matter enters through sites of leakages, leaky joints and hydrant etc and consequently the water is contaminated. Due to low water pressure and intermittent supply, sewage water and other contaminants often get sucked up into the distribution pipe at various points and finally emerge at house hold taps thus posing a potential health hazard to large sections of the population. As long as the water supply in Dehradun is supplied under such circumstances, citizens will be prone to water borne diseases, running the risk of epidemics including such dangerous ones as infective hepatitis. More than 50 million people are particularly incapacitated annually due to water-borne diseases like diarrhoea, dysentery, cholera, typhoid, parasitic infestation and viral afflictions, in the country and more than two million die.

In the intermittent system, the size of pipes needed for the mains and the distribution systems must necessarily be greater. Hence it is concentrated to period of six to eight hour and the supply needed per hour may be four times the average. However, perhaps the only advantage of the intermittent system is rationing - in those regions where the supply is scantly and the per head availability is poor, the town can be divided into zones and the water allowed in each zone at different hours of the day.

In case of continuous supply, the fear of contaminants is tremendously reduced if not completely excluded, as there is a constant column of water flowing through. Further, the pipe is constantly under pressure and is less liable to deteriorate, while in the intermittent supply system, the vacuum created can cause a strain on the pipe joint which may lead to gradual leakage. It also found in practice that a water main or pipe that is always filled with water has much longer life from that which changes intermittently to interface with water and air, promoting oxidation. Continuous water supply at both household and public taps reduces the need for storing of water in unsanitary containers or vessels, and goes a long way preventing contamination at domestic level. For fire-fighting service a constant supply is much more helpful.

Rate of water demand depends upon local conditions such as the size of the population to whom water is to be supplied, the economic conditions and the standard of living of the community to be served, supply pressure etc. Some factors that need to be considered include water charges, whether the supply will be metered, if sewage system will be provided, if provision is to be made for watering of garden and lawns. The water consumed varies widely in different houses from day to day and month to month. Maximum demand is during morning and evening hour of peak demand are 6 am to 9 am in the morning and 5 pm to 8 pm in the evenings. It can be considered that half-of-the demand of 24 hours is consumed in 6 hours and remaining in 18 hours.

Adequate supply of good quality of water at an affordable price is a basic need. Ineffective planning and lack of application of known solutions to technical problems prevent the water-supply systems from providing good quality continuous water supply. The cost of coping strategies is usually significantly greater than paying for a full service water supply charged at full cost. Proper metering of all services can reduce the consumption as much as 50 per cent. A metered system reduces the wastages.

Uttaranchal is in a unique position today to develop systems of water management based on effective community participation in control of natural resources. Such a strategic programme will necessarily have to step out of the normal sectoral limitations and look at the village in a more integrated manner, while using existing institutions in a far more focused manner. This would entail the convergence of sectors that impinge on the use of natural resources, to evolve a comprehensive natural resource management policy.

Annex VII-1 Important Glaciers of Uttaranchal

Jamdar glacier is an important glacier feeding the Tons river which forms the western extreme of Uttaranchal.

Bandarpunch is an important glacier of Yamuna river basin. The glacier is 12-km long situated on the northern slopes of Bandarpunch Peak (6,316m), Bandarpunch West (6,102 m) and Khatling peak (6387 m). The glacier is formed by three cirque glaciers and later joins the Yamuna River. It lies on a gentle slope and is bounded by lateral moraines, which indicate the last surface level of the glacier.

Gangotri glacier is a well-known glacier in Garhwal Himalayas, situated in Uttarkashi district. The glacier originates at the northern slope of Chaukhamba range of peaks. This is not a single valley glacier, but a combination of several other glaciers that are fed to it and form a huge mass of ice. Bhrigupanth (6,772m), Kirti Stambh (6,285), Sumeru Parvat (6,380m) respectively and Raktavarna bamak, Chaturangi bamak and Swachand bamak lie on the northeast slope of Srikailash, Man Parvat, Satopanth and an un-named group of peaks. Bamak is the local name for a glacier. The glacier lies within a span of 28-kms and terminates at Gaumukh (4,000m). The glacier flows at a gentle slope except for a few ice walls and crevices developed in the upper regions of the glacier where as in the lower part (above the snout), the glacier is covered by debris, which imparts a muddy appearance to its surface.

Dokriani bamak is a well-developed medium sized glacier of the Bhagirathi basin. The glacier is formed by two cirques, originating at the northern slope of Draupadi Ka Danda and Jaonli Peak, 5,600 m and 6,000 m respectively. The glacier is 5-km long and flows in the northwest direction terminating at an elevation of 3,800m. The stream originating from the glacier's melted water is called "Dingad", which later joins many other snow/ice-melted streams and finally merges into Bhagirathi River near Bukki village. There are several well-developed meadows and proglacial lakes located 2 km below the snout of the glacier.

Khatling glacier, a lateral glacier situated in Tehri district is the source of river Bhilangna. Snow peaks of the Jogin group, Sphetic Pristwar, Barte Kauter Kirti Stambh and Meru surround the glacier. The moraines on the side of the glaciers look like standing walls of gravel mud. From Kedarnath temple, there is a 3-km footpath to the glacier snout. Between the rock face and right lateral moraine of the glacier, there is a lake formed by glacier-melted water called "Ganghi - Sarovar".

Chorbari bamak glacier is situated in Rudraprayag district of Uttaranchal. It is 6-km. long and originates from the southern slope of Kedar-dome, Bhartekhunta and Kirti Stambh. This hill range is the water divide which separates the Gangotri group of glaciers and the Chorbari glacier. Several hanging glaciers and avalanche chutes feed the glacier. The lower part of the glacier is covered by thick debris and bounded by huge deposits of lateral moraines. The glacier starts from its accumulation zone (600m) and terminates at an elevation of 3,800 m, from where a snow/ ice melt stream originates, called "Mandakini", which merges into the Alaknanda River at Rudraprayag.

Doonagiri glacier is one of the important glaciers of Dhauli Ganga system of glaciers where more than 500 glaciers, of different shapes and sizes lie in the deep and narrow valleys. The important glaciers here are: Changbang, Girthi, Hoti and Niti glaciers. Doonagiri glacier is 5.5-km long, extending between an elevation from it head 5,150m to the snout 4,240m, which is the terminal point of the glacier. A stream originating from the glacier merges into Dhauli Ganga near the Juma village.

Tiprabamak is a 6-km long glacier of Bhyundar Ganga basin in the Alaknanda catchment. Nearly 16 glaciers of various sizes and shapes exist in the basin, out of which only Tiprabamak and adjoining Ratanban glaciers are of significance. The melted water discharge of these glaciers emerges from a single ice cave at the snout of the Tiprabamak.

Satopanth and Bhagirathi Kharak are important glaciers in upper Alaknanda basin and are the source of the river Alaknanda. These glaciers are located 17-km from the famous temple of Badrinath, in Chamoli district. The Satopanth glacier is possibly derived from two words; 'Sato' meaning heaven and 'Panth' stands for path or way. These glaciers originate from the peaks of Chaukhamba and Badrinath range of peaks, which separate them from the Gangotri group of glaciers. These glaciers are 13 and 18 -km long, respectively and terminate at an elevation of 3,810 m and 3,820m, respectively.

Nanda Devi north and Nanda Devi south are two important glaciers, each with a length of approximately 19-km located in the Rishi Ganga River catchment. These glaciers originate on the southern slope of Nanda Devi peak (7,108 m). Other important glaciers in the vicinity are Trishul, Kurumtoli, Nandakna, Bartoli and Ramani. These glaciers are well developed and are large in size and length. Several melted-water streams originate from these glaciers and form the river Rishi Ganga, which later joins the Dhauli Ganga at Raini, 25-km from Joshimath.

Pindari Glacier, in the Bageshwar district, falls in the Kumaon Himalayas and has lured mountaineers and trekkers since the last century. It is one of the most easily accessible of all the Himalayan glaciers. To the west of the Pindari glacier, situated on the southern slope of the Sunderdhunga Khal, is the 5-km Long **Maiktoli** glacier. On the east and west of Pindari glacier are the **Kaphni**, at the foot of Nandakot and Sunderdhunga glaciers. Further west at the snout of the **Namik** glacier rises the Ramganga East river.

The glaciers in the Pithoragarh district are presented in the table below:

Table VII-10 Glaciers in Pithoragarh

River Basin	Glaciers	Catchment Area Sq. Km	Glacier Area Sq. Km
Gori	Milam	212.21	39.50
	Kalabaland	60.00	12.00
	Northern Lwanl	49.00	10.00
	Bamlas	46.00	9.00
	Lower Lwanl	45.00	8.00
	Balati	40.00	10.00
	Baldimga	31.00	8.00
	Terahar	31.00	4.50
	Poting	30.00	8.50
	Ralamag upper	26.00	8.50
	Talkot	24.00	5.00
	Ralamag lower	22.00	8.00
	Sankalpa	19.00	3.20
	Middle Lwanl	15.00	2.00
	Lower Poting	6.50	2.00
Lassar	Upper Lassar	131.60	32.1
	Lower Lassar	126.00	34.9
	Middle Lassar	115.51	21.6
Dhauli	Lower Dhauli	130.00	24.5
	Sona Glacier	72.00	4.00
	Baling Golfu	45.00	3.00
	Upper Dhauli	32.00	8.2
	Sobla Tejam	22.00	4.00
	Middle Dhauli	19.00	3.1
Kali	Lower Kali	30.00	5.2
	Upper Kali	10.00	5.0
Kuti	Glaciers of Kuti Yangti Basin	208.00	20.00

Source: www.pithoragarh.nic.in

Annex VII-2

Desired and Existing Water Quality Levels for Rivers in 2001

LOCATION	DESIRED CLASS	EXISTING CLASS	CRITICAL PARAMETERS
ALKANANDA			
Alkananda B/C Mandakini At Rudra Prayag, Uttaranchal		D	Totcoli
Alkananda A/C Mandakini At Rudraprayag, Uttaranchal	A	C	Totcoli
Alkananda B/C To Bhagirathi At Devprayag, Uttaranchal	A	D	Totcoli
Bhagirathi			
Bhagirthi B/C With Alaknanda At Devprayag, Uttaranchal	A	D	Totcoli
Alkananda A/C With Bhagirathi At Devprayag, Uttaranchal	A	D	Totcoli
Bhagirathi At Gangotri, Uttaranchal		D	Totcoli
Ganga			
Ganga At Rishikesh U/S, U.P	A	C	Totcoli
Ganga At Haridwar D/S, U.P	B	C	Totcoli
Yamuna			
Yamuna At U/S Dak Patthar, Uttar Pardesh		C	Totcoli
Yamuna At Yamunotri, Uttaranchal		D	pH,Totcoli
Yamuna At Hanumanchatti, Uttaranchal		D	Totcoli
Yamuna At U/S Of Lakhwar Dam, Uttaranchal	A	C	Totcoli

Annex VII-3

Index to Class

I. Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	1 .Total Coliforms Organism MPN/100ml shall be 50 or less
		2. pH between 6.5 and 8.5
		3. Dissolved Oxygen 6mg/l or more
		4. Biochemical Oxygen Demand 5 days 20oC 2mg/l or less
Outdoor bathing (Organised)	B	1 .Total Coliforms Organism MPN/100ml shall be 500 or less
		2. pH between 6.5 and 8.5
		3. Dissolved Oxygen 5mg/l or more
		4. Biochemical Oxygen Demand 5 days 20oC 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	1 . Total Coliforms Organism MPN/100ml shall be 5000 or less
		2. pH between 6 to 9
		3. Dissolved Oxygen 4mg/l or more
		4. Biochemical Oxygen Demand 5 days 20oC 3mg/l or less
Propagation of Wild life and Fisheries	D	1 .pH between 6.5 to 8.5
		2. Dissolved Oxygen 4mg/l or more
		3. Free Ammonia (as N) 2.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	1 .pH betwwn 6.0 to 8.5
		2. Electrical Conductivity at 25oC micro mhos/cm Max. 2250
		3. Sodium absorption Ratio Max. 26
		4. Boron Max. 2mg/l

Annex VII-4 River Water Quality Status in Uttaranchal, 2001

Location	DO	BOD	COD	TSS	TDS	Alkalinity	Sulphates	Calcium	Magnesium	Hardness	Chlorides	Sodium
ALKANANDA	All observations in mg/l											
Alkananda B/C Mandakini At Rudra Prayag	9.2	1	5		77	53	32	19	3	21	5	
Alkananda A/C Mandakini At Rudraprayag	8.6	1	5		80	54	93	20	2	22		5
Alkananda B/C To Bhagirathi At Devprayag					79.7	54	34	19	2	20	6	5
Bhagirathi												
Bhagirthi B/C With Alaknanda At Devprayag	8.9	1	51		86.7	29	48	15	2	17	8	8
Alkananda A/C With Bhagirathi At Devprayag	9.1	1.3	8.5		81.3	43	37	20	3	20	5	6
Bhagirathi At Gangotri	7.2	1			51		19	6	2	8		
Ganga												
Ganga At Rishikesh U/S	9.4	1.3	6.2		284.7	55	13	41	23	63	8	
Ganga At Haridwar D/S	8.8	2.2	11.9		311.3	58	17	130	21	151	11	7

Annex VII-5 Annual Mean and Range of Water Quality Parameters in Different Rivers – 2000-01

Parameter		Western Hiyunl	Song	Khoh	Nayar	Bhilangana	Bhagirathi
Water temperature (°C)	Average	20.6	22.3	22	20.1	17.8	16.9
	Range	13.0-26.9	15.0-27.0	13.4-27.8	10.0-26.4	9.5-25.5	9.0-25.5
Water depth (cm)	Average	0.79	0.83	0.61	0.84	2.02	4.48
	Range	0.45-1.3	0.35-1.75	0.4-0.85	0.7-1.2	1.0-2.8	2.0-8.0
River width (m)	Average	8.6	11.85	6.88	12.97	17.1	21
	Range	6.0-11.2	7.5-14.5	4.4-9.6	7.0-18.5	12-22.6	12-290
Flow rate (m/s)	Average	0.6	0.7	0.5	0.6	0.9	1.2
	Range	0.4-0.9	0.5-1.0	0.4-0.8	0.5-1.2	0.6-1.6	0.9-2.0
Transparency (cm)	Average	31.9	32.12	33.22	30.7	30.17	32.43
	Range	27.2-42.0	26.5-42.0	27.5-42.0	23-44	14.5-40.0	15.4-29.0
Total solids (mg/l)	Average	123.4	132.2	114.5	162.8	156.2	161
	Range	102-150	92.0-195.0	92.2-128	110-210	136.8-165.61	145-171
PH	Average	7	7.5	7	7	6	7
	Range	6.8-7.2	7.4-7.9	6.9-7.2	6.8-7.2	6.6-7.0	6.8-7.0
DO (mg/l)	Average	8	7.8	7.6	8.1	8	7.9
	Range	7.4-8.8	7.2-9.0	6.8-8.2	6.0-8.8	6.6-8.8	7.2-9.2
Free CO_2 (mg/l)	Average	1.74	1.66	2.2	2.3	2.7	2.3 1
	Range	0-8.0	0-8.0	0-4.0	0-6.0	0-6.0	0-6.0
Total alkalinity (mg/l)	Average	122.6	184.3	89.4	80.9	58.6	73.1
	Range	106-142	150-210	72-106	56-112	44-84	56-90
Silicate (mg/l)	Average	0.1	0.3	0.3	0.4	0.5	0.6
	Range	0.34-0.22	0.05-0.88	0.1-0.66	0.22-0.70	0.45-0.65	0.60-0.71
Density (no/cm2)	Average	170	247	188	490	305	370
	Range	11-542	6-1 183	40-701	40-1 208	12-1 329	14-655

Note: The data are averaged across the various sampling stations

VIII. ENERGY

A. *Introduction*

Uttaranchal is a power surplus state in terms of its current situation and in the wake of the projects that are already on the anvil. The region has also witnessed a high priority being given to investments in the power sector. Rural electrification has been an important component of the efforts. Despite the difficult terrain and the investment-intensity of the conventional power systems, the region has seen a steady increase in number of villages electrified.

Available Electricity

The total availability of electricity in the State is higher than the total internal requirement of 3900 MU. However, this requirement is the aggregate value derived for a full year, which does not account for seasonal variations in demand and supply through the year, especially as the domestic sector uses the most electricity. While there are instances of surplus availability in the summer months, the State utilizes nearly its entire allocation of Central Generating Stations (CGS) capacity in winter season.

Energy Availability

Availability From	MU
State Generation from UJVNL	3070
Share from Central Generating Sector	2156
Independent Power Producers (IPPs)	26
Micro Hydel	46
Total	5298

Historically, the importance of energy has been identified and recognized from very early days of human age. Various forms of energy, thermal and mechanical and human strength were used for lighting, cooking, heating, and other purposes. Agriculture and food processing was done by human activities, while solar and wind energy, together with forest produce were effectively used for lighting and heating of human habitat. During last century, coal, oil and other petroleum derivatives and nuclear energy to some extent have become conventional sources of energy and are in use for almost every activity of modern world. With knowledge and experience, the human race today understands the importance for identifying more reliable and environment friendly energy sources as conventional sources are fast depleting, apart from the enormous harm their utilization causes to the environment. Thus, renewable sources of energy such as solar, wind, water are gaining popularity. These are cleaner and more reliable forms of energy resources, which with modern day technology could be used locally; they are cheap to produce and maintain, as well as environmentally less dangerous.

B. *The Energy Situation in Uttaranchal*

Electricity is just one form of energy that is needed in rural areas. It is used mostly for lighting in the hill districts and significantly for industries in the plains districts. The existing installed capacity is about 978 MW. The state has an energy surplus during the summer months due to high generation and reduced load demand.

While the state may have an overall position of power surplus, nearly 20 per cent of the villages still need to be electrified and the infrastructure improved as `brown-outs' are frequent and prolonged. TERI carried out power system studies by simulating the

existing 66 kV and above voltage network. The analysis of results of the studies indicated low voltage conditions in a few districts of Kumaon region. There is only a 33 kV interconnection existing between Garhwal and Kumaon regions in the state thereby limiting the exchange of power flow.

The major sources of energy in rural Uttaranchal is still of course fuel wood. Kerosene, electricity, cow dung and crop residues are also important sources of energy in different parts of the state. Uttaranchal has also seen a dramatic increase in the use of LPG.

Cooking fuel

Fuel wood contributes to around 65 per cent of the total energy requirement, 90 per cent of which is met by traditional fuels. Fuel wood is used mainly in the domestic sector for cooking and heating. According to the 2001 census data, 54.6 per cent of the total households in Uttaranchal use fuel wood for cooking. As expected its use for cooking is higher in rural areas (67.5 per cent households) than in urban (14.7 per cent households). The use of crop residues and cow dung cake for cooking is largely seen the districts of Udhamsingh Nagar and Haridwar which are part of Terai belt and have more agricultural activities than the rest of Uttaranchal.

Table VIII-1 Distribution of households by type of fuel used for cooking

	Total	%	Rural	%	Urban	%
Total	**1,586,321**	**100.0**	**1,196,157**	**100.0**	**390,164**	**100.0**
Fire-wood	*865,411*	*54.6*	*807,913*	*67.5*	*57,498*	*14.7*
Crop residue	40,995	2.6	35,607	3.0	5,388	1.4
Cow dung cake	55,141	3.5	50,176	4.2	4,965	1.3
Coal, lignite, charcoal	565	0.0	246	0.0	319	0.1
Kerosene	69,903	4.4	28,707	2.4	41,196	10.6
LPG	531,076	33.5	254,511	21.3	276,565	70.9
Electricity	1,456	0.1	1,025	0.1	431	0.1
Biogas	15,452	1.0	14,319	1.2	1,133	0.3
Any other	847	0.1	673	0.1	174	0.0
No cooking	5,475	0.3	2,980	0.2	2,495	0.6

Source: Housing Profile, Uttaranchal - compiled from Table H – 11, *Census of India 2001*

Giri Institute of Development Studies estimated that in 1984 around 80 per cent of the rural households depend entirely on fuel wood for cooking. This scenario has changed with LPG finding its way into rural areas where it is now used by 21.3 per cent of rural households. A study conducted in 1999-2000 by Academy for Mountain Environics on 734 families in Palas Nyay Panchayat in Block Chamba, showed that despite having access to other fuel sources almost all households used fuel wood since it was still not commercialized; for certain uses like heating of rooms during winter, it was still the most effective.

Uttaranchal's petroleum ministers and growth of LPG use

Uttaranchal has been singularly fortunate for having two Petroleum Ministers - Late H.N Bahuguna and Late Bhramdutt - in the past who realized the importance and scope of LPG usage in the fuel mix of rural Uttarakhand. They provided additional support to the region in terms of connections in an era when LPG was still an item of short-supply. As the GMVN and KMVN were made the marketing arms for LPG, the spread has been significant. However as LPG is a commercial fuel and its price has been constantly rising, many rural households use it sparingly.

The average per capita consumption of fuel wood among the users has not changed significantly over the years. The consumption is dependent upon a number of factors such as altitude, proximity to forests, economic conditions, levels of out migration from the village, ease of availability of LPG, etc. In the case study of Palas Nyay Panchayat, about a fifth of the families subscribe to LPG connections and nearly half of the households have electricity connections in Chamba block. The choice of wood depended primarily upon its availability. Burning durability was rated the second important factor and smoke the third. In the urban areas LPG was clearly the main source. Fuel wood and kerosene are also used.

Table VIII-2 Average per capita consumption of different fuels per month

Village Council	Fuel Wood (Kg)	Kerosene (Lt)	LPG (Kg)	Electricity (Kwh)*
Bagi	61	1.38	0.02	5.6
Chopriyali	54	1.53	0.32	16.12
Indwalgaon	60	1.94	0.08	2.36
Jardhargaon	90	2.03	0.24	2.4
Palas	57	2.0	0.34	11.8
Total	68	1.8	0.23	7.7

*Electricity consumption estimated as Amount Paid/ KwH Rate

Source: Primary Household Survey, AME, 1999-2000-10-20

Environmental Implications:

Health impact of exposure to indoor air pollution

The World Health Report 2002 issued by the World Health Organisation estimates that indoor air pollution from household use of solid fuels is the fourth leading health risk in developing countries with high mortality. Worldwide, exposure to smoke emissions from the household use of solid fuels is estimated to result in 1.6 million deaths annually. Recent estimates suggest that the annual impact of solid fuel use by households in India is approximately 500,000 deaths and nearly 500 million cases of illness. The health effects that have been linked to household fuel smoke in developing countries include acute upper and lower respiratory illnesses (which are the leading cause of child mortality under the age of five in India), chronic bronchitis, chronic obstructive pulmonary disease, asthma, cataracts (of which India has the highest incidence among women) and tuberculosis.

Indoor air pollution has been flagged as the most serious consequence of burning traditional biomass fuels. The smoke from burning these fuels contains large amounts of toxic pollutants such as carbon monoxide, oxides of nitrogen, sulfur dioxide, aldehydes, dioxin, polycyclic aromatic hydrocarbons and respirable particulate matter. Continued exposure to these pollutants can seriously harm the health of women who are directly exposed to them while cooking in the house. According to the World Bank, such exposures exceed the recommended World Health

Organization levels by factors of 10, 20 or more. However, according to the study conducted by AME, the local people in Chamba block consider a certain amount of smoke to be necessary as it protects the wooden roof from pests and deters houseflies and other insects.

The real impact on women's health cannot be ignored and it warrants greater understanding of the actual situations in which the rural women cook. It also calls for providing them with more efficient stoves and other technology options that are more favorable.

Use of fuel wood has been implicated in the **decrease of forest cover**. The area under the control of Forest Department in the Garhwal region is roughly two-thirds of the entire land area while the actual dense forest cover is about one fourth. Several community forests are unable to support the increasing demand for fuel wood, and local people will need greater access to forests. However, many leading environmentalists and activists believe that the use of fuel wood is not the primary reason for destruction of forests as women usually take only collect dry twigs for this purpose.

Fuel WoodFuelwoodas a cause for forest depletion: a myth

Calculations based on household consumption of fuelwood and its quantification often makes one think that the poor rural women, who are the gatherers of fuelwood are the greatest extractors. They are painted as the major culprits in the denudation of our forests. The industry and the strong `forest-mafia' as they are often referred to in Uttaranchal want us to believe that rural energy needs are the cause for forest destruction whereas the truth is that the rural women, particularly in Uttaranchal are so concerned themselves about the health of their forests that they would be the last to see their forests being destroyed. Women only gather twigs and lop selectively the dry branches which helps rejuvenate the forest stock. Bringing back green trees or branches would mean greater effort in drying them and keeping the smoke away.

This is supported by the various energy consumption studies that were conducted in 1970s. These studies revealed that rural firelwood consumption was unlikely to be a major cause of deforestation because it was largely in form of twigs rather than logs. Therefore, rural people were indulging more in lopping branches rather than logging trees to meet their fuel needs

Source: *The Citizen's Fifth Report*, Centre for Science & Environment.

Fuel wood use increases **drudgery for women** as considerable amount of their time is spent in collecting it, processing food, cooking and cleaning. Hill women spend more time on these activities than their counterparts in plains. The AME team in Chamba block estimated that women walk anywhere between 1 to 4 kms daily to collect fuel wood.

Lighting

Electricity is the most significant source of lighting. While in the urban areas over 90 per cent have access to electricity, in the rural areas it is just 60 per cent. Amongst other non-renewable energy sources, kerosene is the most popular. Pine wood is also used for domestic lighting and as torches in some interior rural areas.

A study in 20 sample villages of Almora and Pauri-Garhwal districts on infrastructure services including electricity where all the 200 Village Respondents (VRs) were making use of the power facility for domestic purposes only indicated high levels of dissatisfaction.

Only 70 out of 200 VRs expressed their satisfaction with the power facility available at the village level. The remaining 130 VRs (70 of Pauri Garhwal and 60 of Ahnora) reported being dissatisfied with this facility, mainly because of the erratic supply of power and lack of services of linemen.

Reasons for Dissatisfaction of village respondents from existing power facility

Reasons	Pauri Garhwal	Almora	Total
III-equipped poles & Wires	20	15	35
Erratic supply of power	60	50	110
Lack of services of linemen	40	40	80
Frequent breakdown of transformers	15	9	24
Base	70	60	130

Source: *Uttaranchal Infrastructure & Economic Development* by R T Tewari, Rachna Mujoo and Brijesh Tewari.

Table VIII-3 Distribution of households by source of lighting

Source of lighting	Total	%	Rural	%	Urban	%
Electricity	956,995	60.3	602,255	50.3	354,740	90.9
Kerosene	591,090	37.3	558,411	46.7	32,679	8.4
Solar energy	29,726	1.9	29,104	2.4	622	0.2
Other oil	1,049	0.1	812	0.1	237	0.1
Any other	2,709	0.2	2,137	0.2	572	0.1
Total	1,586,321	100.0	1,196,157	100.0	390,164	100.0

Source: Housing Profile, Uttaranchal – compiled from Table H 9, *Census of India 2001*

C. Rural Electrification

As per the latest data, around 12,863 villages of Uttaranchal's 15,664 inhabited villages (around 82 per cent)are electrified. Over 17,000 pumps, almost wholly in the districts of Udhamsingh Nagar, Haridwar and Dehradun, have been energized. Except for some hamlets, the Terai region is largely electrified while only 70 per cent of the hill villages are electrified.

Table VIII-4 Status of village electrification in Uttaranchal, district wise

District	No. of Villages As per 1991 census	No. of Villages Electrified upto 3- 2003	Percentage
Dehradun	763	763	100
Uttarkashi	667	631	94.6
Pauri Garhwal	3216	2433	75.6
Tehri Garhwal	1888	1528	80.9
Chamoli	1105	864	78.1
Rudraprayag	578	425	75.0
Haridwar	498	442	88.4
Nainital	1095	1017	92.8
Udhamsingh Nagar	673	653	97
Almora	2162	1791	82.8
Bageshwar	862	674	78.1
Pithoragarh	1568	1184	75.5
Champawat	649	468	72.1
Total	15664	12863	82.1

Source: Ministry of Power, GoI & UREDA, 2004

D. Electricity Consumption

The per capita power consumption in Uttaranchal is about 404 kWh in the Terai region and 172 kWh in the hill areas, which is one of the lowest in the country (national average being 363 kWh). However it must be recognized that many parts of the hilly terrain have a lower level of electrification, depressing the average. Further, as many of these places enjoy salubrious climate there is no need for cooling in the summer months; fans and desert coolers are an important element of the houses in Terai region. Further power connections need steady incomes to pay the bills, which come more regularly than the power itself, particularly in the hills.

Table VIII-5 Electricity consumption (Million units)

Electricity consumption	1990-91	1991-92	1992-93	1993-94	1999-2000	Latest
Domestic	368.8	326.3	202.6	430.6	794.6	1084.4
Commercial	109.9	162.9	127.0	104.1	182.1	277.98
Industrial	668.9	642.2	715.0	567.3	443.9	546.20
Street lighting	840.8	656.8	205.5	126.8	419.5	
Agriculture	128.9	177.5	173.5	211.4	351.2	577.11
Water works/waste disposal	637.7	697.9	479.0	408.3	125.5	
Total	1348.9	1377.4	1287.2	1367.0	1939.4	2465.33

Source: Data for 1990-94 is taken from *Uttarakhand Update* and is for the nine districts of UP forming part of Garhwal and Kumaon division. The latest figures are for Uttaranchal state as a whole.

Energy: The critical need for water supply

The abundant water resources in the state, both surface and groundwater, are often not reachable to the people in need because of lack of energy. In the city of Dehradun, which is largely supplied by groundwater, the summer months face water crisis because there are power breakdowns. The power breakdowns are aggravated by the cannibalisation of pumping equipment because of a lack of a proper system of maintenance and renovation. Further the Jal Sansthan, because of their poor revenue recovery have been habitually defaulting on electricity payments, and as bad clients are unable to press for better services during the summer months.

In the rural areas where sources for gravity-fed systems do not exist or are insufficient, reliable power supply and the high costs of water delivered hinder development of effective water supply schemes.

In the Doon Valley and Plains it would be ideal to establish captive power systems for tube-wells using biomass gasifiers fed by sugarcane wastes. Solar pumps are also a good option even if capital costs are high. While in the hilly terrains solar pumps and wind-pumps may offer more permanent solutions through effective utilisation of valley winds. However, very little research efforts have been done so far on these alternatives.

E. Renewable Energy Potential and Utilization

With the formation of Uttaranchal, Uttaranchal Renewable Energy Development Agency (UREDA) has been nominated as the nodal agency to carry out works in the non-conventional source of energy. The vision of UREDA for implementing such programmes in the state includes:

- Large scale generation of energy though non-conventional energy sources in the private and public sectors.
- To determine non-conventional energy systems for creating mass awareness.
- Harnessing solar energy, bio-energy, and hydro energy and wind energy through standardization of energy systems and devices and their decentralized extension.
- To take up energy conservation programmes
- To promote the sale of non-conventional energy systems.
- Electrification of remote villages through solar, hydro, biomass and wind energy.

Using solar, biomass and microhydel systems, UREDA has electrified around 1200 villages which cannot be reached by the grid systems without incurring very huge financial and environmental costs. In view of the commitment by the GoI, MoP, MNES, to electrify all the villages by the end of year 2007, UREDA proposes to electrify nearly 700 villages through solar and the rest through micro-hydels.

Though UREDA, as per its mandate, has been focusing on the non-conventional sources of energy, it has not seen great success. The methodology has not been worked out at the community level and the remoteness of the villages and the small size of the local market for electricity is not attracting commercial interests.

Table VIII-6 Status of renewable energy

Total No.	Solar Cooker	Solar Water Heater System (Installed Capacity)	Solar Home Light System	Solar Lantern	Solar Power Plants	Small Hydro Power Projects	
Upto 9th Plan	7075	267500	30389	26555	17 till 1993-94	29 projects of total 2.08 MW capacity	14 projects under implementation
2001-02	126	10000	2000	6500 (target)			
Total	7071	277500	32389	26555			

Source: compiled from Ninth Plan document and UREDA, 2001

The state has nearly 3000 biogas plants and has great scope for increasing its use. In terms of wind technology, 11 wind masts were installed in the previous year for monitoring wind velocities. One site at Bachelikhal in Tehri Garhwal has been suitable for wind power generation, and a wind farm has been proposed here as part of the 10th Plan. While the state is very keen to exploit its renewable sources of energy not only because of the inherent advantages of these sources but also because these are the only sources which will enable last mile access and help in reaching remote areas where the grid is unreachable, the actual outlays when compared with those for large power projects are very low. For promotion of renewable energy, the Uttaranchal government has proposed an outlay of Rs 115 crores in the 10th Plan period, which is almost twice the outlay during 9th Plan, while for the large scale conventional power development the outlay is nearly Rs 2300 crores amounting to 25 per cent of the entire plan funds.

F. Hydro Power Development and its Implications

In our nation's never ending quest for power, hydropower development in Uttaranchal is seen as a national endeavor rather than as an issue concerning the state and its people. The water resources of the region has always attracted attention for power generation and with the growth of technology the scale of the projects have reached enormous proportions threatening the entire social and ecological systems where they are commissioned.

Table VIII-7 Existing electricity generation capacity in Uttaranchal

Stations	Capacity (MW[1])	Year of Commissioning	Type of Scheme	Generation	
				Estimated MUs[2]	**Projected MUs**

Stations	Capacity (MW[1])	Year of Commissioning	Type of Scheme	Generation	
				Estimated MUs[2]	Projected MUs
Dhakrani	34	1965	ROR[3]	115	160
Dholipur	51	1965	ROR	194	243
Chhibro	240	1975	ROR	742	805
Khodri	120	1984	ROR	358	369
Kulhal	30	1975	ROR	125	155
Ramganga (Kalagarh)	198	1975	Reservoir	273	310
Chilla	144	1980	ROR	560	538
Maneri Bhali - I	90	1984	ROR	372	388
Khatima	41	1956	ROR	172	175
GangaCanal + Galogi	30	1955	ROR	127	119
Total Major Hydel Projects	978			3,038	3,263
Micro Hydel Projects	16			30	33
Total UJVNL[4] *	994			3,068	3,296

* - Excluding Tanakpur project of 120 MW, the generation details of which were not available

1 Megawatts 2 Million Units 3 Run-of-the-river 4 Uttaranchal Jal Vidyut Nigam Limited

Source: Ministry of Power, GoI, 2004

The potential for hydro power in the region for generating electricity was identified as early as the beginning of the 20th century, when the first ever hydel power plant was installed at Galogi near Mussoorie in 1914. Later on micro hydropower plants were installed at Nainital in 1930 and at Almora and Haldwani. Post independence, the initial thrust was on irrigation but the Chinese War (1962) and the rise in oil prices in 1973 provided an impetus to power projects. *Yamuna stage I* with Dhakrani (33.75

***Gharats*: an eco-friendly source for power generation**

People in the past realized the natural potential of the gushing streams and utilized its potential in very many ways. The traditional Himalayan water mill or the *gharat* is of the vertical shaft type. The *gharats* in Uttaranchal can be found alongside the rivers. Grain milling is the most widespread use, while oil-expelling and powering looms for weaving were also in practice. Today, despite many watermills being operational in various places diesel and electric powered mills have come up. These mills located at places where people need to pass through, such as the road-head, gives them a locational advantage as compared to the gharat for which the individual has to make an exclusive trip to the gharat site.

In recent times, there have been several efforts to upgrade the traditional *gharat* technology so as to use it for power generation. It is estimated that are as many as 60,000 *gharats* in Uttaranchal (HESCO). Each can produce on the average about 1.5 KW power, which can be increased up to 5 KW per *gharat* with technical inputs. If all of them were to be put to such use, this could give 300 MW of disbursed power supply. The State has launched a programme and the water mill owners associations formed over the last decade are also taking keen interest in its revival.

MW) and Dhalipur (51 MW) power plants were followed by *Yamuna stage II*, part I and II having an installed capacity of 360 MW and *Yamuna stage IV*, part I and II having a total installed capacity of 102 MW. Similarly, on the river Ganga, *Maneri Bhalli stage I* in Uttarkashi having installed capacity of 90 MW and *Chilla* with installed capacity of 144 MW in Rishikesh were commissioned in 1985. Another landmark was the construction of Kalagarh dam – a storage project having installed capacity of 198 MW - on river Ramganga in Kumaon District. This was commissioned in 1975.

Studies by both Central as well as state Government agencies, including the Central Electricity Agency (CEA), have identified the state's total hydro potential at close to 15000 MW of which only 1100 MW (7 per cent of potential) are operational and about 4200 MW (28 per cent of potential) are under development by the state, Central and private sectors. This leaves almost two-thirds of the potential still to be developed. The per capita power consumption at about 217 KW per annum is one of the lowest in the country.

Government Vs people's view

Power shortages in the country present a scenario wherein Uttaranchal can market itself as an 'Urja Pradesh'. The identified potential is 15031.56 MW constituted by 157 projects sites. The Uttaranchal government's goal is to develop 10000 MW in 20-26 years ie 400-500 MW per year.

Hydro power is a relatively cheap source of electricity generation if the real costs to people and environment were treated as externalities, making it attractive to sell cheap power to other states and become a major supplier of low cost power to the power starved Northern grid. This would allow the state to earn substantial revenues through royalties and project allotment premiums.

The views held by the civil society are diametrically opposed to the government. The civil society would rather see Uttaranchal's selling points as being its ecological and natural beauty. Secondly, there are concerns that large dams will become a norm for achieving the dream of becoming a 'Urja Pradesh' and there will be more Tehri's in Uttaranchal. The State's emphasis on large dams could potentially lead to near total alienation of local communities and conflicts in the state.

Most of the existing hydropower facilities are run-of-river (ROR), accounting for 80 per cent of available capacity. Though such systems have a high rate of spillage (amounting to almost one-fourth in some years), installing more storage plants would be relatively more expensive and environmentally sensitive. Therefore ROR projects (albeit with sufficient pondage to be used for daily peaking) represent the least-cost development plan for the time being.

Currently the Uttaranchal government appears to be keen to exploit its water resources for generation of electricity. While the high cost and long gestation period for hydel plants precluded the development of any new big projects in the last 15 years, a total of 3003 MW capacity plants are under construction. Construction is being carried out on Tehri Stage I and II projects (2000 MW), the Independent Power Producers (IPPs) at Srinagar (330 MW) and Vishnuprayag (400 MW) and about a dozen other small hydro projects. The only reason for active promotion of these projects is the fact that as the host state Uttaranchal will get 12 per cent of power produced as royalty. While the need for financial resources is evident, the lessons from world over on large dams and river valley projects indicate the immense harm it causes locally. Therefore without the direct need for power within the state, large scale power development will foreclose several other possibilities as most of these areas have still not been fully explored for their biological and mineral potential.

While it was not a practice to conduct Environmental Impact Assessments (EIAs) when the early hydro projects were commissioned, the impact of dams cuts across many sectors. For example, almost all hydro power plants except Ramganga project have been run-of-the-river projects involving some pondage, and thus loss of agricultural land and displacement have been less severe than in the case of Tehri project. However, forest land data reveals that nearly 5086 ha of forest land has been transferred for hydro power projects after the enactment of Forest Conservation Act in 1980. This is nearly 25 per cent of the total forest land diverted since 1981-82 and second only to diversion for mining projects (approx. 8358 ha). Thus hydel projects have been a major source of deforestation in Uttaranchal. This figure when looked at in conjunction with the hydro projects commissioned in Uttaranchal shows that only three projects have been commissioned in 1980s totaling 254 MW. One of these was commissioned in 1980 when the Forest Conservation Act was enacted. While no projects have been commissioned after 1984, maximum forest land transfer has taken place after 1984 for projects which are currently under construction.

Table VIII-8 Forest land transferred after Forest Conservation Act 1980

Decade	Area (in Ha)
1981-90	4594
1991-00	464
Post 2000	29

Source: State Forestry Statistics, GoUA, 2001

Table VIII-9 Projects under construction

Name of Project	Capacity	Agency	Info Sources	Comm Date	River
Katapathar	19	State Sec	Annexure-IV, CEA	2005-06	Yamuna
Tehri St- I	1000	THDC	Annexure-IV, CEA	2003	Bhagirathi
Tehri Pump Storage	1000	THDC	TOI-D, 23/12/01	NA	Bhagirathi
Maneri Bhali St- II	304	UHPC	TOI-D, 23/12/01	2003-05	Bhagirathi
Dhauli Ganga St- I	280	NHPC	NHPC Brochure	2005	Dhauliganga
Koteswar	400	THDC	Annexure-IV, CEA	NA	Bhagirathi

Source: compiled from CEA and UJVN Ltd

G. *The Way Forward*

Uttaranchal is endowed with natural resources that are suitable for energy generation. However, unplanned and insensitive exploitation of these resources can have serious implications for the eco-system of Uttaranchal. It is therefore imperative that an energy

The price of power: lessons from the Tehri Dam project

The Tehri dam, in the catchment of river Ganga, a little downstream of the confluence of Bhaghirathi and Bhilanganga rivers, on which work started in 1978, has been envisaged as generating 2000 MW electricity besides irrigating 270,000 ha of land and providing drinking water to Delhi. The dam is designed to be 260.5 m high, and is estimated to cover 5170.21 ha. It will have a storage capacity of 4345.44 million m3.

The dam, once completed, is expected to submerge everything below the critical 840.m level upstream, including the Tehri town, the ancient capital of the region. In addition to this historic town, the Hanumantha Rao Committee report pegs the total number of fully affected villages at 35 and partially affected villages at 74. 14,198 families are expected to be affection, of which 10,200 will be totally affected. There have been serious concerns about the resettlement and rehabilitation of these families.

The reservoir is also expected to have critical impact on the land around the reservoir rim. Environmentalists believe that the introduction of the huge reservoir will cause a rise in the groundwater table, and disturb the balance between soil, water and plants. The natural salt distribution in the soil would also be affected having an impact on the both biomass productivity and agricultural productivity. Incidences of water borne diseases are also expected to go up due increased humidity and impounding of water.

GIS and remote sensing based study of the reservoir induced land use changes in the catchment of Tehri dam done by Indian Institute of Remote Sensing shows that a total of 6034 ha of prime agricultural land will be affected by project. In addition, the Tehri reservoir would affect 3663 ha of mixed and open forests with 2990 ha falling in the buffer zone of 500 m. The Hanumanth Rao Committee report talks of submergence of 2582.9 ha of forest land.

development strategy be adopted that is sustainable and supports the requirements of the state and its people.

The terrain, the cultural diversity and the resources within the state make it necessary to evolve a variety of options through participatory planning and implementation to meet the energy needs of the populace. Two main pillars for energy planning in state should be:

- Decentralisation in terms of planning and implementation of resource exploiltation and technology
- People's participation by way tripartite partnership involving community, private and public sector

The parameters that should govern energy planning in the state are:

1. Clearly, large hydro projects have no future in Uttaranchal because of their ecological impacts and geological sensitivity of the region. This is not to suggest that Uttaranchal should not exploit its resources but it is to underline the importance of doing so at least cost to environment, ecology and the community. Run-of-the-river, small and mini hydel projects are undoubtedly the options that Uttaranchal should develop. *Gharats* present themselves as an alternate which if supported through right policy interventions can reach distant hamlets. Similarly, renewable energy technologies should be exploited further. Bagassse based cogeneneration should be exploited in Terai belt, while solar and hydel should be the main sources of energy in remote rural areas.

2. Decentralised planning with people's involvement is going to be the key to balancing the extent of resource exploitation with the needs of people of Uttaranchal. The people of Uttaranchal have a grudge that the state's resources have been exploited to meet the needs of people outside the state and at a cost to Uttaranchal's own population! This was voiced in the stakeholder consultations that were held during the course of the assignment. Decentralised planning and greater involvement of people can to a great extent address this grouse and lead to sustainable development of the state.
3. The electricity currently generated in the state is sufficient to meet the requirements of its people. However, there are still problems in terms of reach of the network, quantity and quality of electricity being supplied. There are still 2000 odd villages without electricity in Uttaranchal, the number of unelectrified households and hamlets could be much larger. The state should focus on improving the performance of its existing network and achieving full electrification rather than focusing on creating additional generating capacity for exporting to other states, which would only benefit the state by way of 12 per cent power as royalty.
4. Fuelwood is more important in meeting the energy needs of people than even electricity. Even though the blame of forest depletion on fuelwood collection is unfounded, it still calls for energy planning at the village level to sustainably meet the energy needs of people. Energy plantations, strengthening Van Panchayats, use of improved cook stoves, which are energy efficient, etc., are some of the options that should be explored in the State.

Annex VIII-1 Districtwise Consumption of Electricity for Different Purposes (000 KW/HOURS, 1993-94)

District	Domestic	Commercial	Industrial	Public Lighting	Agriculture	Public	Total
Garhwal region							
Uttarkashi	8,794	388	726	82	919	--	10,909
Chamoli	5,146	3,390	3,610	54	706	--	12,906
Tehri	10,365	10,067	26,340	130	550	7,647	55,099
Garhwal	3,115	4,424	1,010	901	10	6,665	16,125
Dehradun	48,392	18,298	2,24,965	3,772	20,392	4,629	3,20,448
Subtotal	1,03,852	36,567	2,56,651	4,939	22,577	18,941	4,43,527
Kumaon region							
Pithoragarh	16,360	2,476	3,116	--	334	7,143	29,429
Almora	2,31,780	8,816	5,225	103	887	2,435	2,49,246
Nainital	78,644	56,306	3,72,357	7,643	1,87,631	12,311	7,14,892
Subtotal	3,26,784	67,598	3,10,698	7,746	1,88,852	21,889	9,23,567
Total	4,30,636	1,04,165	5,67,349	12,685	2,11,429	40,830	13,67,094

Source: *Uttarakhand Update: A Statistical Profile for Development Planning* by A Joshi, PS Garia and I Hasnain

Annex VIII-2 Districtwise Electrified Villages and Harijan Basties, 1993-94

District	Electrified Villages		Harijan Basti	Electrified Pumps Sets/ Tube Wells
	According to CEA Definition	In which LT Mains are Laid		
Garhwal region				
Uttarkashi	866	561	10	515
Chamoli	1,155	1,145	2	724
Tehri	1,372	1,360	10	1,031
Garhwal	2,037	2,014	19	1,262
Dehradun	693	685	459	638
Subtotal	6,123	5,765	500	4,170
Kumaon region				
Pithoragarh	1,450	1,450	0	1,075
Almora	2,200	2,208	40	1,623
Nainital	1,633	1,628	7,738	1,133
Subtotal	5,283	5,286	7,778	3,831
Total	11,406	11,051	8,278	8,001

Source: *Uttarakhand Update: A Statistical Profile for Development Planning* by A Joshi, PS Garia and I Hasnain

Annex VIII-3 Projects under planning

Name of Project	Capacity	Agency	Info Sources	Comm Date	River
Pala-Maneri	416	UHPC	TOI-D, 23/12/01/ R Sahara- 13/01/02, TOI-110902	NA	Bhagirathi
Loharinag-Pala	520	THDC	TOI-D, 23/12/01, TOI-D 11/09/02	NA	Bhagirathi
Bharon Ghati- II	240	UHPC	TOI-D, 23/12/01	NA	Bhagirathi
Bharon Ghati- I	324	UHPC	TOI-D, 23/12/01	NA	Bhagirathi
Lakhwar Vyasi	420	UPHC	Annexure- IV, CEA	10th Plan	Yamuna
Srinagar (Duncans Group)	330	Private Sec	Annexure- IV, CEA	2005-06	Alaknanda
Tapovan Vishnugad	360		SANDRP Database	NA	NA
Tiuni Plasu	42	UPHC	POP, PPS, P-43	NA	NA
Kishau Dam	600	UPHC	TO-D, 23/12/01	NA	Yamuna
Vishnu Prayag (JP Group)	400	Private Sec.	Annexure- IV, CEA	10th Plan	Alaknanda
Arakot Tiuni	70	UHPC	TOI-D 110902	NA	Pabar/Yamuna
G Ganga	70	NHPC	POP, PPS, P-43	11th Plan	NA/Gauri Ganga?

(POP, PPS: Power on Demand By 2012 Perspective Plan Studies, CEA, New Delhi, July 1999.TOI-D : Times of India, Delhi)

Projects under survey and investigation

Name of Project	Capacity	Name of River	Categorised by CEA
Sirkari Bhyol Bogud	240	Sarda	B
Benakuli	40	Alaknanda	A
Tapovan Chunar	485	Dhauliganga	A
Lata Tapovan	320	Dhauliganga	A
Bowala Nand Prayag	132	Alaknanda	A
Vishnugad Pipalkoti	360	Alaknanda	A
Bhela Tipri	100	Bhagirathi	A
Bhariron Ghati	60	Bhagirathi	A
Naitwar Mori	70	Yamuna	A
Sankri- Kunari	33	Yamuna	A
Pishanaitwar	30	Yamuna	A
Ugmir	28	Yamuna	A
Diulong-Sumangaor	26	Bhilangana	A
Tiuni	42	Yamuna	A
Kuwa Ford	42	Yamuna	B
Badri Nath	260	Alaknanda	B
Lohari Nag Tharang	520	Bhagirathi	B
Girthi Ganga	34	Grithi Ganga	B
Malkhet Dam	37	Yamuna	B
Sela Urthing	165	Sarda	B
Khet Tawaghat	225	Sarda	B
Mapang Bogudyar	185	Sarda	B
Kotlibhel	1000	Bhagirathi	B
Mandakini	36	Mandakini	B
Sobala Jhimrigoan	145	Sarda	B
Tamak Lata	200	Dhauliganga	B
Urthing Sobala	340	Sarda	B
Nakot Patlasu	43	Yamuna	B
Banoli Nalgam	55	Pindar	B
Dhargoan-Jandarwa	29	Bhilangana	B
Kalika Dantu	140	Sarda	B
Tokh Gurupa	26	Pindar	B
Gangotri	70	Bhagirathi	B
Jamolna-	44	Bhilangana	B

Ghanshyali			
Karmali	190	Jadh Ganga	B
Niti Ganshali	32	Dhauliganga	B
Taluka-Saul	39	Yamuna	B
Devi Bagar	40	Sarda	B
Khartoli			
Jalem Tamak	150	Dhaulliganga	B
Garjia Dam	295	Sarda	B
Tawaghat	310	Sarda	B
Dharchula			
Gohana Tal	95	Bhagirathi	B
Garba Tawaghat	195	Sarda	B
Utyasu	1140	Alaknanda	B
Khasiyabara	280	Sarda	B
Sirkari Bhyol	145	Sarda	B
Rus Ba			
Malari Jhelum	90	Dhaulliganga	B
Jadh Ganga	110	Jadh Ganga	B
Rishi Ganga-I	115	Rishi Ganga	B
Deodi	65	Rishi Ganga	B
Ramganga Dam	75	Sarda	B
Bokang Bailang	145	Sarda	B
Pala Bhila Tipri	400	Bhagirathi	B
Nayar Dam	34	Nayar	B
Khel Kuran neti	49	Dhaulliganga	B
Bampa Kurkuti	60	Dhaulliganga	B
Rishi Ganga II	65	Rishi Ganga	B
Chhanger Chal	145	Sarda	B
Devasari Dam	78	Pindar	B
Nelang	190	Jadh Ganga	B
Harsil Dam	350	Bhagirathi	B
Khartoli Lumti	105	Sarda	B
Talli			
Nand Prayag	180	Alaknanda	B
Langa			

Ranking Studies

IX. URBANISATION

Urbanisation in Uttaranchal, as with several other regions has not been a planned effort incorporating the physical conditions and social concerns of the region. Initial urban processes were centreed around the pilgrim towns and later the routes, apart from administrative and cantonment towns of the kings and later colonial rulers. Thus even in the hill districts it was more of a regional phenomenon, where rural market centres, road-junctions, administrative towns grew with centralisation of facilities. Most of the urban centres are small, nearly half of them have a population less than 10,000. They are mostly in the transitional phase of their development. Based on the existing norms, thirteen small towns (<5000 population) have already attained the status of 'nagar palikas'.

A. Urbanisation in Uttaranchal

According to the 2001 census, around 25.70 per cent of the total population of 84.89 lakhs lives in urban areas.

Figure IX-1 Urban centres in Uttaranchal

Table IX-1 Proportion of urban population in Uttaranchal

Name	1981 census	1991 census	2001 census
Uttarkashi	6.96	7.2	7.8
Chamoli	7.9	8.91	13.7
Rudraprayag *			1.2
Tehri Garhwal	4.71	5.67	9.9
Garhwal	10.43	11.89	12.9
Almora	5.99	6.8	8.6
Bageshwar*			3.1
Pithoragarh	5.64	7.44	12.9
Champawat*			15.0
Nainital	27.7	32.66	35.3
Dehradun	49.21	50.27	52.9
Udhamsingh Nagar *			32.6
Haridwar		30.9	30.8
Total		23.2%	25.7%

Note: 1981 data excludes figures for Haridwar. Rudraprayag, Bageshwar, Champawat and Udhamsingh Nagar are the new districts carved out of their parents districts namely, Chamoli, Almora, Pithoragarh and Nainital
Source: *Census of India,* 1981, 1991, 2001 & CMAU

Urbanisation is mostly a phenomenon in the plains as can be seen from the fact that almost 80 per cent of the urban population is in the settlements in the plains, foothills or the Doon Valley, while in the hilly terrain the total urban population is less than 20 per cent. Further this tendency is on the rise.

In contrast to the low rural population density the urban density of population is very high, inflicting heavy pressures on the environment. Dehradun, Nainital, Udhamsinghsingh Nagar and Haridwar districts have the highest proportion of urban population.

To fully understand the implications of urbanisation in the state, it is necessary to understand the level of urbanisation (based on 2001 census) in the thirteen districts as belonging to three categories:

1. The high mountain region comprising of major portions of Uttarkashi, Champawat, Pithoragarh, Chamoli and Rudraprayag; this accounts for 19 per cent of the total population and 8 per cent of the urban population

2. The mid-mountain region comprising of major areas in Garhwal, Tehri Garhwal, Almora and Bageshwar, accounting for 26 per cent of the total population and 10 per cent of the urban population, and

3. The Doon and Terai region comprising of the lower foothills and undulating plains of Dehradun, Nainital and Udhamsingh Nagar which accounts for 26 per cent of the total population and 82 per cent of the urban population.

B. Urban Centres

According to the conceptual framework used in the case of Uttaranchal in the census of 1991, a place is counted as an urban centre when it has either been notified by the government as a *notified statutory area* or has a minimum population of 5000 with a density of more than 400 people per sq. km., and where more than 75 per cent of the male workers are engaged in non-agricultural work. Thus, in Uttaranchal, where the population density can be quite low, places that are actually functioning like urban centres in the mid-mountain areas, where there are motorable roads, are often not identified as such, and are clubbed together with adjoining revenue villages. For example, in the Chakrata Block, the 1991 census showed only one urban centre. However, a 1996 survey showed that nine such centres have come up along motorable roads, which are not being counted as urban centres. The same is happening all over the state.

Table IX-2 Number of urban centres

Name	1981 census	1991 census	2001 census
Uttarkashi	3	3	3
Chamoli	8	8	6
Rudraprayag			2
Tehri Garhwal	5	5	6
Dehradun	10	17	7
Garhwal	7	7	4
Pithoragarh	5	5	3
Bageshwar			1
Almora	5	5	2
Champawat			3
Nainital	18	25	7
Udhamsingh Nagar			14
Haridwar			5
Total	61	75	63

Source: *Census of India* and data from ULBs

Dehradun city is the earliest urban centre in the state, having been established in 1827, and is thus one of the most urbanised districts in the country. Haldwani, Kashipur, Rishikesh, and Rudrapur, have shown fairly high growth rates in the post-independence period, while Jaspur, Ramnagar and Nainital have shown lower growth rates. Towns in Udhamsingh Nagar such as Kashipur, Rudrapur, Ramnagar and Jaspur and those in Haridwar such as Haridwar itself, Roorkee are predicted to have rapidly rising growth rates in the current thrust for industrialisation. This will create more pressures on services and urban expansion, leading to pressures on the environment.

The other district headquarters and small towns are seen to rarely perform the central functions that define urban centres. They neither provide the specialised services and commercial goods that urban centres do to more isolated villages, nor do they act as marketing centres for local produce. However certain towns in the hills act as transit junctions for the movement of goods to upper reaches.

The skewed picture of urbanisation in Uttaranchal, especially the lack of notification of many defacto centres as such, hides the gradual changes in landuse pattern from cultivation to construction in places which are technically villages and counted as rural areas for census purposes. For instance, more than 50 per cent of urban settlements are

situated within combinations of less than 6 sq. km urban area, and less than 15,000 population. The majority, which lie in the Doon and Terai regions, cross both these limits as well as those of 20 sq. km. and population between 40 and 50 thousand, and do not in any case, include fringe villages.

The net result of such unplanned growth of urban centres is that both forest land and agricultural land in the adjoining revenue villages are being encroached upon.

Consistent ecological devastation causes landslides in Himalayan pilgrim town

Uttarkashi has seen unrestricted and unsustainable growth and development. Nature does not let such trespassing go unnoticed. Since the night of September 24, 2003, Uttarkashi has witnessed an uninterrupted flow of debris down the Varunavat Mountain. Though no loss of life has been reported, property worth Rs 10 crore lies buried under the debris. While the residents see the present calamity as a sequel to the 12-year cycle of natural disasters that have struck the town, the last being the 1991 earthquake, scientific teams from the Dehra Dun-based Wadia Institute of Himalayan Geology, the Roorkee-based Central Building Research Institute and the Delhi-based Department of Science and Technology have failed to unfold the mystery behind the flow of rocks, boulders and mud.

A news report in the Hindi daily *Amar Ujala*, on August 9, 2003, clearly predicted the landslide. Watching the dusty haze that hangs over the city from his window, senior correspondent Raturi laments the neglect of his repeated warnings, ever since the earthquake caused wide cracks on the mountaintop. "I even gave photo-evidence of such cracks in my reports," he stresses.

Not only were the news reports ignored, technical reports submitted to the government, following the 1991 earthquake, have been gathering dust too. This may indeed be a case of criminal neglect given the fact that the newly formed Uttaranchal is the only state in the country with a full-fledged ministry of disaster management. Given the fact that landslides occur with increasing frequency on the fragile slopes, the government's so-called preparedness to meet such disasters lies exposed.

According to distinguished mountaineer and Arjuna awardee Harshsvanti Bisht: "The manner in which the town has grown following the devastating earthquake, without any consideration to ecological principles, defies logic." Discounting the vulnerability of the slopes, the administration leased land at throwaway prices at the foot of the mountain. It overlooked a public interest case filed by local lawyer Budhi Singh Panwar against the allotments.

Most of the multi-storeyed structures built along the four-kilometre-long stretch of highway now lie buried under the debris. Expectedly, the small strip of allotted land had been illegally expanded by `toe-cutting' into the mountain. Nature has not let such trespass go unnoticed.

The conversion of a small hamlet that serviced pilgrims on their spiritual sojourn to Gangotri into a district headquarters has indeed stretched its carrying capacity. With steep slopes of over 60-70%, the Varunavat mountain stands precariously over the town. According to geologists, the mountain consists of loosely held waste material left behind by melting glaciers hundreds of thousands of years ago. According to one school of thought, the seepage of water through wide cracks on the mountaintop may have triggered the landslide. A trek to the top of the mountain clearly indicates that the erstwhile oak forests that once held the loose soil together have been systematically replaced with pine plantations. The movement of debris along three distinct gorges in the mountain is increasing every day, depositing as much as 50-60,000 cubic metres of material on the slopes

Source: Dr Sudhirendar Sharma (InfoChange News & Features, October 2003)

C. Housing

The traditional houses in Uttaranchal are most appropriate for the local climatic conditions. These houses are built using technologies that depend upon the locally available skills and materials. Stone wall and slate roof with mud or cement floor used to be the predominant building materials used in the hills while mud and brick walls, with variety of roofing materials and mud floors used to be the common materials in the plains. Stringent restrictions on prime local construction materials such as timber and slate has forced local communities to find alternatives and this is leading to a gradual elimination of local building materials and technologies, and adoption of non-local technologies. The use of RCC roofs has increased to the extent that nearly a third of the houses in Uttaranchal today have RCC roofs.

Table IX-3 Distribution of households : predominant material of roof

	Material of roof	Total	%	Rural	%	Urban	%
1.	Grass, thatch, bamboo, wood, mud, etc	141,704	8.9	122,934	10.3	18,770	4.8
2.	Plastic, polythene	9,193	0.8	4,077	0.3	5,116	1.3
3.	Tiles	20,465	1.3	17,788	1.5	2.677	0.7
4.	Slate	254,063	16	250,619	21.0	3,444	0.9
5.	G.I. Metal Asbestos sheets	126,509	8.0	70,449	5.8	56,060	14.4
6.	Brick	285,890	18.0	179,822	15.0	106,068	27.2
7.	Stone	255,625	16.1	251,755	21.0	3,870	1.0
8.	Concrete	487,121	30.7	294,639	24.6	192,482	49.3
9.	Any other material	5,761	0.4	4,074	0.3	1,677	0.4
10.	Total	1,586,321	100	1,196,157	100	390,164	100

Source: Table H-3a (Appendix) India: *Census of India 2001*

Table IX-4 Distribution of households by predominant material of wall

	Material of wall	Total	%	Rural	%	Urban	%
1.	Grass, thatch, bamboo, etc.	49,599	3.1	42,307	3.5	7,292	1.9
2.	Plastic, polythene	2,270	0.1	1,346	0.1	924	0.2
3.	Mud, unburnt brick	110,099	6.9	90,502	7.6	19,597	5.0
4.	Wood	14,924	0.9	11,440	1.0	3,484	0.9
5.	GI Metal Asbestos sheet	9,985	0.6	4,510	0.4	5,475	1.4
6.	Burnt brick	681,482	43.0	360,498	30.1	320,984	82.3
7.	Stone	703,322	44.3	676,451	56.6	26,871	6.9
8.	Concrete	14,183	0.9	8,768	0.7	5,415	1.4
9.	Any other material	457	0.0	335	0.0	122	0.0
10.	Total	1,586,321	100	1,196,157	100	390,164	100

Source: Table H-3b (Appendix) India: Census of India 2001

Table IX-5 Distribution of households by predominant material of floor

	Material of floor	Total	%	Rural	%	Urban	%
1.	Mud	873,720	55.1	85,806	68.2	57,914	14.8
2.	Wood, bamboo	36,225	2.3	34,978	2.9	1,247	0.3
3.	Brick	18,863	1.2	10,716	0.9	8,147	2.1
4.	Stone	33,336	2.1	29,779	2.5	3,557	0.9
5.	Cement	568,911	35.9	292,486	24.5	276,425	70.8
6.	Mosaic, floor tiles	53,296	3.4	10,810	0.9	42,486	10.9
7.	Any other material	1,970	0.1	1,582	0.1	388	0.1
8.	Total	1,586,321	100	1,196,157	100	390,164	100

Source: Table H-3c (Appendix) India: *Census of India 2001*

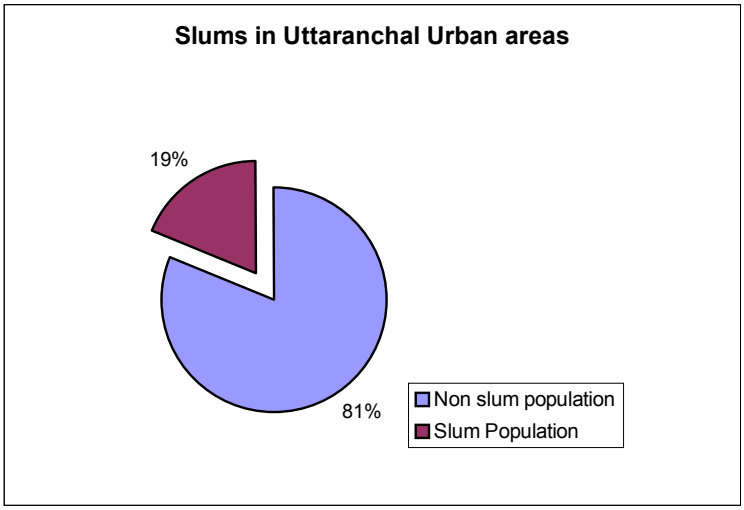
D. Urban Slums

One of the major issues associated with urbanisation is the development of slums. Statistics on six urban centres in Uttaranchal indicate the slum populations of about 20 per cent. Further an analysis of the literacy levels indicates that over 50per cent of the slum populations are literate that indicates a surplus economic potential that exists and also points to the inadequacy of the urban agglomeration to provide adequate formal housing facilities.

Table IX-6 Characteristics of slums in Uttaranchal

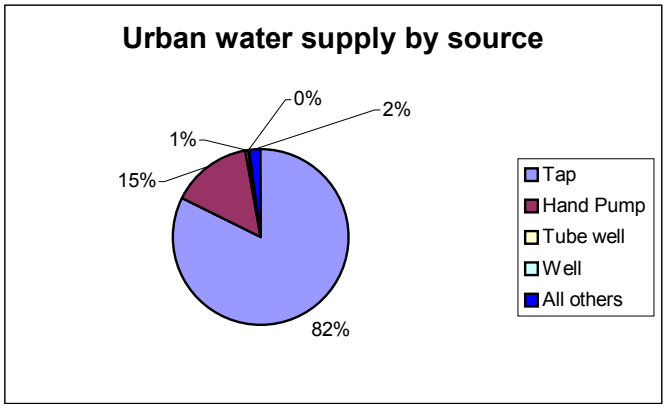
	Pucca	Semi Pucca	Kuccha
Uttarkashi	89.3	9.8	0.9
Chamoli	90.46	8.12	1.42
Tehri Garhwal	92.07	5.68	2.25
Dehradun	88.64	8.99	2.38
Garhwal	90.95	5.16	3.88
Pithoragarh	94.98	3.27	1.75
Almora	91.7	7.99	0.31
Nainital	76.42	8.2	15.3
Haridwar	84.45	6.24	9.31

Figure IX-2 Slums in Uttaranchal



E. Water Supply and Sanitation

Figure IX-3 Urban water supply



Based on the census figures, it would appear that the access to drinking water in urban areas (as compared to rural areas) is quite high. In urban areas, over 80 per cent of the households appear to have access to drinking water from taps and also have access to sewerage connection at their residence. However, these figures are based on census figures, which merely indicate sources and not the frequency and quantum of water availability. If the sewerage network proposed by the 10th Five Year Plan is put in place, the need for water will increase tremendously.

The consequences of the lack of adequate water supply are known: bad health and high mortality rates due to diarrhea, cholera, typhoid and other diseases, especially among vulnerable groups like women and children. As in other parts of the country, urban centres in Uttaranchal are also facing declining supplies of water.

Sanitation Problem in Mountain Towns

The septic tank system is the widely existing technology for sanitation in the hill towns. This has severe implications to water resources downstream. Since the supply is often from different sources at various levels of the town, the seepage from septic tanks into the spring systems downstream has been a nagging phenomenon in many towns. The town of Gopeshwar is a classic case. Unless significant efforts at technology development and adaptation takes place, the problems of vomiting as well as diarrhea which explodes in late summer and early monsoons cannot be easily contained.

A major aspect of the sanitation in most smaller urban areas is the predominance of old septic tank systems that are not well maintained resulting in significant levels of ground water contamination.

In Dehradun, in 1996, consumers were willing to pay more than twice the prevailing tariff (average households were willing to pay up to Rs 4.50 per cubic metre for a continuous water supply as compared to the prevailing rate of Rs 2.00 per cubic metre for the existing intermittent supply). What is more, the study revealed that, on average, households were already paying up to Rs 10 per cubic metre in ‚coping costs™ arising from the irregularity and unreliability of the supply.

Source: WSP Field Note “Willing to Pay but Unwilling to Charge”

A study done by Development Alternatives of drinking water in major cities in India indicates that the drinking water supply in Dehradun and Ranikhet has problems associated with hardness and ammonia. In Ranikhet, ammonia was present in all the 13

sites monitored in the town (which included groundwater and municipal sources), while in Dehradun, ammonia as well as hardness is a problem. Hardness, can be attributed to high mineral content, but ammonia in drinking water and groundwater can likely be traced to sewage contamination and mixing of high organic content waste streams (after degradation) with the water supply lines as well as groundwater contamination. The absence of a coliform problem might also be on account of the relatively smaller pollution load compared to other cities in the figures.

It would thus appear that while the statistics indicate reasonable access, there are significant environmental and health issues associated with the water and sanitation in urban areas in Uttaranchal. However with marginally lower urbanisation compared to the plain states, Uttaranchal should consider action before the problem becomes un-manageable.

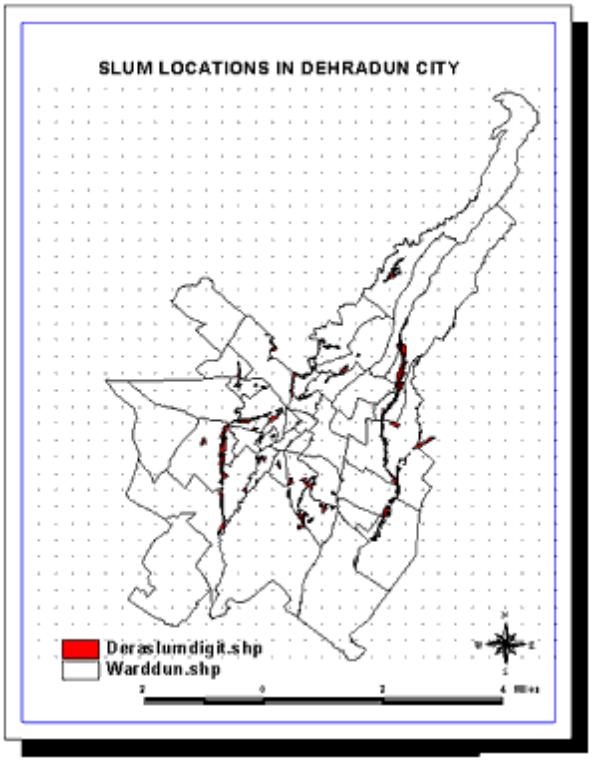
Study on slums in Dehradun City

The slums in Dehradun city have experienced a drastic change as revealed from this study. It has been observed that the number o slums have increased from 75 in 1996 to 113 in 2000. The total area under slum is now more than 279.65 acre. Out of the 113 slums of Dehradun city, nearly 90 slums are developed along the two major non-perennial rivers, Bindal Rao and Rispana Rao. Most of the river bed of these two river had become narrower due to encroachment of slums. Another remarkable feature came out from the study of the slums was that, out of the 113 slums, only 23 slums are away from the drainage channel. Most of these slums (23) have grown up either along the railway line that goes to Haridwar, or along the major city roads. It is observed that the slums are mostly developed as a continuous patch particularly in the central part of the Rispana Rao and Bindal Rao. However, it is seen that the growth of slums is not restricted within the existing municipal ward boundary as two big slums have been identified near the Raipur road.

The slum expansion is due to the pressure of the population mostly on un-used, un-protected and un-suitable government land. In highly developed areas, the slum pockets do not expand as the land is not available for expansion and is better protected due to the higher cost. It is observed that though the extent of slums area is more in residential pockets, but there is a tremendous growth in the existing slum located along the linear features like drainage channels, roads, and railways and as a result mostly are linear in nature. The slums in inner city area are less in extent and are in stagnant situation than the slums in peripheries (as no provision for further growth is there). In Dehradun, the slums, in inner city area did not register any increase in number between 1996-2000, whereas the slums in the peripheral area registered a high growth.

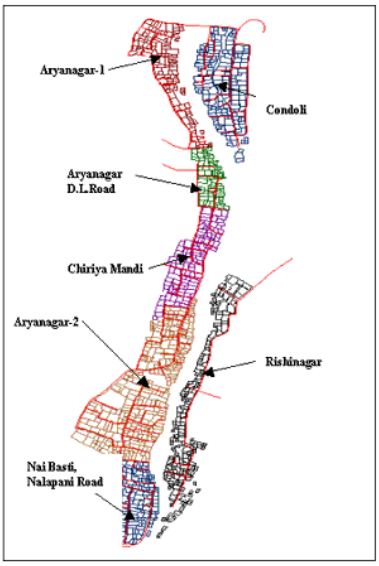
The internal land use and utility were studied through satellite imagery and through field survey to find out the causes for sporadic and haphazard development of Slums.

Figure IX-4 Slums In Dehradun



The study area constitute 7 different slums , namely Aryanagar-1, Aryanagar D.L.Road, Chiriya Mandi, Aryanagar-2, Nai Basti Nalapani Road, Kondoli, Rishinagar (fig.no.-2). Thus, the satellite imagery was found very useful in marking the layout pattern of slums, by-lanes, counting the buildings (structures), water logged areas etc. However the imagery does not show the activity within buildings, but show only the site adaptation.

Figure IX-5 Water situation in Dehradun



Condition of Water Supply: In the study area 520 houses (43%) don't have the piped water connection. Availability of water to houses is highest in Aryanagar-2 where more than 73% houses have water connection (table-3). The condition is same in Aryanagar-1. But in Rishinagar and Aryanagar D L Road the situation is really bad. In Rishinagar about 64% of houses lack this facility. In rest of the areas the condition is medium.

Table IX-7 Physical infrastructural facilities

	Water Supply		Electric Supply		Sanitation		Drainage		Street Lighting	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Aryanagar-1	83	49	96	36	84	48	40	92	62	70
Aryanagar. D.L.Road	34	46	49	31	31	49	32	48	36	44
Chiriya Mandi	90	29	86	33	89	30	94	25	76	43
Aryanagar-2	229	83	242	70	228	84	205	107	203	109
Nai Basti, Nalapani Road	102	92	141	53	124	70	122	72	103	91
Kandoli	87	86	130	43	116	57	105	68	62	111
Rishinagar	77	135	147	65	108	104	194	18	41	171
TOTAL	702	520	891	331	780	442	792	430	583	639

Sanitation Condition: The slums of study area show medium to better sanitation condition as 780 houses (64%) in the area have sanitation facility and 442 houses (36%) without sanitation (table-3). But if we take the slums individually into account, it reveals an interesting picture. Only in Aryanagar D L Road the number of houses without sanitation is high (61.25%). In rest of the slums though the number of houses with sanitation is higher (65.58%).

Drainage Condition: In the area under study, it has been observed that out of 1222 houses 643 houses (52.62%) don't have any drainage facility (table-3). Wherever drainage facility is available in 579 houses (47.38%) and all the drains are open drains. Out of seven slums in that area, four slums have very bad drainage condition particularly in Rishinagar where out of 212 houses, 193 houses (91.04%) are without any drainage. Only Aryanagar-1 and Chiriya Mandi have relatively better drainage condition. Wherever open drains are available, though either they are too narrow or half the portion is filled up with garbage.

Source: "Identification / Mapping of Slum Environment using IKONOS Satellite Data: A Case Study of Dehradun, India" by Ujjwal Sur and Sadhana Jain

F. Solid Waste Management

The total solid waste generated by 63 urban centres in Uttaranchal as estimated by the City Managers Association is about 850 tpd for a population of 16.5 lakhs. The rough per capita generation of waste thus works out to 500 grams/capita/day. Limited information exists on the waste characteristics.

A study on the top 20 urban local bodies in Uttaranchal and estimates of the extent of waste likely to be generated, shows that only 12 per cent of the larger urban local bodies had no identified place for waste disposal. In smaller urban agglomeratios, the land availability is much higher – 96 per cent. However, at present, all locations are only having open dumping as the means of solid waste disposal, with slopes being used in hill towns, and vacant land far from the city in the plains.

Table IX-8 Urban local bodies and solid waste generation

Urban Local Body	Population	MSW (t/day)	Land for dumping
Nagar Nigam Dehradun	447808	200	Yes
NPP Haridwar	175010	190	Yes
NPP Haldwani	129140	55	Yes
NPP Roorkee	97064	60	Yes
NPP Kashipur	92978	55	Yes
NPP Rudrapur	88720	54	Yes
NPP Rishikesh	59671	20	No
NPP Ramnager	47099	3	Yes
NPP Manglore	42782	3	No
NPP Pithoragarh	41157	18	Yes
NPP Jaspur	39048	1.5	No
NPP Nainital	38559	18	No
NPP Almora	30613	15	Yes
NPP Kicha	30517	1.2	Yes
NPP Mussoorie	26069	10	No
NPP Tehri	25425	40	Yes
NPP Kotdwar	25400	5	No
NPP Pauri	24742	3.2	Yes
NPP Sitarganj	21943	22	No
NPP Bajpur	21782	5	No

Source: Data from ULBs and National Solid Waste Association of India

G. Environmental Impacts of Non-sustainable Urbanisation

Urbanisation is accompanied by demands for housing, traffic networks, and civic amenities. If unplanned, urbanisation becomes unsustainable. For example, in Dehradun and Chamba, there are several colonies built along Khalas, and on unstable slopes, which, besides making them vulnerable, lends to congestion, which, in turn, increases air pollution, obstructs natural drainage, and is energy intensive. It also lends itself to the problem of managing solid wastes including biomedical wastes.

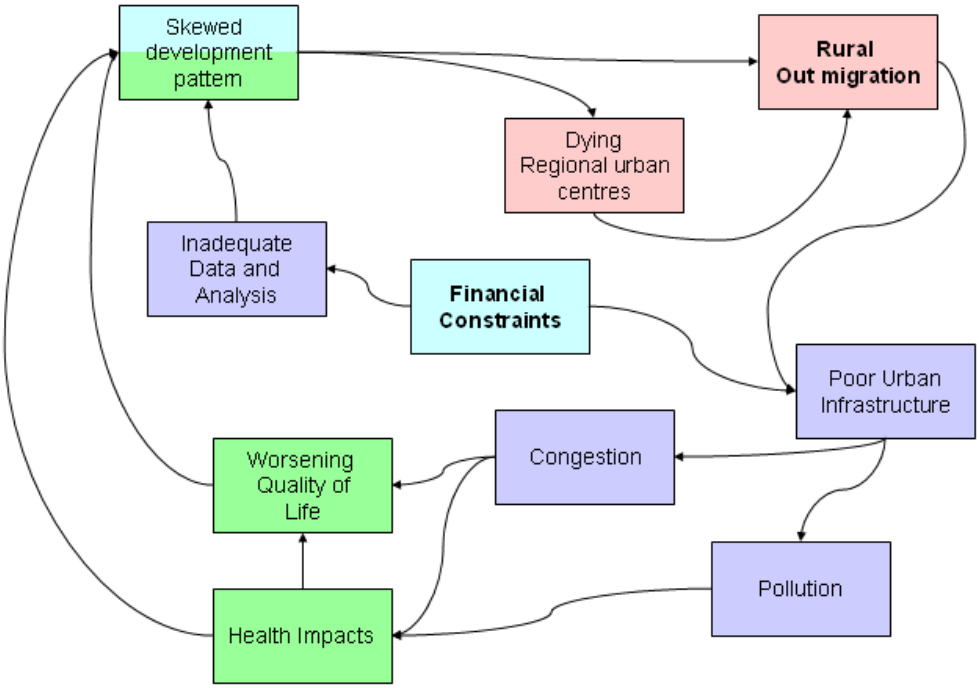
The problem of solid waste management takes on a new dimension in the urban centres, where non-biodegradable wastes such as polythene are on the rise. The problem is also increasing in rural areas, particularly along the pilgrim routes where mass tourism is creating numerous problems.

The availability of drinking water in urban centres is a problem that has already been analysed in an earlier chapter. Surface water pollution is not a problem in upland regions. However, in small hill towns, where water shortages for sanitation create problems of pollution, drinking water often gets contaminated with sewage, which is often disposed off in natural water bodies. This also leads to pollution of drinking water downstream.

Air pollution is not yet a problem in the middle and higher Himalayas. However, suspended particulate matter (SPM) is a major problem in Dehradun, which is monitored by the Central Pollution Control Bureau. It sometimes becomes a problem in centres of pilgrimage, especially during tourist season.

Yet another facet of urbanisation that is causing great environmental concern is road construction. It involves blasting, cutting and dumping of debris, which has negatively impacted soil stability and drainage, caused landslides and soil erosion (due to loss of vegetation). Often the debris that is dumped gets into the river (as in the case of a stretch of above 300km. which is being constructed on the Rishikesh-Badrinath route), which causes further environmental problems.

H. Balancing Urbanisation: The Way Forward



The management of large cities is extremely difficult, and smaller cities seem to be a sounder approach to urbanization than creating megalopolis. However, the combined ecological footprint of smaller cities may be greater than that of a large city, hence care must be taken from the beginning to plan urbanisation in such a way that small cities can offer a good living environment, attractive investment conditions and job opportunity with the most minimial of ecological disturbances. The small hill towns and especially on the tourist-pilgrimage circuit are facing an evergrowing pressure from

the visitors. The tourists rarely stay long enough to contribute to the local economy, yet long enough to generate pressures on the civic infrastructure.

Another factor that needs to be taken into account is that Uttaranchal's urbanisation is tied to two factors - out migration, and the concentration of nonagricultural economic activities in two districts – Dehradun and Nainital. Effective planning thus needs to take into account balanced creation of adequate employment opportunities in other districts, together with educational opportunities and social and cultural facilities, so that rural people will look for jobs close to their home towns and villages.

Need for integrated planning

Urbanisation in Uttaranchal is a process that may determine the future course of the state in terms of its physical use and the economic linkages that will be created. It is therefore necessary that an integrated plan for urbanisation that reflects the future development of tourism, nature of industrial and institutional development in the state. Given the fact that Uttaranchal has a distinct topography and socio-economic characteristics arising from it, and that the state is located on the international border and is thus spatially, institutionally and strategically important, effective planning for urbanisation must ensure that

1. The potential for economic development using small and medium scale industries and service centres could be developed along linear corridors without impinging severely on the slopes; for example the Mussoorie – Chamba – New Tehri – Ranichauri axis could be developed as a knowledge corridor, enabling education and associated institutional development areas; Ramnagar-Masi-Gairsain-Simli as the medicinal plants corridor etc.
2. Seriously explore the potential of alternative site for capital, particularly Gairsain which will then determine the growth of various hubs across the region;
3. Identify specific technical solutions for existing problems in the hill towns such as of sewerage and sanitation;
4. evolve criteria for planning hill towns or urban spread linked to the needs for future development;
5. evolve practical mechanisms beyond the current Master Plan model which has proved to be ineffective in providing a mechanism for mid-course corrections and
6. develop and put for public debate specific proposals for
   - an integrated land use for Dehradun, Haldwani, Kashipur, Rudrapur, Ramnagar and Jaspur given the rapid urbanisation of the regions.
   - an integrated landuse plan is speedily developed for midmountain areas like Nainital and Mussorie regions, and rapidly developing towns like Almora, Pauri, Srinagar, Ranikhet, Pithoragarh, Uttarkashi and Gopeshwar,
   - Identification of smaller spatially scattered centres in mid and higher mountains that can be developed as relatively smaller towns, with adequate basic infrastructure and market places for disposing rural surplus, as well as exploring the potential of tourism development.

In essence, urban planning needs to ensure that the smaller urban centres do not merely take the load off megapolis, they also have the capacity in themselves to avoid the complex problems of larger cities. Only integrated design and development of urban centres will ensure that the ills of urbanisation are taken care and not ignored to incurr later a great environmental, social and economic cost.

X. DISASTERS

A. *Introduction*

The last decade of the last century that was designated as the International Decade for Disaster Mitigation proved to be one of the most disastrous decades for the State of Uttaranchal. The decade began with a severe earthquake rocking the Uttarkashi District in October 1991 taking a toll of nearly 800 people and left nearly 20,000 houses totally damaged; it closed with another earthquake in the Chamoli District in April 1999[26]. The intervening years were witness to droughts, forest fires, landslides and cloudbursts and, for the first time in the history of the region, communal and political violenceThe decade also indicated the glaring deficiencies in disaster preparedness and mitigation efforts.

The World Health Organisation defines a disaster as "any occurrence that cause damage, economic destruction, loss of human life and deterioration in health and health services on a scale sufficient to warrant an extraordinary response from outside the community or region".

Despite the two major earthquakes and an average of 500 micro-earthquakes each year over the last decade, seismologists and geo-physicists have clearly earmarked the region between Kathmandu and Kinnaur as a region of seismic-gap, which means that an earthquake of very large magnitude is imminent to diffuse the accumulated geotectonic pressures. This has been so widely emphasised by the scientists that, together with the experience of the recent past, the state government has taken set up a Ministry for Disaster Management, the first in the country.

This ministry is still in the process of formulizing a policy document for the state but in the process it has created Disaster Mitigation and Management Centre (DMMC), an autonomous body located within the state secretariat campus, with a mandate to deal with prevention and mitigation measures for natural and man-made calamities in the state. Appropriate measures in terms of disaster management and mitigation are the key to prevent natural and man-made hazards becoming disasters.

Table X-1 Loss due to various natural hazards in Uttaranchal

Year	Life loss	Cattle loss	Household damaged	Crop loss (in Ha.)	Total loss(Rs. in lakhs)
1971-80	263	1512	1333	917	182
1981-90	80	860	3028	8546.2	783
1991-99	1243	5144	123462	47785	22113

Source: Revenue Department, Govt. of U.P.

B. *Vulnerability of Uttaranchal*

Uttaranchal, with its fragile eco-system and geo-dynamic terrain is highly vulnerable to earthquakes, landslides, forest fires, cloud burst etc. The state also faces serious threat from numerous man-made hazards such as massive deforestation, encroachment of unstable slops for settlement and for agriculture, ill planned and unscientifically implemented developmental schemes and projects unfavorably disturbing the delicate

[26] See list of Earthquakes in Annexure 1

balance of the nature. Though the local communities by experience have learned to live with known natural hazards and have developed coping mechanisms as reflected from local house building techniques, in recent times the intensity and magnitude of calamities, which have increased manifold because of human interference with nature and more and more dependency on technology driven lifestyle, have also increased the vulnerability of the population.

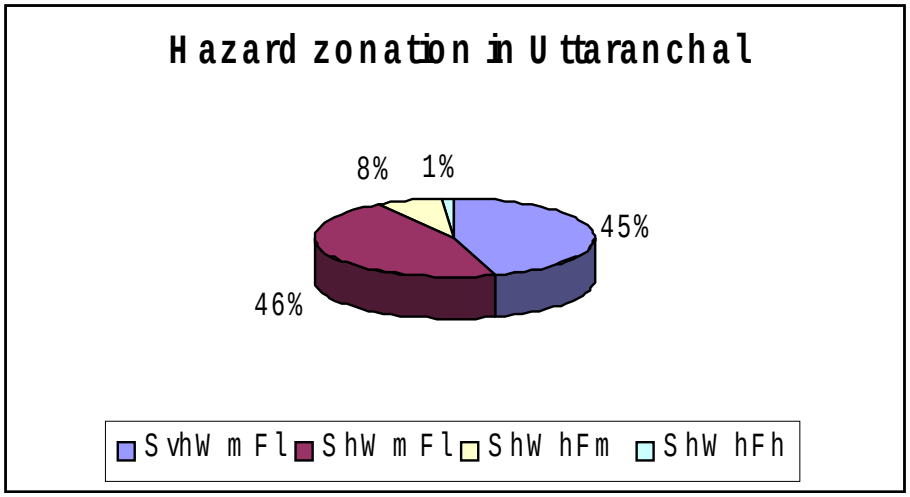
According to the hazard Zonation of Uttaranchal based on the *Vulnerability Atlas of India* whole of the state falls under very high – to - high category earthquake zone i.e. the state is highly vulnerable to earthquakes. According to the BMTPC analysis the hazard Zonation for the state could be summarised as follows:

Table X-2 Hazard zonation for Uttaranchal

S.No.	Disaster Zone	Area Covered (in Sq. Km.)	Population	Density
1.	SvhWmFl	23149.10	1342161	57.98
2.	ShWmFl	23297.94	3034661	130.25
3.	ShWhFm	3944.20	1272161	322.54
4.	ShWhFh	733.76	277163	377.73
S: Earthquake; W:Wind; F:Flood h:high; m:medium; l:low				

Source: DMMC, Dehradun

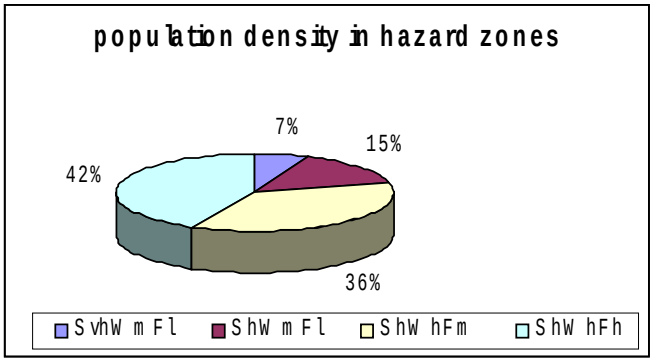
Figure X-1 Hazard zonation in Uttaranchal



The *Vulnerability Atlas of India* considers only three major natural hazards. Three districts -. Bageshwar, Chamoli and Pithoragarh fall fully under *very high category* for earthquake zone as also most of Almora, Rudraprayag and some parts of district Champawat. The rest of the state falls under *high* category of earthquake zone.

For wind hazard, Udhamsingh Nagar Champawat Pauri and parts of Nainital and Pithoragarh districts fall sunder *high* category while rest of the area of the state falls under *moderate* category.

Figure X-2 Population density in hazard zones



In case of flood hazard, parts of the districts of Udhamsingh Nagar (11 per cent land area) and Haridwar (29 per cent land area) are susceptible to seasonable flooding while rest of the state is not. The state's vulnerability has been summarised as follows

Table X-3 Vulnerability status of Uttaranchal

District	Vulnerability Status		
	Earthquake	Wind	Flood (index)
Almora – Bageshwar	Very High	Moderate	66.6 (category II)
Chamoli – Rudraprayag	Very High	Moderate	66.6 (category II)
Dehradun	High	Moderate	58.33(category III)
Haridwar			
Nainital – Udhamsingh Nagar	High	High	75 (category I)
Pauri	High	High	66.6 (category II)
Pithoragarh – Champawat	Very High	High	75 (category I)
Tehri Garhwal	High	Moderate	58.33 (category III)
Uttarkashi	High	Moderate	58.33 (category III)

Source: DMMC, Dehradun

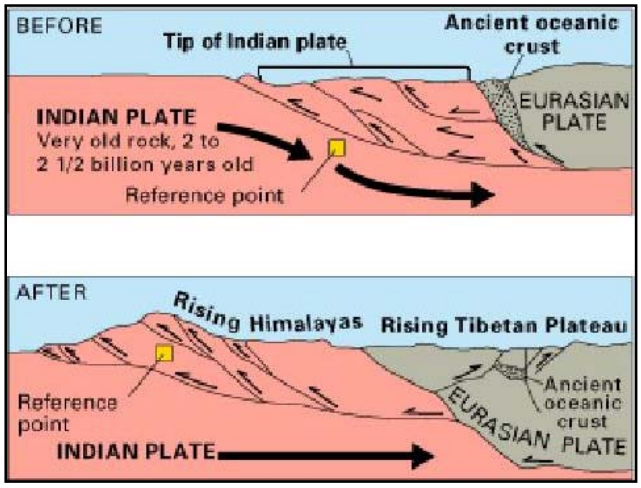
Vulnerability and gender

Gender roles refer to the set of traditional practices of women and men which varies according to culture, ethnic identity, race, class and age. Women are particularly vulnerable (whether in the case of Uttaranchal particularly, or in developing countries in general) because of they have fewer resources in their own right as well as under their own control. They assume additional and often entire responsibilities like caring for the family, managing house holds and, like in Uttaranchal, most of the activities related to livestock management and agriculture. Often they have no permanent place in the decision making system and suffer traditional and routine gender bias and oppression. By virtue of their lower economic, social and political status the women tend to be more vulnerable to disasters. For example during Ukhimath landslide in 1998, 62 widows from 23 villages were found running around trying to collect the relief which was rightfully theirs; however many of them got nothing but consolation, as other family members grabbed their rightful share and disappeared. In most of the cases, health needs, especially of pregnant and lactating women were ignored. In general developmental related benefits are denied to the women folk.

C. Earthquakes

Earthquakes are the most visible of the disasters and impact the understanding of disasters. They have serious implications for the design of management and mitigation plans. Uttaranchal has had a history of at least one major quake in a century and newer research in paleo-seismology is pointing to the occurrence of such earthquakes over several millennia.

Figure X-3 Geology of Earthquakes in Uttaranchal



The fundamental cause for earthquakes in the region is the tectonic structure and the ongoing plate movements. The impact of the Indian Plate overriding the Eurasian Plate has given rise to the highest mountain chain in the world and the continuum of quakes that rock not only Uttaranchal, but also the entire region right across the Himalayas-Hindukush region.

Seismologists and geo-physicists have clearly earmarked the region between Kathmandu and Kinnaur as a region of seismic-gap, where no major earthquakes have occurred for hundreds of years. They predict that a quake of 8.5 or above is imminent to diffuse the accumulated geotectonic pressures. Observations on micro-seismic events indicate that the entire region experiences quakes on an ongoing basis. The records in three locations adjoining the Tehri dam reservoir zone is revealing:

Table X-4 Average microseismic events in a day

S.No	Location	Seismic Events/Day
1	Barethi	2-4
2	Bhetiara	2.39
3	Lambgaon	1.35
4	Tehri	1.90

Source: Valdiya K.S. 1985

Figure X-4 Earthquake Hazard Zonation in Uttaranchal

The Uttarkashi earthquake focused attention on the causes and consequences of large earthquakes and the issues that need to be recognised in the case of an earthquake event.

Location of the epicentre

After an earthquake the first focus is on the exact location of the epicentre. There was considerable confusion during the 1991 quake as the first reports indicated that the epicentre was close to Almora, later it was corrected to be near Agora, near Uttarkashi and finally, when seismic data sets were analysed in detail, the epicentre was located in Pilag gad near Bhatwari in Uttarkashi district. The initial information is crucial as all the focus of attention is geared to the location and any changes in the information on the area of maximum impact reduces the ability to provide immediate support.

Rescue operations

The rescue operations are the most critical in saving lives of people. The local people and administration are the nearest and are often the most significant in rescue operations. It requires a lot of ingenuity and technique to extricate people trapped in buildings. After several earthquakes we still do not have standing instructions or a

protocol for the army or the airforce to air drop trained rescuers. In the Latur earthquake, it took more than 10 hours for the army to be given instructions to reach the spot. The first few hours after an earthquake are crucial for saving several lives.

Relief operations

Relief operations can last from a few weeks to several months depending upon the situation and require very compassionate and orderly effort. In the Uttarkashi earthquake the immediate relief given by several well meaning people proved useless as the materials they brought - old clothes, food articles etc - were not what was urgently required; what was most vital but unavailable was material for shelter to immediately house the victims. Social norms and local customs have to be considered in such circumstances and this has been a great failing in many of the relief operations when the trauma of the event is heightened with relief being handed out as a dole. Equitable distribution and support to all communities must be ensured in the process.

Reconstruction

Reconstruction is an area fraught with controversies after each quake. The first issue is of damage assessment as the compensation or the reconstruction package depends upon the nature and extent of damage. There have been innumerable cases of wrong assessment and often the administrative-technical bureaucracy adopts a method that is not easily understood by the local people. There has been very little participation of the affected population on the criteria for assessment and the assessment itself. The second issue is related to the choice of material and technology for reconstruction. The current methods highlight the convenience of the providers rather than a right choice for the region.

Gauri Kutirs and Kedar Kutirs: An epitome of useless spending

Immediately after the 1991 earthquake the state government came up with a project to install a number of community shelters designed by the Central Building Research Institute. The two designs, which raised serious doubts and concerns amongs the people and the local officials, were called the Gauri Kutir and Kedar Kutir. The total cost of constructing these shelters across the region was around Rs 90 crores. The shelters were a miserable failure because the designers did not consider the important social fact that people do not like to live together in a single shelter without any privacy. They also totally missed out on the fact that given the low temperatures in the region the GI sheet based structures were just too cold for any one to stay inside during winters. Six months after the quake the District Magistrate had to report that not a single unit was of any use to the local community!

In the aftermath of the Uttarkashi earthquake, the government embarked on a programme of constructing community shelters, which were totally useless (see box). Similarly, after the 1999 earthquake HUDCO suddenly announced and initiated building centres in the region in order to service the people who needed support in reconstruction. These building centres were all established in a hurry without any consultation with local institutions and community, and once again are not suited to the needs of the community.

Earthquakes are disasters that mankind cannot control and yet it is well recognised that quakes do not kill, it is our organisation and management of settlements and technologies that cause damage. Though earthquakes are the least predictable,

particularly in terms of their exact time and location of occurrence, there are several pre-quake preparations that can make a community confident of handling such imminent disasters. The first and the foremost is the nature of construction.

In every earthquake, the kind of construction defines the vulnerability of the region. Traditional construction in the hills was capable of withstanding quakes as buildings were built keeping the possibility of disaster in mind. The easy availability of timber meant that at least in the most vulnerable region, which is close to the Main Central Thrust, buildings were constructed using wooden members at intervening levels, which dampened the effect of quakes. Since the advent of tough forest laws, the promotion of modern building materials like steel and cement in the region, the buildings have become more vulnerable.

Table X-5 Types of construction in Uttaranchal

District	Building Type							Total
	Earthen	Stone	Brick (burnt)	Concrete	Wood	G.I.	Bamboo	
Almora[1]	12,355	2,61,175	6,515	1,455	1.120	795	3.215	2,86,630
Chamoli[2]	435	1,93,200	1,250	3,680	1,180	1,415	7,585	2,08,745
Dehradun	45,145	44,795	1,55,055	5,790	4,200	1,300	10,930	2,67,215
Garhwal	5,400	2,12,935	27,855	3,835	1,510	1,125	10,170	2,62,830
Haridwar	77,620	220	1,85,520	830	1,820	365	10,380	2,76,755
Nainital[3]	72,760	65,395	1,79,010	6,190	9,700	2,525	58,885	3,94,465
Pithoragarh[4]	1,385	1,72,270	7,945	2,075	1,945	675	715	1,87,010
Tehri Garhwal	1,935	1,87,935	9,060	3,625	2,100	2,230	7,535	2,14,420
Uttarkashi	615	69,885	5,725	3,585	8,820	1,255	2,570	92,455
Total	2,17,650	12,07,810	5,77,935	31,065	32,395	11,685	1,11,985	21,90,520
% of total	9.94	55.14	26.38	1.42	1.48	0.53	5.11	100

1 includes Champawat, 2 includes Rudraprayag, , 3 includes Udhamsingh Nagar, 4 includes Bageshwar

Source BMTPC , *Vulnerability Atlas of India*

Figure X-5 Category A house of stone in the hills

Figure X-6 Category B with burnt brick walls in the plains

Under intensity IX All category A houses are liable to total collapse and category B houses are liable to heavy cracking in all walls including partial collapse, with many totally collapsing . Loss of lives could be huge, many ten thousands.

Under intensity VIII Most categories A houses are liable to collapse and category B house to heavy cracking with some partial or total collapses. Loss of lives could be considerable, few thousands.

Under intensity VII Most category A houses could have heavy damage and few collapses while category B house could have minor to moderate damage. Loss of lives could be small - few tens or hundred.

Traditional aseismic architecture in Western-Central Himalayas

Rural houses are usually non-engineered structures that are constructed according to traditional practices, without the involvement of a professional architect or engineer. Locally available materials like stone, mud and wood are used in constructing these houses, and they generally exhibit adaptation to social, cultural and economic conditions and the natural environment. Traditional houses also show adaptation to local hazards, like floods, cyclones and earthquakes. The western-central Himalayas are a seismically active region, and earthquakes and landslides are major hazards. Traditional rural housing in this region is adapted to these hazards, and construction styles like the *pherols* of Uttaranchal and *kath-ki-kuni* of Himachal Pradesh are exceptional examples of indigenously developed aseismic construction techniques. Reinforcement of door frames, diagonal bracing, tie-bands and the geometry of stable structures provide ample evidence of the prevalent knowledge of aseismic construction principles. Traditional houses and temples that are centuries old have survived several earthquakes, and stand as testaments to the durability of this construction. The synthesisation of earthquake-resistant elements with religious, cultural and aesthetic values and practices in the region is a testament to the indigenous technical and creative capacities.

However, economic and demographic changes in the region, accompanied by a slew of government policies and programmes are replacing the traditional architecture and the indigenous base of knowledge is being lost. Declining access to traditional construction materials such as wood, bamboo and slate, accompanied by the infiltration of modern construction materials such as cement, concrete and steel into rural areas, which are backed by aggressive advertising and promotion campaigns that malign traditional housing results in a rapid transition in construction styles and community patterns. At the same time, inappropriate use of new materials results in seismically unsafe houses, which can increase vulnerability in earthquakes and landslides.

Traditional construction techniques have much to offer, even though construction materials are changing. The inherent sustainability and adaptability of traditional construction are the cornerstone for disaster-resistant housing and self-reliant communities in the region. The Peoples' Science Institute has surveyed and documented traditional construction techniques and has worked to incorporate these techniques into the evolving context of rural housing in the western-central Himalayas.

- Bishraj Das, People's Science Institute, Dehradun

The pattern and history of damaged buildings indicate the following interlinked causes:

1. A sudden spurt in the construction of government buildings and development projects using new technologies and materials to trigger rapid construction by people who had access, particularly after the development of the major roads post 1962 war;
2. Aspirations of local people to own a RCC roofed house following the models in the plains and the government buildings;
3. Unsafe expansion of previous Random Rubble Masonry walls with heavy RCC roofs;
4. Artificial shortage of local building materials like slate, stone and wood following the ban on mining and tree felling by local people;
5. Shortage of skilled manpower in construction using newer materials and weakening of the traditional mechanisms of training;
6. Mushrooming of a semi-skilled workforce employed largely in low quality government construction projects executed through contractors and resulting in degradation of construction quality and skills;
7. Leakage of cement and steel from projects reaching people at abysmally low prices for a short specific period leading to unscientific use;

8. Tendency of absentee owners or migrant head-of-household to give construction contract without any supervision andUncontrolled and random growth of settlements from pre-existing safe core to unsafe peripheries.

Among these the last one is due to the settlement system followed by the British and later by independent India, where the villagers did not have an option to develop satellite hamlets or new settlements in places of their choice and had to restrict themselves within the `Abadi' land.

Rehabilitation

Long-term rehabilitation is seemingly not on the agenda of disaster management. The agencies charged with disaster management usually believe that post reconstruction, the local government will take up the regular developmental tasks, which will suffice to rehabilitate the community. However a large number of families are often unable to cope with the changed situation either because of the loss of the bread-winner or the loss of land and cattle which was their sole basis for survival. The case of people permanently disabled due to the event, physically or psychologically has been a matter of grave concern and the lack of sustained attention of media and other agencies does not help in any way.

D. Landslides

The problems of landslides, subsidence and erosion are quite common in the hilly regions due to a combination of several factors like geological movements, structure, lithology, water seepage, soil cover, vegetal cover; weather and climatic changes. In this decade, cases of large-scale subsidences on hilltops, hill slopes, river banks and settlements have increased alarmingly. The problem of landslide is intricately linked to the nature of earthquakes in the region. The period between major quakes is characterised by a swarm of micro-earthquakes, which migrate across the region, the patterns of which are still a matter of research. These micro-earthquakes cause landslides directly or trigger already weakened portions of the landmass.

Table X-6 Major landslides in Uttaranchal

S. No.	Disaster Location	Year	Life loss
1.	Gudiya Tal	1868	73
2.	Nainital	1880	151
3.	Birehi Ganga	1893	-
4.	Namtal	1898	27
5.	Alaknanda Valley	1970	70
6.	Khaila Village	1977	-
7.	Bhagirathi Valley	1978	25
8.	Mandakini Valley	1979	50
9.	Neelkanth Valley, Pauri	1990	104
10.	Dewar Khadora	1991	25
11.	Pindar Ghati	1991-92-93	59 (total)
12.	Okhimath & Malpa	1998	326

Source: Compiled by TARN, Dehradun

While every monsoon there is at least one major landslide, the localised nature of the impact does not often attract sufficient attention in terms of support from the outside world. The two major landslides that caused considerable havoc and were noticed by the outside world were the Malpa landslide that killed several pilgrims enroute to Kailash and the Ukhimath landslide in the Madhyamaheshwar valley.

Figure X-7 Landslide on Road

The Malpa landslide

Around midnight on August 17, the village of Malpa, in Pithoragarh district in the Kumaon region, was buried under a heap of rocks two storeys high in a massive landslide. Around 210 people, including 60 pilgrims en route to the religious shrine of Kailash-Mansarovar in Tibet were feared dead. The landslide cut off Malpa and areas beyond it from the rest of the world. Survivors were stranded without food, shelter or medicines. A few Indo-Tibetan Border Police (ITPB) and army jawans in the area began the initial rescue work, which had to be abandoned after fresh landslides. The administration woke up to the crisis only three days after the tragedy, and launched a rescue operation codenamed Operation Whitehorse. The first rescuers landed at Malpa four days after the landslides, when the weather cleared for the first time. Ten survivors were rescued from the debris. Thirty-two bodies, including those of nine women, were found. Many bodies would never be recovered. Among the prominent people who lost their life in this tragedy was Ms Protima Bedi, danseuse and actor. Thousands of villagers were evacuated. Officials and relief agencies estimated the death toll at more than 300. The massive landslide, triggered by incessant rains, wiped out Malpa village. Further landslides have reportedly caused more deaths in the region.

The Madhyamaheshwar Landslide

In 1998, between 11 and 19 August, subsidences, slides and severe erosion played havoc along the Madhyamaheshwar valley, engulfing 34 villages and converting 25 sq. km fertile land into waste land, bringing boulders and cobbles over the fields and blocking the Madhyamaheshwar river. The landslide was due to cloudburst and torrential rains that lashed this valley during this period. This led to over-saturation of the topsoil and superficial unconsolidated material.

The Mandakini valley has been experiencing frequent tremors in the near past and the epicentres of Uttarkashi quake of 1991 and Chamoli quake '99 are located in adjacent areas. Many epicentres are located within the valley and the M.C. T. passes through this area. These tremors have made this area very fragile due to shearing/shattering. The slopes have become steeper due to later modifications. The severe erosion that occurs during the rainy season is probably due to the fissuring and shearing. The erosion is so severe along the right bank of Madhyamaheshwar that it has threatened the existence of several villages on hill slopes, which are quite steep, and so gullied, with deep rills, that the river changes its courses quite frequently

The left bank of Mandakini is covered by a very thick forest. Still during the heavy downpour in August 1998, a huge hill mass of 600 m x 500 m, along with the forest, slid off along existing fissures and cracks, and buried three villages - Koti, Bheti and Paundar. This mass came down in a few seconds with a thud and blocked the Madhyamaheshwar, which was already overflowing its banks, flooding the area. This blockade continued for more than a day and a huge lake was created along Madhyamaheshwar river upstream of the buried village Paundar. The discharge downstream of Paundar decreased drastically due to obstruction/damming in the course of flow, threatening the population downstream, because if the lake had burst, the river waters from Ukhimath to Deoprayag would have risen and resulted in flash floods. Since this blockade was created by the debris or loose rock mass, on saturation it gave way to seepage. The river valley was filled up to its capacity, 250 to 400 m deep, and finally its over flow carved out a channel by eroding the debris.

According to some geologists, the problem of frequent earthquakes in the Mandakini valley is directly linked to the neotectonic activity in the form of downward gradual movement of Delhi-Haridwar-Harsil ridge (DHH) -Aravalli Basement. This made the slopes vulnerable to failure and severe erosion. Secondly the downward movement of DHH has created an open space between the Aravalli and Himalaya. The sinking and adjustment of the base finally leads to cave in subsidences and slumping of hills. This happens even if the hills are clad with thick forest. Madhyamaheswar valley is one of the best preserved forest (Kedarnath Musk Deer Sanctuary) and it still experienced large scale erosion and slumping, The subsidences are noticeable in first phase by cracks in houses, fissures in ground and wide cracks in open areas.

Rubbing salt in the wound: resettlement of Madhyamaheswar victims

The greatest tragedy in the Ukhimath landslide was not that the villages were totally obliterated from the map of the world but the callous attitude that was presented by the officials. Only the voluntary agencies and local officials, with a few exceptional officials trying their best to provide some help, initially helped the people affected by the landslide. When some of the people found land to rebuild their homes and thought that it would be possible to take out some of the timber from the landslide debris, the forest officials immediately told them that the timber was now the property of the forest department and they had no right to take it out. After several months of lobbying and efforts of various groups and agencies the government asked the PWD to reconstruct homes for some of them. The location and the multistoried building built for their resettlement is so vulnerable that it remains to be seen if it will withstand the next quake.

E. Forest Fires

There are several reasons for the occurrence and expansion of damage due to forest fires.

Table X-7 Some of the recorded forest fire incidents since independence

Year	Forest lost (ha)
1947	20833
1973	70000
1984	29800
1995	211500
1999	514400

A study undertaken after the major 1995 forest fire indicated[27] the following causes:

1. The practice of maintaining the forest fire lines is in disarray. Every year before the beginning of summers, the fire lines are supposed to be cleared. Prescribed burning immensely reduces the potential for wildfire. However, the fact is that the ground-level action does not take place at appropriate time since the release of funds often takes place just around the close of the financial year. The forest staff at the field level find it difficult to then mobilise the labour and undertake the task before the fire season begins. Field staff also find that the villagers have lost interest in volunteering in such efforts ever since the concept of wages has been introduced, or the policies have made them distanced themselves with the management of State's forests.
2. Some forests are burnt where there is an ongoing conflict between communities and the Forest Department over the rights of the community, or when in times of crises the Forest Department has been found to be particularly unhelpful.
3. Some fires have been engineered by the Department staff where plantation targets have not been achieved, thereby giving an excuse of forest fire as this is the most logical to ward off any inquiries.
4. Some fires are engineered by vested interests - `forest mafia' in local parlance, who wants to extract timber sometimes with the collusion of local people and officials.
5. Pine forests where resin tapping is underway becomes vulnerable to fire and one may find a combination of all the causes in such a situation.
6. Fires may also be lit in order to scare wild animals especially where there is a fear of man-eaters close to the settlements.

The problem with prescribed burning is that, apart from its being unorganised or not implemented, the process has not been evolved for every forest type and a generalised approach is taken. Further the situation gets aggravated if there is a prolonged dry spell following less of winter rain and snow. In recent times it is seen that the fires have advanced to March and April while in the past it was mostly after the beginning of May that such fires occurred.

A detailed assessment of forest fires in 1999 indicates that nearly 23 per cent of the forest was affected. Forest fire not only causes loss of timber but also damages the regeneration potential, soil system and cessation of increment of the existing stock.

[27] AME internal paper `Causes and Consequences of Forest Fires in Uttarakhand'

Table X-8 Forest cover affected by fire (sq Km)

	Forest Cover				Forest cover affected by fire			
Region/District	Recorded Forest Area	Dense Forest	Open Forest	Total Forest	Dense Forest	Open Forest	Total Forest	Percentage Affected by Fire
1	2	3	4	5	6	7	8	9
Kumaon								
Almora	3940	2071	466	2537	786	72	858	33.82
Nainital	4036	2928	640	3568	279	95	374	10.48
Pithoragarh	3303	2188	808	2996	537	146	683	22.80
Sub Total	11279	7187	1914	9101	1602	313	1915	21.00
Garhwal								
Chamoli	5210	2530	622	3152	475	51	526	16.69
Dehradun	2117	1243	327	1570	169	51	220	14.01
Garhwal	4513	2207	969	3176	652	421	1073	33.78
Tehri	4059	1811	749	2560	494	187	681	26.60
Uttarkashi	7108	2634	465	3099	678	51	729	23.52
Sub Total	23007	10425	3132	13557	2468	761	3229	23.80
Grand Total	34286	17612	5046	22658	4070	1074	5144	22.70

New recruits are damaged by the fire, which affects regeneration of the native species and paves the way for encroachment by non-native species. Valuable raw material is burnt, which otherwise could have been recycled in the forest floor itself or in agriculture fields after decomposition. Fire affects soil and geomorphic processes, it volatilises large amounts of nitrogen and carbon contained in soil organic matter thereby contributing to global warming and ozone layer depletion. In addition, high rainfall following fire causes soil erosion and reduces water infiltration. Fire damages the habitat of several mammals, birds, reptiles, insects, micro-organisms, etc. Burning in pine forests coincides with the period of resin collection, which makes the species more susceptible to fire. Once the resin catches fire, the ground fire transforms to crown fire in no time. The practice of prescribed burning should not consider trees in isolation. Trees are a part of an ecosystem that involves various other biodiversity elements with complex linkages. Prevention mechanisms should be developed against catastrophic fires for different forest ecosystems.

F. Disaster Management: The Way Forward

Disaster management is a 'state subject' and different states have initiated efforts to strengthen their agencies responsible for disaster management. The Uttaranchal Government is the first to create a ministry specifically for this purpose. The ministry claims that its main thrust is proactive pre-disaster measures rather than on post disaster response. However, the processes so far unfortunately indicate that Disaster Management is getting bureaucratised rather than evolving a society that is capable of responding to the vulnerabilities of the region.

If disaster management has to become an effective process then the state will have to vastly reorient itself and consider some of these suggestions carefully:

1) Improve ability to predict

The task of prediction has to be an important component of the scientific activities of the State. Though modern science has not been known for its ability to produce consensus on issues that directly affect human well being but in most cases there is a definite possibility of generating a decent estimate of risk. This cannot be achieved by a one-time preparation of vulnerability atlas with too many parameters, but only with an ongoing process. Some of the specific tasks will include:

- Strengthening of the information gathering systems and making information freely available rather than keeping it an exclusive preserve of scientists and officials. There should be a repository where information can be accessed enabling more people to be involved in developing prediction systems and contributing to the effort;
- Developing methods to evolve prediction models using multi-level and multi-precision data sets rather than merely seeking more sophisticated instruments and putting existing infrastructure to disuse. This should allow better assessment without adding costs to burden the new state.
- Scientific organisations involved or established anew must evolve a mechanism for closely involving the community in the data acquisition processes and also utilise other information inputs such as behavioral patterns of animals, fluctuations in flow-levels which have a bearing on earthquakes, forest fires and floods.

The Department of Disaster Management, Government of Uttaranchal signed a Memorandum of Understanding (MoU) with UNDP for a five year project starting in 2003 and ending in 2007. The project activities include

a) Awareness & sensitisation campaigns through out the state on different hazards.
b) Organising capacity building & training programmes for all government functionaries, CBOs, PRIs, Volunteers, and other stake-holders for preparation of community owned disaster management plans in all the districts.
c) Constitution and review of existing Disaster Management Committees and Disaster Management Teams at all levels in all districts of Phase I and in Phase II.
d) Review and preparation of existing District, Block, Gram Panchayat and Village Disaster Management Plans for the 4 districts such as **Chamoli, Pithoragarh, Bageshwar, Rudraprayag** in Phase I and remaining 4 districts **Nainital, Dehradun, Tehri Gharwal and Uttarkashi** in Phase II.
e) Organising specialised training programmes for the Disaster Management Teams [DMT] at various levels.
f) Strengthening Disaster Management Information Centres (DMICs) at state and district levels.
g) Conducting mock drills at all levels, twice a year (before the disaster seasons for seasonal hazards).
h) Construction of model demonstration units with disaster resistant technology and Transfer of disaster resistant housing technology through masons training. These units would act as Area Resource Centres and multi-purpose shelters.
i) Enhancing the capacity of communities to establish and operate on-site communication systems (HAM radio) in each district.
j) Strengthening DMTs at various levels with emergency kits.
k) Planning and initiation of Vulnerability Reduction Master Action Plan for Uttaranchal.
l) Initiation of Insurance Initiatives in disaster management at the State level.
m) Model/demonstration units of rainwater harvesting features (with special reference to potable water) as drought mitigation measures in selected districts.

2) Establish clear instructions to the local officials and defence services of the tasks to be carried out by them in case of a calamity

- The administration is found to be in a quandary during all the past events and it takes very senior people in the government to intervene before some clarity emerges, while it is the lower rungs of the administration who are available for action immediately but do not know how far they can take decisions independently.

- Standing Instructions must be provided to the defence services to immediately move for rescue operations *suo moto* or with the first information available.
- The new Disaster Management Information Centres must have the ability to respond in a coordinated manner with all agencies and voluntary institutions during a calamity.

3) Develop Pragmatic Programmes for Vulnerability Reduction
Long term reduction of vulnerability cannot be effected without fundamental changes in the process of village settlement and construction practices.

In association with Geological Survey of India to expand the scope of mapping vulnerable settlements and mobilise people to relocate to safer sites. This will require active effort to provide for land and other resources to such communities.

Provide technical and appropriate material support for reconstruction as merely identifying and providing a site will be insufficient for effective vulnerability reduction. Foster professional guilds to ensure that building construction practices are upgraded.

XI. INDUSTRY

One of the main objectives behind the creation of the separate state of Uttaranchal was to ensure rapid economic development of the area. Various factors have contributed to the economic backwardness of Uttaranchal, among the foremost being slow industrial growth. The reasons for this include hilly and difficult terrain; gaps in infrastructure; lack of connectivity; problems of raw materials availability; limited access to markets and, most importantly, the absence of a specific policy for industrial development in the area keeping in view its special conditions.

The state has already gone through a shift in its focus on industrialisation. The first industrial policy announced in 2001 focused on opportunities for enhancing the productive base of the state through areas conducive to the natural environment and stated succinctly that, `Protection of environment and the maintenance of the ecological balance will be accorded top most priority. Industrial units will be encouraged to establish effluent treatment plants, develop sites for solid waste disposal, establish clean production centres. The violation of environmental safeguards will be severely penalised'. The new policy is silent on the issue of environment and the current thrust seems to be to bring into the state exotic industries which can benefit from the concessions and subsidies that the Central and state governments have announced.

A. Development of Industries in Uttaranchal

The industrial development in the Terai parts of Uttaranchal is closely linked to the agricultural profile of the region. The industrial corridor of Udhamsingh Nagar has a number of sugar mills and paper mills; which draw their raw materials from the agro produce and forest produce of the area. In contrast, post the declaration of the Doon Valley as an ecologically fragile zone, the nature of industries has shifted from extractive industry to small-scale industries producing miscellaneous products. The industrial development in the hill districts has been negligible, except a few pockets of household manufacturing units.

In an attempt to promote ecologically sustainable industrial development, the state policy makers have focused primarily on the unique strengths of the state – its natural resources including its biodiversity, its extensive handicrafts, and clean production technologies.

B. Khadi, Village and Small Scale Industries

The present status of the different types of the industries reveals that only village and small-scale industries have been established by the private entrepreneurs. According to 1994-95 data, of the total khadi, village, handicraft and small scale industries located in the state, nearly 52 per cent are in Garhwal region, whereas, 48 per cent in Kumaon region. The district wise distribution of these

Weaving is an important cottage industry providing employment to numerous women

industries shows that the highest concentration is in Nainital district, followed by Dehradun.

Table XI-1 Industrial profile of Uttaranchal

	Khadi & Village	Handicraft industries	Small scale industries	Total
Uttarkashi	1142	2711	1951	5804
Chamoli	1201	3092	2030	6323
Tehri Garhwal	893	2270	2036	5199
Pauri Garhwal	1285	2994	2411	6690
Dehradun	2614	4728	5067	12409
Garhwal region	7135	15795	13495	36425
Almora	1525	6836	3664	12025
Nainital	2504	5883	6311	14698
Pithoragarh	1405	3835	2401	7638
Kumaon region	5434	16554	12376	34364
Uttarakhand	12569	32349	25871	70,789

Source: ASI, GoI, 2004 & compiled from Small Industries Service Institute's document, Kanpur

Significant growth in the number of handicraft industries has been registered between 1995 – 2000. However, as far as employment is concerned, small-scale industries have provided maximum employment with less investment as compared to khadi and village and handicrafts industries. The very low investments and sub-critical size of many enterprises is evident.

Table XI-2 The investment figures for khadi, village and small-scale industries

	1995	1999-2000	2000-2001
Small scale industries			
Number	25,871		41,216
Investment (Rs crores)			305.58
Employment			153229
Khadi & village industries			
Number	12,569	16,568	17,534
Investment (Rs crores)		14,341	14,871
Employment		58,026	59,659
Handicraft industries			
Number	32,349	51,326	54,047
Investment (Rs crores)		3,605	3,839
Employment		56,256	59,127
Total			

Ecological impact of forest based industrialisation

The 1952 forest policy gave a new thrust to the commercialisation of forestry and the growth of forest based industry. The concept of 'sustained yield' was replaced by 'progressively increasing yields'. Mixed natural forests were clear felled and replaced by monocultures of industrial species.

The forest working plans for the Doon Valley provide a clear example of the impact of such a forest policy. Till 1933, the only strategy was based on the principle of controlled and selective felling. In 1933, large-scale afforestation through plantation was introduced for the first time. The trend continued even after independence. In the working plan (1941-50) prepared by Sen a special plantation working circle of clear felling with artificial regeneration was introduced to meet the needs of the plywood and match industry'! Important plywood species like semal and tun supplemented by khair and sisoo were to be raised. However, in 1962, the demands of the pulp industry overtook the demands of the plywood and match industries, and plantations of species like eucalyptus became the new mantra.

During 1966-67, the production of pulpwood increased by 400 per cent. The raw material needs for this rapid expansion were met by changes in sites and species selected for afforestation. Labour-intensive methods of plantation like the Taungva system gave way to mechanised ones 'to simplify management and to reduce exploitation costs especially in the case of species on short rotation suitable for paper pulp like Eucalyptus'.

The selection of new sites was not guided by ecological considerations, but purely by market demand. Initially, open patches in the sal areas were planted with trials of various species chiefly sal, teak and some bamboo. Later from 1963 onwards the open miscellaneous forests were selected for plantation involving limited felling of standing trees. Finally, even better stocked forests were clear felled to replace 'uneconomic' species with 'economic' ones.

Historically, therefore, modern scientific management of forests concerned itself primarily with increasing the yield of species with high market value and demand, completely ignoring their ecological impact. In the case of the Doon Valley, this impact proved to be disastrous. Thus it neither addressed itself to an assessment of basic needs of the local population nor the ecological needs of the local environment.

There are 32000 small-scale industrial units in the state. According to a survey conducted in 2003 by the Department of small-scale industries, around 11,000 of the almost 27000 industrial units surveyed are either closed or missing; only 16000 units are operational. The majority of the closed units are located in Dehradun, where changed environmental regulations made it impossible for most of them to continue operating. In Udhamsingh Nagar district, around 1500 of the total 3000 units are closed.

C. Medium and Large-scale Industries

Uttaranchal is rated as C grade as far as the distribution of medium and large-scale industries is concerned.

- Zero industry districts: Chamoli, Uttarkashi, Pauri and Tehri Garhwal.
- Special area districts: Almora, Pithoragarh, Dehradun and Nainital.

Table XI-3 Large and medium industries in Uttaranchal, 1999

	Large & Medium Industries			Small Scale Industries		
District	**No of Units**	**Investment Rs. Crores**	**Employment**	**No. of Units**	**Investments Rs.in Crores**	**Employment**
Almora	3	10.28	260	4716	10.3	14588
Nainital	87	902.49	23045	3948	49.25	12766
Pithoragarh	3	8.89	211	2386	8.61	5243
Udhamsingh Nagar	1	8.71	32	1122	11.82	1776
Bageshwar	-	-	-	50	0.21	78
Champawat	-	-	-	52	0.38	103
Chamoli	-	-	-	2734	11.85	6383
Dehradun	50	233.74	14052	2864	38.14	9533
Pauri Garhwal	7	266.43	1187	2883	16.27	8811
Tehri Garhwal	8	29	510	2779	20.93	8469
Uttarkashi	-	-	-	2206	9.06	5726
Rudraprayag	-	-	-	108	0.62	200
Haridwar	7	99.37	7080	4024	48.1	14885
Total	*166*	*1588.91*	*46377*	*29872*	*225.54*	*88561*

Source: Directorate of Industries, U.P., Kanpur

Although there is not much scope for setting up large industries in Uttaranchal, yet some medium and large-scale industries exist here. The Tata Group has four joint venture units manufacturing dead burnt magnesite in Almora, Titan Watches in Dehradun, and Eureka Forbes vacuum cleaners and water purifying equipments in Bhimtal (Nainital). India Glycols of the Bhartiya Group of Industries is established at Kashipur (Udhamsingh Nagar). The Birlas have their Century Pulp and Paper unit at Lalkuan (Nainital). The Bombay Dyeing Group is represented by Sturgia Chemicals at Rishikesh. Other industries include Surya Roshini (lighting equipment and fittings), Jalpac (metallised paper film and holographic paper), SRF (biaxially oriented polypropylene packaging film), Cutler-Hammer (switching and control equipment), Flex foods (freeze dried fruits and vegetables), Shriram-Honda (portable gensets), Usha Rectifier (electrical resistances).

Some groups of industries operating in Uttaranchal enjoy a national or state-wide reputation. Miniature bulbs of Dehradun, electric arc steel manufacture in Kotdwara (Pauri-Garhwal), solvent and vegetable oil industry, stone crushers, rice mills, sugar mills, plywood manufacturing, seed production, and manufacturing of card boards and craft papers in the districts of Udhamsingh Nagar and Nainital are some such well-known industries.[5]

D. Resource base of Industrialisation in Uttaranchal

Industrial development in Uttaranchal is largely linked to the resource base, which can either be sustainably used or lead to degradation of the local ecology/environment.

Uttaranchal is endowed with natural resources like rich biodiversity, agro-diversity and mineral wealth.

Tourisitic Resources Perhaps the greatest resource base for economic growth are the touristic resources, which range from pilgrimage places to high-adventure areas;

Biodiversity Forests are major resources for the state supplying raw material for various forest-based industries. However it would be important to recognise that the forests are already depleting in stock and the focus must be on the creation of specific resources for industry such as medicinal plants and timber production.

Table XI-4 Major forest produce

Estimated growing stock	188.8 thousand cmt
Timber production (1995-96)	307 thousand cmt. (round)
Fire wood production (1995-96)	167 thousand cmt.(stack)
Resin production (1999-2000)	1 lakh quintal

Source: Uttaranchal At A Glance, 2002-03

Agro-diversity Due to terrain and climatic variations, it is possible to grow various fruit and vegetable crops all over the state.

Table XI-5 Fruits and vegetables production

	Area in.	Production	Productivity
	000ha	000 tonnes	t/ha
Fruits	187.53	508.20	2.71
Vegetables	69.16	387.50	5.60
Potato	23.60	428.90	18.17

Source: Industrial Policy of Uttaranchal, GoUA

Mineral resources While Uttaranchal has rich mineral resources, mining in the state is fraught with severe environmental and social problems.

Table XI-6 Availability of important minerals (million tonnes)

Mineral	Quantity
Limestone	430.5
Marble	6.4
Rock Phosphate	25.0
Graphite	10.7
Dolomite(superior)	30.0
Magnesite	70.3
Copper	1.6
Soap stone	26.6

Source: Industrial Policy of Uttaranchal, GoUA

E. Environmental Impacts of Industrialisation

Industry and pollution

The fragile ecological nature of the state leaves it particularly vulnerable to the negative environmental impacts of large-scale industrialisation. There is limited data on the extent of environmental damage caused by industrial pollution but the environmental impact, however, does not appear significant.
Hazardous industries are categorised as follows.

- Aluminium
- Copper
- Fertiliser
- Pesticide
- Pulp & Paper
- TPP
- Caustic
- Distillery
- Iron & Steel
- Petrochem
- Refinery
- Zinc
- Cement
- Dyes & Dyestuffs
- Leather
- Pharma
- Sugar

According to the Central Pollution Control Board, Uttaranchal has 17 industries in the highly polluting category: all of them, however, have reportedly adequate waste water treatment facilities.

The UEPPCB has information on the industries requiring consents under the Air and Water Acts.

Table XI-7 Consents accorded by the UEEPCB

Type of industry	Number
Distillery	2
Sugar mills	6
Paper & Pulp	14
Iron & Steel	2
Electroplating	3

Source: UEPPCB

Ecological damage

Among various industries, mining is the one that causes the most ecological damage. Since the enactment of the Forest Conservation Act in 1980, largest amount of forest land has been transferred for mining (as seen in the following table).

Table XI-8 Land transferred for mining purposes

Year	Land transferred (in ha)
1983-84	2.2
1984-85	2.0
1988-89	1547.0
1989-90	4089.0
1990-91	208.7
1999-2000	2455.0
2000-01	58.8
Total	8358.3

Source: State Forestry Statistics, GoUA, 2001

The exploitation of minerals in Uttaranchal has come at a price. The ecological damage caused by mining of minerals can be best illustrated by impact of limestone quarrying in Doon valley. Quarrying has disturbed the ecological balance of the valley, which is geologically unstable due to the existence of a tectonically active zone and a geological thrust.

The extraction of minerals disturbs the land-soil-vegetation system by the removal of the vegetation, the top soil, and the overburden, for surface quarrying. The precipitous slopes and high rainfall accentuate this locally, which add to the land's instability caused by mining.

The actual process of extraction of limestone thereafter creates the second ecological impact on land resources, which is unique to the fragile and sensitive ecosystems that characterise the Doon Valley. The use of explosives to remove the rocks further weakens the already weak rock structure. Explosives also activate faults in the dislocation zone of the main boundary thrust, where the quarries in the Mussoorie area are located. The result is induced slope failure and landslides, which are increasing in the region since the mining operations began.

'it is a price that has to be paid for protecting and safeguarding the right of the people to live in a healthy environment with minimum disturbance of ecological balance and without avoidable hazards to them and to their cattle, homes and agricultural land and undue affection of air, water and environment'.

The Supreme Court bench justified the closure of mining operations on the above grounds

Landslides raise the beds of streams and rivers, by piling up debris in these drainage channels. The combination of heavy monsoons, bare slopes, and silted river beds, leads to flood in a valley that was endowed by nature with excellent drainage.

A less visible process of destruction has been associated with the water resources of the Doon Valley, which is served entirely by rain fed streams originating in the Mussoorie Hills. The limestone deposits, besides being a reservoir of water, overlap the catchment of these streams. The ecological crisis generated by limestone quarrying is reflected by the fact that, in a valley with abundant rainfall, areas affected by mining no longer have enough water available for the sustenance of crops or humans.

The destruction of the internal hydrological system is reflected in the fact that the spring sources of all villages surveyed in the local catchments have registered an average decrease of nearly 50 per cent in their lean period discharges over the last two decades. Such disturbance of the hydrological cycle resulting from human intervention in the limestone belt in the processes of quarrying seems to be the unavoidable and expensive impact of quarrying.

Limestone quarrying in Doon valley

The Doon valley is a distinct ecobiome in the district of Dehradun, situated in the himalayan foothills of the state of Uttaranchal. During the last three decades the limestone industry in the Doon Valley, consisting of both quarrying of limestone and its processing, received a lot of encouragement, which led to its accelerated growth. For the people residing in the Valley, this growth has threatened the material basis of survival through the destructive impact of the limestone industry on the hydrological balance of the Valley.

Fragile Ecosystems of the Doon Valley

The Himalayas, which are said to comprise the youngest mountain system of the world, form one such fragile super ecobiome, whose fragility is due in some degree to their inherent geological instability and furthermore to the violence of the monsoon rains that they arrest and moderate.

The Doon Valley is bounded on the north-east by the lesser Himalayan Ranges, and on the eastern half of its south-west by the Shivalik Ranges. The two most important rivers of North India, the Ganga and the Yamuna, demarcate its south-eastern and north-western boundaries, respectively. The 'fragility' of the Doon Valley is further accentuated by the presence of a major boundary fault passing through the northern parts of the Valley and by the unusually heavy rainfall of about 2,000 mm per year. The average width of the Valley is about 20 km, and the length is nearly 70 km. The Doon Valley ecobiome comprises two distinct sub-catchments, one formed by the drainage basin discharging into the Ganga a little south of Rishikesh, and the other formed by the drainage- basin discharging into the Yamuna near Rampur Mahdi (just outside Dehradun district). Thus the Doon Valley forms a sub-catchment for the Ganga Yamuna rivers system, which carries the vital water resources for the northern part of the Indian subcontinent.

Origin of the Lime Rush

Direct and major human interference in the limestone deposits began in 1900, when the railway line was brought to Dehradun and the forest department started selling quarrying rights to the limestone deposits at a royalty of Rs. 5 per 100 cubic feet (ca 2,832 dm3). An attempt by the government to assume full control of all limestone deposits was challenged in the court by the local landlords. They argued that the boulders on the surface of the earth and river beds were not mines, and their objections were upheld. As a result, surface boulders were declared as not to be quarried, until the settlement of 1904 that declared all quarries as government property.

Extraction of limestone and marble in Dehradun (in tonnes)

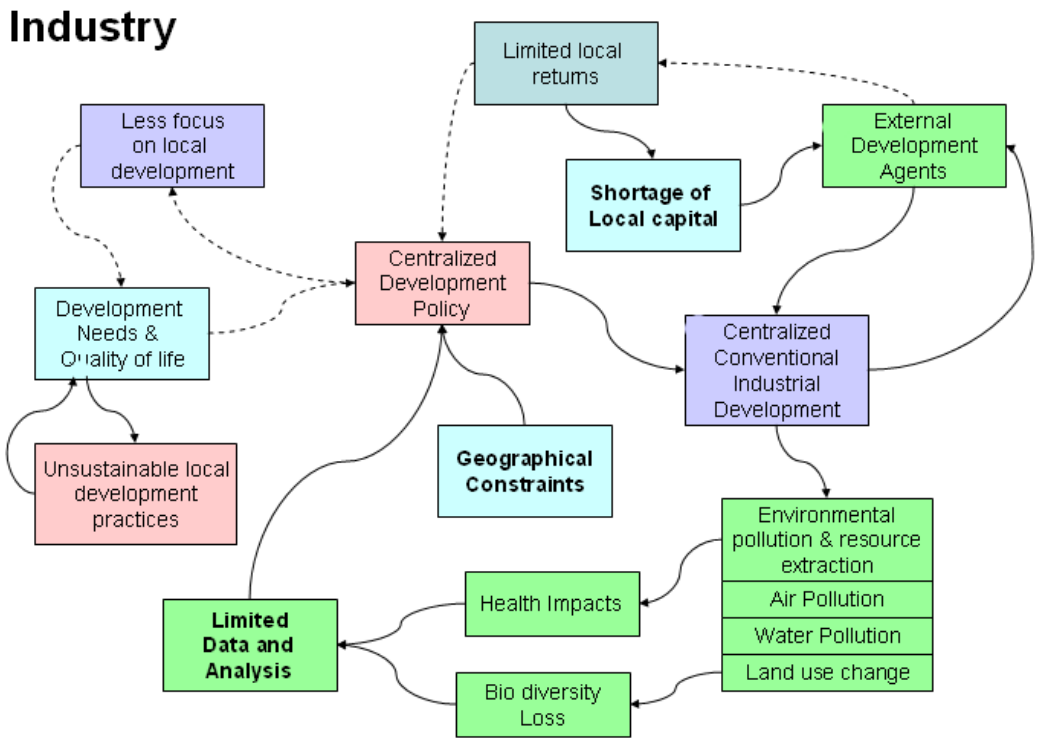
Year (Major)	Limestone (Minor)	Limestone	Marble	Total
1977	323753	101010	103213	527976
1978	436561	100515	106996	644072
1979	520454	114760	134774	769988
1980	390572	121879	136321	648772
1980-81	430278	132202	139015	701495
1981-82	471196	166962	123278	761436

In 1911, four quarries were being worked in the Doon valley and by 1982, there were nearly 1000 quarry

leaseholders holding about 1250 ha of leased area.. The limestone of the Doon valley, being of high purity, has a ready market in the steel, chemicals, sugar, textile and other industries. The amount of limestone and marble extracted in the vicinity of Dehradun is shown in the above table.

On 12 March 1985, in response to a public interest litigation, a Supreme Court bench consisting of Justice P.N. Bhagwati, Justice A.N. Sen and Justice R. Misra passed an order closing permanently or temporarily, fifty-three limestone quarries out of sixty within the geographical limits of the Doon Valley or the Dehradun Tehsil.

F. The Way Forward



The industrial policy of Uttaranchal broadly looks at providing fiscal and other incentives to industrialisation. However increased focus needs to be on the

7. Cleaner production
8. Smaller decentralised industry in industrial parks that are ecologically designed

Proposals galore for industries in Uttaranchal

After the announcement of its new industrial policy, the state government has received 450 proposals to set up industries in the two new industrial estates. and an IT park that are being developed at Haridwar, Pantnagar and Dehradun. If these proposals materialise, the state would get investments worth nearly Rs 3500 crores in the next few years. Around 4500 acres of land is being developed at Pantnagar, Haridwar and Dehradun.

The break-up of the proposals received shows that maximum units have been proposed in steel manufacturing, food processing and general manufacturing units followed by electrical goods manufacturing, pharmaceuticals and textile units. Interestingly, the emphasis is towards no discharge of effluents to water bodies thereby preventing water pollution or wherever unavoidable would have integrated wastewater treatment facilities.

Table XI-9 Proposals received for industries

Industry Type	Number
Steel factories	54
Food processing units	52
General Manufacturing units	50
Electrical Goods	45
Pharmaceutical units	35
Textile Factories	29
IT units	13

Cleaner production

Cleaner production is envisaged for the state while undertaking industrial development. Cleaner production describes a preventive approach to environmental managgement and encompasses eco-efficiency, waste minimisation, pollution prevention, or green productivity. The government should look at incorporating policies which look at how goods and services are produced with the minimum environmental impact under present technological and economic limits.

Cleaner production does not deny growth: it merely insists that growth be ecologically sustainable. It should not be considered only as environmental strategy, because it also relates to economic considerations.

In this context, waste is considered as a 'product' with negative economic value. Each action to reduce consumption of raw materials and energy, and prevent or reduce generation of waste, can increase productivity and bring financial benefits to enterprise. It protects the environment, the consumer and the worker while improving industrial efficiency, profitability, and competitiveness.

The key difference between pollution control and cleaner production is one of timing. Pollution control is an after-the-event, 'react and treat' approach. Cleaner production is a forward-looking, 'anticipate and prevent' philosophy.

Uttaranchal should actively promote cleaner production with the setting up of centres that can process and leverage local resources sustainably, add value and create economic development that does create negative environmental externalities.

Annex XI-1 Highlights of the Industrial Policy 2003 of Uttaranchal

The first Industrial Policy of Uttaranchal was declared in 2001. In March 2002, Hon'ble Prime Minister of India during his visit to Nainital, announced a special package for Uttaranchal and Himachal. The official notification to this effect was issued by Government of India on 7th January 2003.

Keeping in view the industrial opportunities in the State, its inherent advantages, building upon the past experience and keeping in view the existing economic scenario, the State Government decided to come out with a New Industrial Policy. The Stake holders were consulted and experiences from other States were factored into drafting the New Industrial Policy of Uttaranchal.

The New Industrial Policy 2003 got the approval of the Hon'ble Cabinet of the State on 13-06-2003 and is to be placed on the table of the House.

The Industrial Policy 2003 contains the vision for Uttaranchal, advantage Uttaranchal – Non Fiscal and Fiscal, Institutional frame work (Single Window, Udyog Mitra etc.), sections on Land, Power, Simplification of Labour Laws, Finance, Infrastructure, Public/Private Partnership, Deemed Clearances etc. Besides this, sections on individual sectors like Floriculture, Tourism, Handicrafts, Handlooms, SSIs, Khadi and Village Industries, Information Technology, Bio-Technology, Herbal, Wool & Wool based Industries, Agro and Food based Industries, Tea Industry, Forest based Industries and Mineral Water Bottling Plant etc, also find place along with the main features and opportunities in these sectors.

Policy at a glance

- Institutional Mechanisms for Industrial Facilitation.
  - State Industrial and Investment Promotion Board under the Chairmanship of Hon'ble Chief Minister with experts and Captains of Industry along with Government representatives.
  - State Udyog Mitra under Chairmanship of Hon'ble Chief Minister and District Udyog Mitra under Chairmanship of District Magistrate.
  - State level Committee under the Chairmanship of Chief Secretary and District level under District Magistrate for Single Window Clearance.

- Non- Fiscal Advantages-
  - Inherent Advantages.
  - Procedural Facilitation:
    - Udyog Mitra.
    - Single Window System.
    - Simplification of procedures under different labour laws.
    - Deemed Clearances.

- Fiscal Advantages-
  - Under the Central Government Industrial Package, concessions including 100% Excise Exemption for 10 years, 100% income tax exemption for first 5 years and thereafter 30% for companies and 25% for others, Central investment

subsidy @ 15% with maximum of Rs. 30 lakhs on plant and machinery, Central Transport subsidy schemes extended upto 2007.
- State Interest Incentive @ 3% per annum with maximum of Rs. 2 Lakhs for new SSIs and modernisation and expansion of existing SSIs.
- State Interest Incentive @ 3% per annum with maximum of Rs. 2 Lakhs for rehabilitation/revival of SSIs.
- Entertainment Tax Exemption for Multiplexes for three years & for Ropeways & Amusement Parks for five years.
- Exemption from Entry Tax on plant and machinery.
- Land use conversion charges to be rationalised.
- Concessional Stamp Duty for IT Park and Specialised Industrial Estates.
- Tourism has been given Industry status.
- State Assistance for patent registration, ISO series certification, Installation of pollution control equipments etc.
- Purchase and Price Preference for SSIs and Purchase Preference for Non- SSIs in State purchases.
- A special provision for remote areas which are situated 3000 ft above mean sea level, wherein State Interest Incentive is applicable @ 5% per annum with maximum of Rs. 3 Lakhs.

- Main provisions

  - Public Private Partnership for infrastructure development and development of maintenance of specialised Estates.
  - Land Bank – scientific and modern development of estates in Clusters.
  - Mega Projects above Rs. 50 Crores to be dealt with by Chief Secretary level Committee for any special dispensation.
  - Others sectors have been incorporated in the Policy drawing their main features.
  - IT and BT sectors have been given special concessions in Labour Laws, upto 2 mbps connectivity free for 1 year, land use conversion facilitation, Industry status, etc.

As part of power sector reforms, Power Regulatory Commission has been set up and although the Commission fixes the power tariff for consumers, keeping in view the additional investment in hydro power generation and strengthening of the grid, quality power is likely to be available at competitive rates.

Annex XI-2 Industrialisation during British Raj

Industrial development is among the drivers setting the tone for the nature and impacts of development. An excellent example of how the traditional Iron smelting operations in Kumaon were `industrialised' by the British and yet the lack of investments deterred them from further expansion even while there was a market opportunity, as private investors were keen to get more out of the government. An excerpt is presented here:

Kumaon Iron Works, the British and Traditional Technology

by D.P. Agrawal and Pankaj Goyal

Various studies point out to the conflicts of the British with the traditional Indian technologies, as also between iron industries in Britain and India. Kumaon under the colonial rule for more than 120 years. The mineral wealth of Kumaon drew early and special attention of the British. The colonial rule marked the beginning of exploitation, demolition and commercialisation of the Himalayan wealth for the benefit and expansion of the British Empire. The new government imposed new rules, applied restrictions on the rights of local communities regarding the use of natural resources. They started new land tenure system to maximise the revenues.

Traditional Technology

People of Kumaon were aware of iron smelting practices and it was part of their folklore. The iron technology evolved and was mastered in the first millennium of BC.

The Kumaon Iron Works

The chronology of iron smelting in Kumaon can be briefly sketched in the following phases of the British colonial interest in the Kumauni iron making. High quality iron ore, rich forests for charcoal and an abundance of running water as a source of energy were of major interest at the Kumaon Iron Works.

Phase I: Pre-1850
Jim Corbett conveyed a living tradition of the richness and use of Kumauni ore. During that period 7 iron ore mines with 187 families in work, 54 smelting forges with 167 families in work and 86 refining forges with 273 families in work were found in the Kumaon region.

Phase II: 1850-60
After the report of the 1850s, a small group of British individuals started to promote and develop iron making. This led to the establishment of iron working sites at 4 places: Dechauri, Kaladhungi, Khurpa Tal and Ramgarh.

Phase III: 1860-65
Julius Ramsay was hired to manage iron making using the blast furnace. A total of 424 tons of pig iron was made during three different campaigns.

Phase IV: 1876-79
In 1876 the government made the last attempt and production was again started. The "Sowerby blast furnaces", now supplemented by hot blast, was used in 7 different campaigns, from January 1877 to September 1878, and a total of 1,080 tons of pig iron were made.

Minerals and Logistics
Ores: Two different qualities of iron ore, were considered. But the most important were extensive fields of easily accessible, low quality surface iron ores deposited in the foothills of the mountains, close to Dechauri and Kaladhungi. These ores were described as Bhabar ores. The ore was found on the ground in blocks of different sizes. The other areas were close to Ramgarh up in the hills, which had long been mined underground by the Indian iron makers.

Coal, Wood Consumption
Not only the amount of coal available, but also its quality is of importance. The kind of wood used in making charcoal influences the heat content, and also its strength. It has to be strong enough to carry the weight of the ore in the blast furnace.

Water Power, Steam and Transport
Power was not only needed for the blowing machinery, but also to run hammers, the rolling mill and different kinds of machinery in the workshops. The masonry water channels in Dechauri were built partly for irrigation purposes, and partly to supply the iron works with water. Since rainfall was extremely unevenly distributed through out the year, the addition of steam power was needed in the new works. Thus the power was to be delivered by a combination of waterpower and steam power.

Topography was not only important in the physical planning of the works site itself, but it was still more important in a wider geographical sense. Ramsay put most of his efforts into optimising the technological set up at the works. He put emphasis on the transport of raw materials to the works and completed commodities from the works, as tactically crucial for success. But lack of capital did not permit the company to build the road to Ramgarh. When the Ramgarh ore was used during the late 1870s, sheep and goat transported the ore.

The technical efficiency of blast furnace was measured in two ways: 1) By the amount of coal needed to produce a certain quantity of iron, and, 2) By the quantity of iron produced as a percentage of ore input.

The Indian Workers
Kumaon was, like the rest of India, pre-eminently agricultural, but according to the census of 1872 there was also a section of the population exclusively connected with metalworking. Close to 19,000 inhabitants were classified as *Lohars* (blacksmiths). The Agaris, not more than 800 according to census, were miners and ore smelters. 90 blacksmiths were employed in Dechauri, but the traditional blacksmiths were not given any preference in the recruitment of workers. In general Julius Ramsay wrote that the working methods and the tools of the Indian workers were different from those used in Sweden. He also admitted the

skilfulness of the workers, but no effort was made to use their traditional skills. There was a tradition of migrant labour in Kumaon. During the summer workers retreated up into the mountains, not only to avoid the heat in the lower altitudes, but also to take part in agricultural work in the mountains. The reason for the seasonal migration was not only the negative push of a malignant climate, but also the positive pull of the work. This type of behaviour of the Indian workers shows that the Indians were part of a society and economy, which was outside the control of the Europeans.

The Market Strategy

One dominating reason for building the Kumaon Iron Works was the probability of supplying iron to a potentially very big Indian market, principally to the big colonial public works, irrigation, transportation infrastructure, the railroads, the telegraph and military establishment.

An important part of the market strategy of the Kumaon Iron Works was the proposed tramway from the foothills, connecting to the main railway stations of India. The Kumaon Iron Works could have used this tramway as a means of transport for the produce and this would have given it access to important markets. To raise capital for the proposed tramway, the owners embarked on a long controversy with the government and the tramway was never built.

XII. TRANSPORT

Historically, the major forms of transport in the Himalayas have been porters and pack animals. They continue to remain important, but the construction of roads has introduced motorised vehicles and has changed the traditional transportation pattern. The formation of motor owners union in the region gave a unique mechanism for a collective of people to serve many routes instead of concentrating on the most lucrative and was the first formal public transport system catering to local population as well as the pilgrims.

A. Road Development in Uttaranchal

A Himalayan farmer's view

"People believe that if there are roads in the village, development has taken place. But what is the direct benefit of having a road in our village? The people here are not connected with the roads, but with their forests. The grass will go, the trees will go, the stone will go from our village." Himalayan farmer, quoted in Olivia Bennett 1999a

Major roads are sparse in Uttaranchal, and there is negligible rail infrastructure in Garhwal and Kumaon. Roads are narrow mountain roads, with limited load-bearing capacity, hence average vehicular speeds are quite low. The construction of roads in the region picked up after the 1962 and 1965 wars with China and Pakistan respectively, when, for defence purposes, many new roads were constructed or extended.

As the terrain is hilly, the total road distance in Uttaranchal is much more than the aerial distance. This has led to a unique dichotomy. While the length of pucca roads under the Public Works Department (PWD) per lakh population is much better in Uttaranchal at 200.91 km, as compared to Bihar (35.1km), in terms of road length per 000sq. km, Uttaranchal has only 346.7 km/000 sq. km while Kerala has the highest at 1160.2 km. Thus using population as an indicator hides the genuine dearth of roads in the state.

Table XII-1 Road length (km) in Uttaranchal

Department	1996-97	1997-98	1998-99	2001-02
(a) PWD	14233	14424	14976	
• National highways	-	-	107	534.45
• State highways	1510	1510	1458	1228.79
• Major district roads	1379	1424	1374	1420.94
• Other district/village roads	11344	11490	12037	6613.41
• Rural roads				4675.52
Roads maintained by local bodies	1428	1439	1539	
• District Panchayats	403	417	505	
• Other local bodies	1025	1022	1034	
Under other departments	2883	2928	3028	
• Irrigation	194	194	194	
• Cane development	478	509	511	
• Forest	1042	936	1086	
• DGBR	1033	1144	1078	
• Others	136	145	159	
Total	18544	18791	19543	

Source: *Uttaranchal At A Glance, 2002-03*

Roads are considered to be a lifeline as they facilitate movement of people and goods. They assume special significance for Uttaranchal due to its physical, geological and ecological character. As in every process of development, road transport has its positive and negative effects. In terms of negative effects, inappropriately designed transport systems can damage the environment in which people live and work as well as threaten individual safety. Thus it is important to ensure sensible road development so that the road to well-being does not become a road to disaster!

B. Road Connectivity

About 64 per cent inhabited villages of Uttaranchal are connected by pucca roads and the remaining 36 per cent villages - mostly smaller settlements located in difficult situations in the upper reaches - suffer from remoteness/ inaccessibility. Furthermore, only 26 per cent villages have bus stops within a distance of 1 km.

Table XII-2 Bus stands and railways stations in Uttaranchal

Year	Railway stations	Bus stands
1997-98	42	2496
1998-99	44	2584
1999-2000	44	2588

Out of the 16,177 villages in the state, 10,260 were connected by roads till the end of March 2003. Approval had been given for construction of roads in a further 1166 villages. A study of road connectivity reveals that Garhwal has the highest number of villages connected by roads followed by Tehri Garhwal and Almora.

Table XII-3 Road connectivity in Uttaranchal

Division	Total no. of Villages	Connected Villages to Road upto 31/3/2004
Uttarkashi	669	395
Dehradun	743	571
Haridwar	497	466
Tehri Garhwal	1836	1320
Garhwal	3388	2191
Chamoli	1132	619
Rudraprayag	661	457
Pithoragarh	1635	670
Champawat	695	350
Almora	2231	1308
Bageshwar	912	432
Nainital	1090	824
Udhamsingh Nagar	688	657
TOTAL	16177	10260

Source: PMGSY, State Profiles, Ministry of Rural Development, GoI, 2004

C. Vehicle Population

Two-wheelers dominate the vehicle population in Uttaranchal accounting for 76.15 per cent of the total. Among two wheelers, scooters and motor cycles account for 44.8 per cent and 41.8 per cent respectively. Cars account for about 7.4 per cent share while buses and taxis have even smaller share of 3.6 per cent.

Table XII-4 Vehicle population of Uttaranchal (as on 31.10.2001)

Type of vehicle	Number of vehicles
Heavy vehicles	`9383
Delivery van	1991
Bus	2913
Maxi cab	3112
Taxi cab	7345
Auto/vikram	5452
Two wheelers	289280
Car/jeep	32514
Tractor	28497

Source: *Uttaranchal Statistical Diary, 2001-2002*

Vehicle population is seen to be highest in Dehradun which accounts for 40.75 per cent of the total. Thus on an average every family has two vehicles in Dehradun, which would be very high by national standards.

Interestingly, while Dehradun has the highest number of two-wheelers and cars in the state, Haldwani has the maximum number of buses and taxis.

Table XII-5 Vehicles on road

Year	Personal	Public	Total
2001	334879	29560	364439
2002	373705	32186	405891
2003[28]	422025	34573	456598

Source: Motor Transport Statistics, Department of Road Transport and Highways, GoI, 2004

The vehicle growth has shown constant increase over the years.

There is a spurt in the growth of vehicle population after the formation of the state as more officials and institutions have been established. Further this growth is also helped by the fact that loans for vehicles are easily available today.

Another notable large-scale activity in context of at least Garhwal Himalaya is construction of roads and choice of technology. The entire important road network in Garhwal is undertaken along the course of river Alaknanda, Bagirathi and Mandakini and the most preferred method of road construction has been blasting. This has been chosen right up to Badrinath, Hanuman Chatti, Gangotri and Gauri Kund. One can understand the need for infrastructure development and also the fact that roads increase mobility as well as are key to development but the question remains as to the path of roadways and the choice of technology. One has to see places like Kaliya Saur which have become perennial landslides so much so that the Engineering University of Roorkee (now IIT) has undertaken a long term project to check the landslide. The question here is - what was the need to cut through the bottom of the mountain for building road. It would have been safer and cheaper in long run to have the roadways along the ridges. Secondly, when we know that the Himalayan Mountains are fragile, then, do we not have safer means of cutting through the rocks other than blasting?
Source: www.mtnforum.org

[28] Based on Data for 5 Major locations

The increased interest in Uttaranchal as a tourist and pilgrimage destination also adds to the number of vehicles on the street at any one time.

Uttaranchal's killer roads scare away tourists

Uttaranchal, the land of the Four Dhams, seems to be fast taking its famed title of being a "road to heaven" too literally. Despite the administration's promise to improve road safety, more than a hundred road accidents have taken place in the state, leaving nearly 700 dead in 2001 alone. The failure of the state administration to ensure safety on the roads and the consequent accidents could bring the curtains down over the new-found boom.

	Year	No. of persons
Persons killed	2000	556
	2001	704
Persons injured	2000	860
	2001	1113

The state administration has started checking the state of vehicle, but the exercise barely follows the full procedure. No provision exists to scrutinise the vehicular safety of the tourists. To add to the mess, the state does little about vehicles coming from areas of maximum tourist inflow, like Delhi, UP and Rajasthan.

"The transport office is most definitely faltering as it gives fitness certificates without a complete and proper checking of the bus staff. The officials are also lax in their approach", remarked Vijay Godiyal, a resident of Rishikesh.

According to Sanjay Shastri, president of Yatra Buses Union, "the traffic in these areas has increased but the roads have also been widened. The vehicles coming from outside the state are responsible for these accidents. The administration has no control over them. There are drivers coming from the plains who have little knowledge about hill driving. They do not control their speed."
Source: www.indiatraveltimes.com

D. Energy and transport

Energy consumption in the transport sector is crucial not only because the sector is second largest consumer of energy but because different modes of transport use energy with varying efficiency. It is estimated that the transport sector consumes nearly 40 per cent of the energy in India. The corresponding figure is not available for Uttaranchal. However, it would not be incorrect to say that a large part of diesel and petrol supplies would be for the transport sector.

E. Environmental Implications

Deforestation

Road construction has been one of the major forces of change for mountain people and their forests.

Ever since the enactment of the Forest Conservation Act 1980, a total 2311 ha of forest land has been transferred for purpose of building roads. This is mostly for the expansion and widening of many of the existing roads, as the forest laws make it very difficult for new roads to be established.

Table XII-6 Forest land transferred for building roads

Period	Land Transferred (ha)
1981-1990	665.28
1991-2000	1223.07
2000-2001	422.85

Source: State Forestry Statistics, GoUA, 2001

Construction of roads received an impetus after the formation of Uttaranchal. At the same time, several projects under different categories, were brought under the head of National highways, and this gave further impetus to road construction.This makes it imperative to evaluate the environmental impacts of road construction, especially the handling of debris.

It is often seen that cut and fill technology is used in road construction in Uttaranchal, which entails more powerful blasting than usually required. This leads to huge pits being created which then need to be filled. The debris is often thrown down the mountain, destroying the forest on the slopes of mountains. The natural inclination of the hill face is also disturbed by road cutting operations. The debstabilising of the terrain has resulted in many roads being buried during the recent earthquakes beneath rubble initially loosened when the roads were blasted through the mountains. Additionally, road construction, together with quarrying, has greatly disfigured the mountain landscape, and traffic pollution from the new roads will affect the wildlife severely.

At times the construction of roads frequently cut- across the debris flow tracks. The result is that debris is dumped on the roads in every surge, particularly during the monsoons. When debris has accumulated in sufficient amount blocking the road, it is pushed down on the lower slopes to clear the passage. Besides causing traffic hindrance, this also destroys the natural vegetation- ecosystem on the lower slopes.

As a result of ecologically unsound methods of constructing roads, a large number of trees along the roadsides are falling down. Improper road construction results in soil erosion, which in turn leads to uprooting of large trees and degeneration of lower plants. This can cause serious ecological imbalances, adversely affecting run-off factors, temperature gradient, surface radiation etc.

Exploitation of forests

Historically, roads have been developed with the objective of providing access to valuable resources hidden in a region. It would not be wrong to say that roads were built with the extractive purpose. Even when the roads are not built primarily to provide access to valuable resources such as forests, they often lead rapidly to new pressures on resources by implication by if not by design.

There is growing realisation that roads not only destroy the environment but provide little financial return for locals in exchange for the heavy ecological price. Local groups and one regional political party have begun to protest such development priorities.

Road to disaster via Corbett Tiger Reserve: the proposed highway from Kotdwar to Ramnagar!

A highway has been proposed to connect Kotdwar to Kalagarh, and on to Ramnagar. The highway will pass through the Corbett Tiger Reserve along its southern boundary, with several stretches of the planned road traversing the core areas of the tiger reserve between Khara Gate and Kalagarh town. The remainder will run largely through the buffer zone.

Conservationists managed to get a stay order from the Supreme Court in April last year during the proceedings of an ongoing PIL on tiger conservation. Solicitor General Harish Salve mentioned an interim application submitted by the Wildlife Protection Society of India (WPSI), which clearly outlined the disastrous impact such a highway would have on wildlife, as it would bring in its wake a high frequency of heavy vehicular movement, proliferation of road-side establishments for food and vehicular maintenance, thereby causing noise and disturbance levels to reach mind-boggling levels in this hitherto prime wildlife habitat.

Thanks to the Supreme Court directives, the highway construction has been stayed for the moment, but it is far from being a permanent solution to the problem. Currently, the existing road networks in the state make use of roads lying within the jurisdiction of Uttar Pradesh, and thus vehicles plying between far-flung origins and destinations within Uttaranchal, have to pay various taxes that accrue to the UP transport department. Transporters in particular resent having to pay dual taxes and take long circuitous routes to their destination. The state therefore feels a compulsive need to make roads that will make it possible for vehicles to traverse the state without having to criss cross Uttar Pradesh.

Yet another reason for the compulsion to build roads is the lobby of contractors and the timber industry who benefit through such projects. For instance, by the time the stay was ordered, around 7000 trees had already been felled. The speed with which this was done makes it abundantly clear that environmental concerns are not taken into account in the process of planning and executing road projects.

If the solution to this problem had been sought with environmental concerns – and not "developmental" ones - being paramount, it might have been a good idea for the Central government to arbitrate between the UP & Uttaranchal governments, and enforce either some kind of a moratorium or waiver of this dual taxation, or maybe effect an increase in the number of kms which a vehicle is allowed to traverse in another state without inviting taxation – if its origin and destination is within its own state. Calculated on the basis of state's annual revenue, this financial setback may undeniably amount to a sizeable sum, but in the long run it would still be too little as compared to the massive environmental degradation we may suffer at the hands of faulty planning at this stage.

Although the highway construction has been stayed for the moment, it should not be forgotten that that its planning and execution was bad in law, otherwise it would never have invited the attention of the Supreme Court. The significance of the Supreme Court stay order lies in the fact that for the time being the road cannot be constructed even in the reserve forest land, as has been proposed by the state government. The stay order sets an important precedent for protecting reserve forest lands and national parks from mega road construction.

Air Pollution

Uttaranchal has only two air quality monitoring stations, both in Dehradun. Respirable Suspended Particulate (RSPM) levels were measured in various cities and towns including Dehradun in India by CPCB. From the data available from 26 cities in which air quality is monitored by CPCB, Dehradun was found to have the worst particulate problem, exceeding the SPM standard almost by a factor of six. The monitoring results show that RSPM levels exceeded the NAAQS (annual average) in residential areas as well as industrial areas of Dehradun.

Table XII -7 Status of air pollution in Dehradun

	Year	Sulphur dioxide	Nitrogen Dioxide	SPM
Industrial at Rajpur road				
Dehradun	1999	17.20(L)	17.70(L)	238(M)
Dehradun	2000	19.10(L)	18.30(L)	235(M)
Dehradun	2001	19.60(L)	19.70(L)	283(M)
Dehradun	2002	17.60(L)	20.80(L)	336(M)
Residential at Clock tower				
Dehradun	1999	17.00(L)	15.90(L)	197(M)
Dehradun	2000	18.10(L)	18.50(L)	255(M)
Dehradun	2001	19.90(L)	21.40(L)	308(M)
Dehradun	2002	18.50(L)	20.90(L)	405(H)

Source: Central Pollution Control Board

Traffic contributes significantly to this pollution in in Dehradun city, more so since it has become the state capital. The increased traffic leads to traffic jams and congestion on the roads, which in turn degrade the roads, decrease fuel efficieny and exacerbate certain types of air pollution like ozone pollution.

Apart from Dehradun, other cities are also expected to have high pollution levels because of increased flow of traffic. These include Haridwar, Rishikesh, Roorkee, Haldwani, Rudrapur, Kashipur and Dehradun.

Other impacts

Due to the lack of data, some of the other impacts cannot be quantified but these are equally critical to ecological sustainability of Uttaranchal. These impacts are:

Road construction in hill areas involves

Traffic policemen and exposure to auto-exhaust

Traffic policemen are directly exposed to auto-exhaust mixtures that mainly contain air pollutants like carbon monoxide, benzene, lead, etc. Benzene is absorbed by inhalation. Investigations were undertaken in six cities, including Haridwar and Dehradun, for biological monitoring of exposure to benzene in traffic policemen of north India. Investigations of urine samples collected at the end of the day showed evidence of phenol: almost one-third of the retained benzene is excreted in urine as conjugate phenol and dihydroxy phenol. The presence of benzene is measured in relation to specific gravity and/or creatinine concentration in the urine.

The conclusion drawn at the end of the study include:

- Higher amounts of benzene are present in ambient environment of north Indian cities.
- Traffic policemen are facing a serious health hazard through occupational exposure to benzene. Creatinine values were alarming in Delhi, Dehradun, Meerut and Muzaffarnagar.
- Social habits like alcohol intake and smoking increase the potential harmful effects of benzene, with smoking having the worse effect.

Vikram or Vethal

Vikram – the basic transport lifeline of the towns of Uttaranchal is one of the most polluting vehicles in the country. The vehicle not merely emits smoke, which chokes congested areas, it also contributes significantly to noise pollution. In fact, many of the long standing drivers of the Vikram have loss of hearing. While wet scrubbers and other devices to reduce pollution are being mooted by the UEPPCB, unless other less polluting vehicles are also allowed to go on roads such as shared taxis using CNG and a good axial transport system created for the main routes, the Vikrams will continue to be vethals.

operations like blasting excavation, chipping of mountain slopes to desired accessibility. These operations create geological disturbances in the mountain body. The blasting operations set in action dynamic forces causing movements of slip zones, cracks, fissures and weak planes. Huge amounts of explosives used in construction works of road have adversely affected the ecosystem of the region and the stability of mountain slopes.

Construction of bridges and culverts on the road as well as due to cutting operations leads to very high increases in the velocity of run-off at lower levels. This leads to eroding of banks and threatens the existence of trees and vegetation on the hill slopes.

Natural water resources get disturbed due to blasting. Moreover, improper disposal of fuel, lubricants used in the process contaminates both surface and groundwater.

A large quantity of excavated material that is disposed on the lower slopes is carried by the river and gets accumulated in the dams and reservoirs, reducing their life-span.

Erosion from road sites

Scientists have estimated the erosion from road sites to be ten times more than from agriculture fields, 200 times more than grass land and 2000 times more than forest cover. The environmentalists on the basis of various researches have revealed that one-km length of road construction requires removal of 60,000 m3 of debris from the site. Dr. Satender in his book on Disaster Management in the Hills has estimated the total debris removal for roads in Uttaranchal using the above factor. This is calculated for the entire length of the mattled road in Uttaranchal, i.e., 16654 kms. The debris removal comes to 999240000 m3 and it provides an indication of the damage caused to environment and stability of the region due road construction.

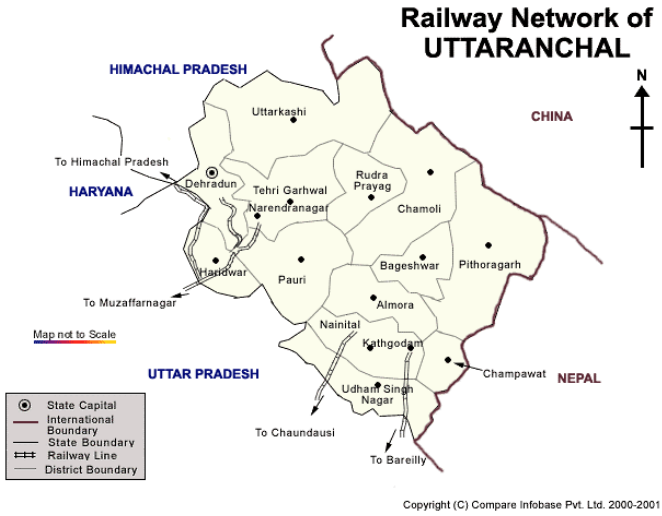
F. Other modes of transport

Railways

Rail transport is very elementary in Uttaranchal. The total route length is 356 kms which translates into 6.66 km per '000 sqkm of area in terms of density of route length. While this is highest amongst the hill states, it is far lower in comparison to other states in the country. Dehradun in Garhwal and Kathgodam in Kumaon are the two main stations in Uttaranchal.

Figure XII-1 Rail Network of Uttaranchal

B.



G. The Way Forward: Future Transport Options

Airships

The initial costs in setting up a rail or road infrastructure are very high, especially in hilly terrain. In such areas, the aviation sector has the capability to connect remote places in a speedy and efficient manner.

Uttaranchal is a good candidate for the development of an aerial transportation network for movement of goods and passengers using airships. An airship is an airborne vehicle obtaining most of its lift from lighter-than-air gas, usually helium, contained in the envelope. An airship is more environmentally friendly than either road or rail transport. A gondola is attached below the envelope, inside which the passengers/goods are located. Since airships are capable of vertical takeoff and landing, their infrastructure related requirements for operation are minimal.

Development of railways in India and its impact on the forests of Uttaranchal

Building of railways is considered to be the landmark in the history of Indian forestry. In fact, construction of railways, which started in 1853, was the reason behind creation of forest department and enactment of the Forest Act in 1865 in India during colonial period. The large-scale destruction of accessible forests in the early years of railway expansion led to the hasty creation of a forest department, set up with the help of German experts in 1864.

During the early period of forest management there was a heavy demand for sleepers started from 1874-75. The process of timber extraction, for instance, had to serve both the goals of revenue generation and supply of sleeper woods and other industrial goods, for the expanding commercial economy and growing political integration of the late nineteenth century.

In the Kumaon region there is evidence that the needs of the empire and not of the local people led to rapid forest denudation. According to Atkinson's Gazetteer, the forests were denuded of good trees in all places. The destruction of trees of all species appears to have continued steadily and reached its climax between 1855 and 1861 when the demands of the Railway authorities induced numerous speculators to enter into contracts for sleepers, and these men were allowed, unchecked, to cut down old trees.

IIT Bombay is working on a research project for developing airships for use in Uttaranchal. The program will be carried out in three phases: conceptual design phase (six months), preliminary design phase (12 months), and detailed design and development phase (18 months). Preliminary cost estimate for the total program (including 3 prototype airships) is Rs. 100 to 125 crores (Bought out airships of this class cost around Rs. 30 crores per airship).

Building airships will create employment opportunities for the local population. If airships prove to be useful for transportation needs of hilly areas, many new markets can open up, such as Himachal Pradesh, Sikkim, Nepal and Bhutan. Airships developed in Uttaranchal could then be supplied to these markets.

Use of airships for Uttaranchal

Uttaranchal could use airships for a variety of applications, like:

- Transportation of tourists from major getaway points to the various locations of tourist interest.
- Alternate mode of transportation for passengers between major cities of the state, or from the major cities to towns.
- Transportation of essential items such as foodgrains, vegetables, LPG cylinders to remote areas.
- Transportation of perishable goods and agricultural produce from remote areas to the point of sale.
- Provision of relief supplies and medical/paramedical staff and associated equipment during natural disasters such as landslides and earthquakes and emergencies.
- Aerial inspection and survey for geological, ecological, forestry applications.
- Control of illegal activities like poaching and logging.

Ropeways

Ropeways have been used effectively in the neighbouring state of Himachal Pradesh, especially in Kullu district, to enhance transportation. There are several distinct advantages of establishing rope ways such as;

- Construction and maintenance costs for rope ways are lower than for railways and roads.
- Ropeways are much less susceptible to mountain hazards such as landslides, avalanches, and flooding than roads or railways.
- Ropeways provide local communities with greater economic control over trade and transport. Roads provide an easier entry point for outside economic interests.
- Ropeways are relatively environmentally friendly; they consume less space than roads and create less air pollution.

However in expanding accessibility with ropeways care must be taken as they can threaten fragile mountain areas, especially if related to mass tourism.

XIII. TOURISM

In Uttaranchal, tourism is the most important activity in the non-farming sector. The aesthetic appeal of the land and the socio-cultural heritage of the state present it with immense potentialities for tourism development. The state is replete with religious and mythological sites that are a rich legacy of the cultural past. The state has always attracted tourists on pilgrimage; in fact, the land is often referred to as the land of the divine - *Dev Bhumi*.

The pilgrim towns of Haridwar and Rishikesh draw the maximum number of visitors anywhere in the world. Other pilgrim destinations in the state are Badrinath, Kedarnath, Gangotri and Yamunotri.

Travel to other destinations in the state started with the British, who developed hill stations and alternate centres of power such as summer capitals and cantonments - Mussoorie, Chakrata, Ranikhet and Nainital are places which have climates similar to places in Britain for prolonged periods of the year. The increase in tourist inflow into these hill stations is a later phenomenon.

Yet other reasons for travel in the Himalayas include mapping and geographical research, fossil hunting, study of biodiversity, climate change, and natural disasters such as earthquakes. . Oddly enough the devastating earthquake of 1991 and the more recent quake of 1999, brought in a heavy influx of official and business tourists and volunteers into the region.

The unplanned growth of places as centres of tourism has had a severe and negative impact on the environment. The inflow of tourists puts tremendous pressure on existing resources and infrastructure. In the year 2000, Uttaranchal received as many as 111 lakh tourists - about 32 per cent the population of the state. The tourist inflow during the year 1987-88 was estimated to be a staggering 138 lakhs. While the problem of pollution of Ganga at Haridwar remains, the state is now faced with the new problem of pollution of rivers at source. The continued tourist activity in the state has resulted in a dramatic increase in hotels. This has intensified the pressure on forests, as the main source of heat energy even in hotels is wood.

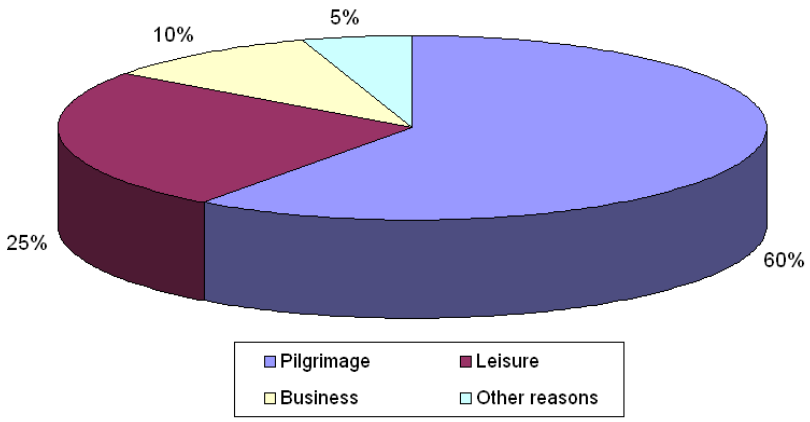
The new state has the opportunity to identify a range of policy-programme-project action strategy to utilise its tourist resources to effectively contribute to the sustainable development of mountain communities without being detrimental to the environment.

A. Tourism in Uttaranchal – Status and Potential

The natural beauty in the form of magnificent glaciers, majestic snow clad monunntains, gigantic peaks, the valley of flowers, skiing slopes and dense forests coupled with places of pilgrimages makes the state a highly promising tourist destination. The important attractions include the emergence of Holy Ganga from the ice cave of Gaumukh in the captivating Gangotri glacier, rarest of the wonderful scenery unveiling suddenly at confluence of Kedar Ganga with Bhagirathi, the twin beauties of Sato Path and Kharak Path in southern slopes of great majestic Chaukhamba giving birth to sacred Alaknanada, picturesque waterfalls of Vasudhara and Sahasradhara, and the confluences of various rivers.

Statistics reveal that the tourists arriving in the state belong to the category of budget tourists. The destination-wise tourist inflow in the state shows that there is predominance of tourists to the pilgrim centres. Haridwar and Rishikesh draw as many tourists as all the rest of the destinations combined. A 1995 study by ICIMOD revealed that the majority of the tourists – 60 per cent – traveled on pilgrimage, 25 per cent on leisure, 10 per cent on business related and 5 per cent for other reasons.

Figure XIII-1 Travel Reasons: Uttaranchal



The study also pointed out that infrastructure, popularity and accessibility does not obstruct any destination from having significant potential from tourism point of view.

Table XIII-1 Percentage of tourists to various destinations

Destination	Cumulative percentage	Destination	Cumulative percentage
Haridwar	45.26	Kedarnath	97.13
Rishikesh	60.23	Gangotri	97.75
Mussorie	68.41	Uttarkashi	98.28
Dehradun	76.35	Yamunotri	98.74
Pithrogarh	81.18	Joshimath	99.11
Punyagiri	85.57	Hemkunt	99.48
Nainital	89.27	Corbett Park	99.70
Almora	92.08	Kathgodam	99.86
Ranikhet	94.53	Kausani	100.00
Badrinath	96.50		

Source: Discussion Paper MEI 95/6, ICIMOD, 1995

Tourists visiting the four major pilgrim centres in the state– the Char Dham - swelled by whopping 70 per cent between 1998-2000.

Table XIII-2 Tourist arrivals at the Char Dham 1998-2000

Tourist Destination	Tourist Arrival (in Lakhs)		
	1998	1999	2000
Badrinath	3.51	3.40	6.95
Kedarnath	0.82	0.81	3.00
Gangotri	2.38	1.22	2.08
Yamunotri	0.86	1.06	0.89
TOTAL	7.57	6.49	12.92

Source: *Food for Thought*, Dr. R.S.Tolia, GoUA

The trend in tourist arrivals in Uttaranchal for 2002-2003 shows that there has been an overall increase of 3 per cent between the years. Domestic tourists showed a shift from pilgrimage to non-pilgrimage centres whereas foreign tourists traveled more to interior parts of the state as well as to pilgrimage destinations of Haridwar and Rishikesh.

Table XIII-3 Trends in tourist arrivals in Uttaranchal

Venue	Jan-Mar 2002			Jan-Mar 2003			% change		
	Domestic (Nos)	Foreign (Nos)	Total (Nos)	Domestic (Nos)	Foreign (Nos)	Total (Nos)	Domestic (Nos)	Foreign (Nos)	Total (Nos)
Almora	12994	402	13396	12686	451	13137	-2.37	12.19	-1.93
Auli	3950	83	4033	3585	133	3718	-9.24	60.24	-7.81
Badrinath									
Bageshwar									
Champawat	1989	5	1994	2023	7	2030	1.71	40	1.81
Dehradun	89839	2286	92125	102834	3019	105853	14.46	32.06	14.9
Gangotri									
Gopeshwar	13134	49	13183	15078	49	15127	14.8	0	14.75
Haridwar	1023424	1334	1024758	1022728	1890	1024618	-0.07	41.68	-0.01
Hemkund Saheb									
Joshimath	2758	42	2800	1298	44	1342	-52.94	4.76	-52.07
Kathgodam	9732	64	9796	10116	68	10184	3.95	6.25	3.96
Kausani	6900	81	6981	9642	8	9650	39.74	-90.12	38.23
Kedarnath									
Kotdwara	33950	1310	35260	52809	1440	54249	55.55	9.92	53.85
Mussorie	255355	592	255947	255620	468	256088	0.1	-20.95	0.06
Nainital	67960	1297	69257	67871	1184	69055	-0.13	-8.71	-0.29
National Corbott Park	16775	1508	18283	18847	1503	20350	12.35	-0.33	11.31
Pauri	8527		8527	8631	23	8654	1.22	0	1.49
Pithoragarh	13313	34	13347	11958	28	11986	-10.18	-17.65	-10.2
Punyagiri									
Raniketh	10007	73	10080	10172	128	10300	1.65	75.34	2.18
Rishikesh	42281	858	43139	32902	1546	34448	-22.18	80.19	-20.15
Rudrapraya	5151	25	5176	7084	21	7105	37.53	-16	37.27

Venue	Jan-Mar 2002			Jan-Mar 2003			% change		
	Domestic (Nos)	Foreign (Nos)	Total (Nos)	Domestic (Nos)	Foreign (Nos)	Total (Nos)	Domestic (Nos)	Foreign (Nos)	Total (Nos)
g									
Srinagar	11899	51	11950	14126	18	14144	18.72	-64.71	18.36
Tehri	28301	1249	29550	43166	1329	44495	52.52	6.41	50.58
Udhamsingh Nagar									
Uttarkashi	26546	41	26587	31113	68	31181	17.2	65.85	17.28
Valley of flowers									
Yamunotri									
Total	**1684785**	**11384**	**1696169**	**1734289**	**13425**	**1747714**	**174.39**	**216.42**	**173.57**

B. Outlay for Tourism Activities

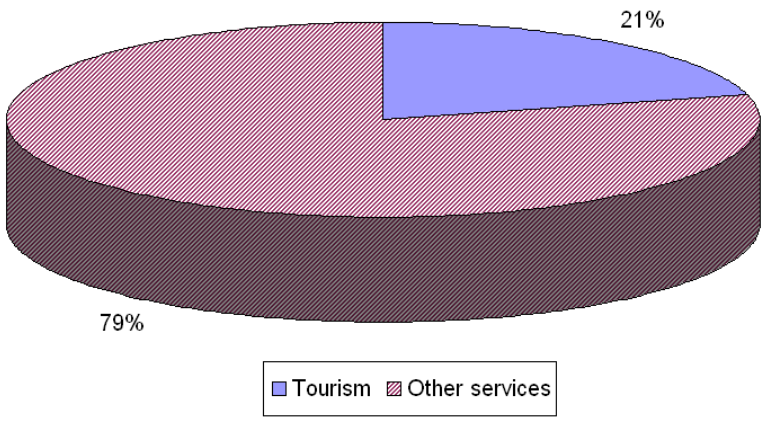
The relatively small population and low population density of the state promises a clean and wholesome environment, which has been recognised by the State. Expenditure on schemes for tourism development and promotion of tourism in Uttaranchal has progressively increased over the years. In the ninth five year plan, approximately Rs 8600 lakhs have been spent which is more than ten times of the amount spent during 1980-85. However, in terms of percentage outlay, the outlay on tourism accounted for less than one-fourth of the outlay on General Economic Services for the annual plan for 2002-2003, of which tourism forms a part.

Table XIII-4 Plan wise financial allocation

Plan period	Outlay (Rs. Lakhs)
First plan	0.50
Second plan	10.00
Third plan	14.00
Fourth plan	72.50
Fifth plan	200.00
1978-79	175.00
1979-80	100.00
Sixth plan	750.00
Seventh plan	2800.00
Eighth plan	3800.00
Ninth plan	8600.00
Tenth plan	30000.00

Source: compiled from various documents

Figure XIII-2 Outlay for Tourism as part of General Economic Services, 2002-2003



Source: Uttaranchal At A Glance 2002-2003

C. *Types of tourism*

Visitor tourism, pilgrim tourism and cultural tourism have always been popular in Uttaranchal, though pilgrimage has traditionally accounted for the biggest segment. The state is blessed with enormous resources for cultural, adventure, wildlife, nature and leisure tourism and a wide variety of entertainment and sporting activities, which attracts the domestic as well as foreign tourists.

Table XIII-5 Key Tourist Centres across different type of tourism

Type of Tourism	Tourist Centres	
	Key Centres	Potential Centres
Pilgrimage	Badrinath, Kedarnath, Yamunotri, Gangotri, Haridwar, Hemkund Lokpal, Nanakmatta, Meetha-Reetha Sahib, Piran Kaliyar, Punyagiri; Nanda Devi Raj Jat; Kailash Mansarovar Yatra	Panchbadri, Panchkedar, Panchprayag, Patal Bhuvaneshwar etc.
Cultural Tourism	Jhanda Mela (Dehradun), Surkanda Devi Mela (Tehri), Magh Mela (Uttarkashi), Nanda Devi Mela (Nainital), Chaiti Mela (Udhamsingh Nagar), Purnagiri Mela (Champawat), Piran Kaliyar Mela (Haridwar), Joljivi Mela (Pithoragarh) and Uttarayani Mela (Bageshwar)	
Natural Beauty	Queen of the Hills, Mussoorie, the Lake District of India - Nainital, Kausani, Pauri, Lansdowne, Ranikhet, Almora, Pithoragarh, Munsyari	Ghuttu valley (Tehri)
Adventure Tourism	Mountaineering (Bhagirathi, Chowkhamba, Nanda Devi, Kamet,	

	Pindari, Sahastrataal, Milam, Kafni, Khatling, Gaumukh), trekking, skiing (Auli, Dayara Bugyal, Munsyari, Mundali), skating, water sports (in all the lakes and rivers in Uttaranchal) to aero sports like hang gliding, para gliding (Pithoragarh, Jolly Grant, Pauri)	
Wildlife Tourism	Corbett National Park; Rajaji National Park, Govind Pashu Vihar, Asan Barrage, Chilla, and Saptarishi Ashram	

Garhwal Mandal Vikas Nigam and Kumaon Mandal Vikas Nigam are government enterprises providing accommodation and other tourist facilities for all the tourist spots. Though these enterprises are offering increased and improved services, yet there is a gap between the needs of the tourists and the available facilities. There is no available data on the accommodation at interesting tourist. All stay arrangements are concentrated in main cities. For instance, tourists neither find accommodation in the birth-place of the renowned Hindi poet Sumitra Nandan Pant in Kausani nor in the developing tourist resort of Sheetlakhet and they have no choice but to stay in Nainital. The situation is more or less same of other tourist destinations in the sate.

Figure XIII-3 Tourist destinations in Uttaranchal

Case study: Rudraprayag and Deoprayag

Rudraprayag and Deoprayag are two of the five sacred river confluence towns, or *prayags*, in the Garhwal Himalayas. They are 70 and 140 km from Rishikesh respectively, and are situated along the significant pilgrimage routes from Rishikesh to Kedarnath and Badrinath. Thus they have become critical settlements in the network of the *Char Dham* (Gangotri, Yamunotri, Kedarnath and Badrinath). Their religious significance also makes them important as transit points. The *Yatra* season peaks from May to October, and ends in November. Most of the tourists here come from the middle and lower classes, and approximately 40 per cent are in the the Rs. 10,000+ income bracket. About 500-600 buses and an equal number of private or shared cars pass through these towns daily during the peak *Yatra* season. Of these, about 10 per cent are run by Garhwal Mandal Vikas Nigam (GMVN).

Rudraprayag town is also a starting point for trekking routes in the region. 40-60 per cent of all the tourists from Rishikesh halt at Rudraprayag (source: approximate estimate given by the Collectorate Office, Rudraprayag).

Nightstay facilities:

The town has a number of hotels and dharamsalas. There are 3 dharamsalas (one in Badrinath Temple Committee, catering to about 60-70 people, and two in Kali Kamli accommodating 70-80 people each), which are full during the peak season. There are several lower end (Rs.150-500) lodges, a few middle range ones (Rs. 500-1000) including the GMVN Rudra complex (Rs 100-1200), and a high end hotel (Hotel Monal Rs. 1600-3500). Most of the hotels remain full during peak tourist season, and Monal has 80 per cent occupancy. There is still scope for the development of more medium range hotels (Rs. 700- 1000) and at least one or two more high end hotels, considering the high rate of occupancy at the Hotel Monal.

D. Eco-Tourism

Uttaranchal has a rare diversity of flora and fauna. This makes it an ideal area for developing eco-tourism, projects and activities like jungle safaris, trekking on mountain and forest trails, nature walks, catch and release angling for Mahaseer and other fish species. All these activities have to be conducted in a manner that promotes awareness of environment and helps maintain the fragile ecological balance.

E. Environmental Impacts of Tourism

Tourism in Uttaranchal, while vital for both state finances and people's livelihood, is fraught with many implications for both the environment as well as for community development.

For instance, the urban pockets particularly along the major pilgrim routes are in utter decay. Mass tourism contributes to increased pollution load, most of which reaches the venerated rivers. Rudraprayag and Karnaprayag are themselves two sad examples. Similarly the high altitude meadows, such as the Valley of Flowers, Har-ki-Dun etc have been pushed beyond the point of resilience of natural systems. The expansion of weeds in these meadows is no longer just a threat, it's a reality.

Impact on natural resources

The increasing in the number of tourists visiting to a particular location increases the pressure on land and water. Land degradation is the most common effect of tourism, particularly in hill resorts. Mussoorie, for example, has vastly expanded and degradation has extended to over five kilometers along the ridge. Nainital has been well

studied for the degradation wrought and there have been long term efforts to diffuse tourists to other neighbouring lakes. Construction activities are mushrooming in pilmgrim centres at higher altitudes. Often such construction does not take into consideration the minimum precautions needed when building in such environments, and thus becomes vulnerable to disasters.

Tourism intensifies the water crisis. Most pilgrim centres draw huge crowds and the limited or poor infrastructural facilities collapse under such an onslaught. Religious tourism during monsoon is often the cause of widespread epidemics.

In addition, as most of the tourist centres evolved in places with good natural vegetation, the expansion of areas has meant the degradation of adjoining green belts.

The demand for fuel wood – the primary fuel for restaurants and dhabas - is much higher during the tourist season, especially in the higher parts of the state, leading to further pressures on the forests.

Solid waste management and wastewater handling

Increased flow of tourists has direct impacts in terms of increase of waste and wastewater generation. Wastes in tourist centres come from various sources such as hotels, restaurants, temples, etc. Since most of the tourist centres are small in size, there is a limited capacity to collect and dispose off wastes in these areas. Especially in valleys, wastes is usually dumped into the rivers for convenience. It has been estimated that in and around Valley of Flowers 0.253 kg/capita/day waste is generated. The waste is either strewn all over the place or thrown in rivers, which are now getting polluted at source.

Dry waste poses more threats to environment. For instance, the polythene bags thrown down the Mussoorie hill cover the roots of trees lining the mountain slope and thereby preventing water from reaching the roots. The roots gradually die and the trees get uprooted. Part of the waste that is thrown down the slopes gets carried away with water and pollutes the streams.

Water pollution in and around river-centred religious places like Haridwar and Rishikesh is inevitable. Lakhs of pilgrimage tourists visit these places and take bath in water bodies. Pilgrims offer / throw various religious material into the river.

Impact on local community development

The tourism activities in Uttaranchal have affected the lives of the local communities. Some features of tourism in the state are:

Lack of linkage of tourism with local or regional production systems: Tourism has failed to develop adequate linkages with local production systems, and continues to remain a peripheral seasonal appendage to the local economic systems. There are a number of products and services that can be exchanged by the local communities with the tourists, such as fruits and nuts, handicrafts, herbal medicines, arts and crafts, music and theatre, which need to be linked to tourism so that local communities can also benefit from it.

Lack of retention of benefits from tourism: When linkages with local communities are not built, there is an increased flow of goods and services away from the state. In Uttaranchal, most of the goods and services related to tourism are provided by larger national enterprises and services by agencies in Delhi and state capitals from where the tourist originates. The local people undertake the least remunerative tasks; in these services also there is a stiff competition from the poorer migrant rural workers from the plains of Uttar Pradesh or from poorer regions of Bihar and Orissa.

High level of seasonality: This is an intrinsic character of tourism in the region and though there is a scope of expansion of the traveling season, the mechanisms for coping and the limits to dependence on tourism as a contributor to the local economy must reflect these constraints. Seasonality is also seen as a favourable factor as systems recoup, particularly in areas where the carrying capacities are exceeded during the tourist season.

The struggle of Bhotia tribe in Nanda Devi Biosphere Reserve in Niti Valley best illustrates the impact of tourism development on the local community. The area had a flourishing trade with Tibet, which came to an end after the Indo-China conflict of 1962. With the closure of the trade, the local population also lost the rights over our traditional camping grounds right from Niti down to the lower Terai areas.

In the words of the local Bhotia leader, the closure of the Tibet trade led to people shifting to mountaineering activities as a source of livelihood around Nanda Devi. "In 1982, our area was notified as a National Park vide Uttar Pradesh Government Order No 3912/ 14-3 /35 / 80 dated 6th Sept 1982. The community was never consulted on this important decision, which changed their lives and affected livelihood. The community lost rights to access the areas, which were the traditional grazing lands and also their summer dwellings (*Chanees*). It also led to the collapse of the traditional health care system with the unavailability of herbs and food supplies. Though the community was to be compensated for the restrictions imposed on them athis was not done."

From 1982, the people of the region have been struggling for the restoration of their traditional rights. In October 2001, they passed the Nanda Devi Biodiversity Conservation and Eco Tourism Declaration:

The Nanda Devi Biodiversity Conservation and Eco Tourism Declaration
Gram Sabha Lata, Chamoli, Uttaranchal
October 14, 2001

Today on the 14th of October, 2001 in the courtyard of the temple of our revered Nanda Devi, we the people's representatives, social workers and citizens of the Niti valley, after profound deliberations on biodiversity conservation and tourism, while confirming our commitment to community based management processes dedicate ourselves to the following -

1. That we, in accordance with the resolutions adopted by the World Tourism Organisation's Manila Declaration 1997 on the Social Impact of Tourism will lay the foundation for community based tourism development in our region
2. That in our region we will develop a tourism industry free from monopolies and will ensure equity in the tourism business
3. With the cessation of all forms of exploitation like the exploitation of porters and child labour in the tourism industry, we will ensure a positive impact of tourism on the biodiversity of our region and the enhancement of the quality of life of the local community
4. That in any tourism related enterprise we will give preference to our unemployed youth and under privileged families, we will also ensure equal opportunities for disabled persons with special provisions to avail such opportunities
5. That we will ensure the involvement and consent of the women of our region at all levels of decision making while developing and implementing conservation and tourism plans
6. While developing appropriate institutions for the management of community based conservation and eco tourism in our area we will ensure that tourism will have no negative impact on the bio diversity and culture of our region, and that any anti social or anti national activities will have no scope to operate in our region
7. We will regulate and ensure quality services and safety for tourists and by developing our own marketing network will eliminate the middlemen and endeavour to reduce the travel costs of the tourist
8. While developing the tourism infrastructure in our region we will take care of the special needs of senior citizens and disabled persons
9. As proud citizens of the land of the Chipko movement we in the name of Gaura Devi will establish a centre for socio-culture and biodiversity, for the conservation and propagation of our unique culture
10. We will ensure the exchange and sharing of experiences with communities of other regions to develop eco tourism in accordance with the Manila Declaration of 1997 in those regions
11. Acknowledging the spirit of Agenda 21 of the Earth Summit, Rio 1992, the Manila Declaration on the Social Impact of Tourism 1997 and the International Year of the Mountains and Eco tourism, 2002, we will strive for bio diversity conservation and an equitable economic development within the framework of the Constitution of the Republic of India
12. Today on October 14, 2001, in front of our revered Nanda Devi, and drawing inspiration from Chipko's radiant history we dedicate ourselves to the transformation of our region into a global centre for peace, prosperity and biodiversity conservation.

Source: http:// www3.sympatico.ca/rajiv.rawat/history.html and Mountain Forum

F. The Way Forward: Strategy for Sustainable Tourism

Tourism is one of the most vital sectors of industry in Uttaranchal, for both the state as well as the people, and hence it needs to be developed. However, it is essential that such development be based on sustainability of the environment and of communities. Any strategy for developing tourism needs to change the current situation of high-volume low-value tourism and to identify the high-value low-volume opportunities. This means

- broad-basing of the tourist profile, both economic and geographic;
- proportional decline in environmental threats with increase in number of discerning tourists;
- enlargement of the tourism `cake' bringing in its wake the potential for greater quality based services that the local people can be trained to offer.

The tourism activities associated with the tourists on the basis of which the specific policies and programmes could be drawn are identified as:

Mass Tourism: A large number of tourists visiting the state annually are from this category. Tourism of this kind `happens' more without any design and planning by the state, and thus requires no promotion. In this kind of tourism, tourists end up becoming "mauraders". The social and environmental costs of such tourists are incalculable. Evidence of damage wrought by such tourists is visible in places like Mussoorie and Shimla as well as the centres enroute the Char Dham.

This kind of tourism it breeds all the ills of a large industry - influx of outside commercial interests, widening of economic disparities, lop-sided distribution of income between the local and the outsider and depletion of natural resources and contortion of social values.

Mass tourism's insensitivity to the environmental concerns, both physical and cultural, is itself a sufficient reason for arresting the growth of this kind of tourism. An important factor that is missed is the fact that the revenues accruing at macro-level to the state and the large private enterprises, which is argued as a reason for its promotion, is not proportional to the high levels of investments made for creating and sustaining the infrastructure.

Class Tourism: The Class Tourist is better oriented to the range of destinations and is more often traveling on a purpose. The Class Tourists range from the culturally educated Mass Tourists who have not ventured beyond the identified destination for lack of sufficient information, to tourists exploring the art and culture of the region. A well-developed network of information centres with trained personnel to guide at these centres can convert the marginal Mass Tourist into a Class Tourist.

Among the low-spending Class Tourists are the pious pilgrims, trekkers, amateur skiers, mountaineers, motor-cycle riders, spiritual sanctuary seekers with the numerous ashrams while the high spending Class Tourists are those holiday makers seeking hygienic spas, Club Class Businessmen seeking relative solitude for planning and strategising, heli-skiers and aero-sports lovers.

Given the greater sensibilities and discerning nature of the Class Tourist, a band of honest and efficient guides and local tour operators could grow to service them. Professionally managed training centres which have the ability to devise various packages using the knowledge of the local environment, such as designing botanical and ecological tours, cultural tours based on the nuances of the visitors will need to be developed to generate many more tourism `products' for such tourists.

This would also involve wide-ranging inputs to the local entrepreneurs and will require more care and attention in developing their skills. Some of the destinations such as hot-spring locations, the large number of Protected Areas in the region offer an excellent opportunity to consciously promote this kind of tourism. Investment in this sector will not be capital intensive and can be an area for exploring and implementing alternate technologies and the return on investment will be far larger than in the case of those provided for Mass Tourists, both financially and in terms of lower environmental and social costs.

Value Tourism: At the apex of our classification is the Value Tourist, who is a veteran climber or trekker, researcher, high-altitude flora and fauna enthusiast who has traversed his way through the world and is almost romantic about the Himalayas. The Value Tourist needs no persuasion from image-makers and advertisers and is willing to replace anything that is needed in his travel with local material provided they meet the high quality standards of the tourist. Value Tourists are travelers who completely merge with the Himalayan identity and are extremely conscious of the risks to the local ecology and culture.

The needs of such travelers are also highly personalised depending upon their backgrounds and particular focus on a specific tour. This would require:

- creation of a string of high-calibre professionals who can aid the Value Tourist with more intense and deep knowledge of the area and thematic aspects;
- creating a exclusive club that would serve as a meeting ground for these reclusive travelers; create a schedule of fairs and festivals some of which are less known but which bring to the fore the spirit and élan of the local people and
- create conditions for aviation so that helicopters could ply to points where it could be viably operated and to those destinations where the value tourists could charter.

Tourism, with careful forethought and planning, can thus fulfill its potential of being a high value revenue earner for both the state and the people of Uttaranchal, without causing environmental destruction.

XIV. RECOMMENDATION AND CONCLUSION

In the current development debate, the State of Environment report can generate different kinds of responses, right from the process of assessing the environment to enabling some of the changes in current practices. In terms of assessment, several ideas have been thrown up, including Millennium Ecosystem Assessment. Such new ways of evaluating the environment may make a case stronger for seeking compensation for conserving it. This raises several questions, such as whether an ecosystem is worth preserving only if it is of immediate value to human existence, the intrinsic worth of ecosystems such as desert ecosystems, coastal ecosystems, deep sea ecosystems, etc. It also raises the specter of future conflicts over the management of the ecosystems.

For a state like Uttaranchal, which has a very small population living in diverse ecosystems, and where people have a very strong stake in their environment, not only for survival but also based on reverence, the current challenge is to respond to people's needs while enhancing the quality of the local ecosystems, rather than looking for solutions and resources from outside the state, whether in terms of corporate investment for few large projects, or total dependence on compensation for ecosystem services. The state also needs to devise ways to ensure that any revenue earned by corporate investment is not taken out of the state, and that any compensation received is actually ploughed back to local communities that are the true caretakers of the environment.

A. State Environment Policy

Uttaranchal is committed to development of the state with the objective of providing improving economic and quality of life benefits to its citizens. The state is shortly developing a State Environment Policy in line with the National Environment Policy, which will keep the environmental and development concerns of the people of the state as its central concern.

Eco- Industrial Policies

Environmental policy developed from end-of-pipe controls with the cutting of pollution to the environment as the primary objective. Although policy-makers have gradually added concern with resource issues, the result is a patchwork of policies, regulations, and voluntary programs. There is no overall framework of policy that seeks to optimize utilization of resources in our economies while preventing pollution.

One of the reasons for the increasing popularity of industrial ecology in the world of business is that it seeks whole systems responses to this need for resource efficiency linked to pollution prevention. Research by Michael Porter and Claas van der Linde29 links the economic value of regulation to resource productivity, *a basic industrial ecology measure of sustainability.* (Porter & van der Linde 1995A) The authors emphasize the dynamic character of industrial innovation in response to external pressures (regulations). They offer case studies and statistical evidence indicating that companies in the U.S. and Europe are seizing competitive advantage through the higher resource productivity created by their responses to regulatory pressures.

29 Porter is at Harvard Business School and van der Linde at the International Management Research institute of St. Gallen University in Switzerland.

These companies are looking not just at the costs of compliance but also the opportunity costs of pollution/inefficiency ("wasted resources, wasted effort, and diminished product value to the customer"). When the companies act upon the opportunities, they save significantly from their investments in technical changes that improve environmental and economic performance simultaneously. By eliminating inefficiencies in the use of resources all along a product's lifecycle, managers cut costs and create new values. These inefficiencies include incomplete utilization of material and energy resources; poor process controls; product defects; storage of wastes; discarded packaging; costs of products to customers of pollution or low energy efficiency; and the ultimate loss of resources through disposal and dissipative use. Poor resource productivity also triggers the costs of waste disposal and regulatory penalties.

Reflecting this direct experience in industry, the World Business Council for Sustainable Development now champions the concept of "eco-efficiency" as one of the means of achieving sustainability. It has identified 7 elements of eco-efficiency:

- Reduce the material intensity of goods and services.
- Reduce the energy intensity of goods and services.
- Reduce toxic dispersion.
- Enhance material recyclability.
- Maximize sustainable use of renewable resources.
- Extend product durability.
- Increase the service intensity of goods and services." (WBCSD. 2000)

Ultimately resource efficiency will be a factor in national competitiveness, not just the ability of individual companies to compete. A country's products will have to meet standards imposed by the more advanced countries or they may be banned.

Businesses devoted to resource recovery recommend phasing out the word "waste" altogether from the names of bureaucracies and the legislation giving them their mandate. It is a word that hides the value of the by-products of our industry and commerce. The challenge is creating policies and organizations for managing resources with very high efficiency (by a factor of 4, 10 or higher). These policies should eliminate subsidies for virgin materials; provide incentives to encourage resource efficiency and recovery of materials and energy; and put disincentives on the disposal of materials as waste. Policy needs to encourage full development of resource recovery systems and phase out continued dependence on landfills and incinerators as the primary means of handling discards.

Development Planning Process

Development planning processes need to integrate environmental considerations and concepts of sustainability in order to become truly responsive to people's needs while preserving the environment. The critical steps in the development process in a state stem from

- Formulation and articulation of a policy
- Regulation and legislation to put it into force
- Institutions to implement
- Programs to govern
- Monitoring and evaluation processes.

The real value of eco-system services

Uttaranchal's forest resources are a special feature with important implications for the centre state financial transfers. Forests are a resource that generates benefits to a multiple groups of stakeholders far beyond the confines of the state where they are located. The potential beneficiaries exist at various levels – local, national and global. The cost of preservation of forest is borne by the state apart from the potential loss from non-exploitation of the forest resources. The state therefore, needs to be suitably compensated by way of economic incentive by including forest cover of the state into the devolution formula.

Ecosystem services can be defined as services generated as a consequence of interaction and exchange between biotic and abiotic components of an ecosystem. Some others include goods generated from ecosystems. We know that economies of earth would grind to halt without ecosystem services. Ecosystem services consist of flow of material, "energy and information from natural capital stocks which combine with manufactured and human capital services to produce human welfare". Ecosystem valuation is difficult and fraught with uncertainties. Estimates for Himalayan forests have been based on the estimates of tropical forests and temperate/boreal forests. In terms of species richness, the Himalayan forests are closer to tropical forests. Though the Gangetic Plains owes its origin to geological processes, the ecosystem services such as soil fertility and hydrological regulation flowing through the watercourses emanating from Uttaranchal have a great nursing effects. Although it has been possible yet to give estimates of ecosystems flowing from Uttaranchal to Gangetic Plains, there are certain evidences as given below that testify their value:

- High water status in lowland forest ecosystems than in highlands despite lower precipitation. For instance, through the sal forest in the plains receives 100 cm less rainfall than the forests in Nainital catchment, its (sal forest) water potential both in soil and trees are significantly higher largely because of the downstream movement of water, soil and nutrients resulting in a high productivity.
- Increase in proportion of sand and gravel in downstream areas subsequent to deforestation upstream. The grasslands in plains adjacent to mountains are among the most productive ecosystems of the world.
- In many parts of the world the ecosystem productivities are much lower in plains than in adjacent mountains. In some regions, desert vegetation in plains surround forest vegetation in mountains. In contrast, plains of the Himalayan region productivity is generally greater than in the mountains, indicating an effective downstream flow of ecosystem services.
- Resumption of crop cultivation in the plains immediately after scooping out one meter soil for brick making is testimony to build up of soil fertility.
- Crop cultivation in Gangetic Plains for several thousands of years without widespread degradation is made possible because of the ongoing replenishment of soil and its fertility from the mountains.

Thus it is obvious that a considerable amount of ecosystem services created in Uttaranchal flow to the Gangetic Plains, the grain bowl of the country.

In the following table, a representation of the forest ecosystem services flowing from Uttaranchal and other Himalayan states to enable people to conserve forests is being presented.

Forest Ecosystem Services	Identification of qualitative aspects of Ecosystem Services	Scale of area benefited and example of benefits	Developing tentative financial solutions for enabling the Uttaranchal people to conserve forests
Non Consumptive			
Carbon Sequestration	Rate of sequestration and its effectiveness, difference in forest type, role of community forests	Global, mitigation of global warming	Exploring various options, such as substituting the present firewood subsidy by cooking gas/electric/solar energy at affordable costs, sensitizing people and raising awareness at various levels, working on benefits of this strategy such as use of forest for organic agriculture and marketing.
Soil formation	Replenishment of soil fertility in crop fields. Use of forest litter in crop fields maintenance, control of erosion, soil storages (nutrient and water) comparisons of forest types	Local, National and Global	Justifying a demand for infrastructural support and capacity building for eco-friendly enterprises, such as eco-tourism, those based on organic agriculture and other niche-products
Hydrological regulation	Water filtration by forests spring discharge, control on overland flow, contribution to river flows	Local and National	
Climatic amelioration	Role of forest in water circulation through evapo-transpiration and consequent contribution to humidity rise and temperature moderation	Local and National	
Recreation	Eco-tourism based on forest, wildlife, lakes, glaciers and cultural traits	Local, National and Global	Payment is already there, but needs to be scaled up by creating and enabling favorable environment with the support of central government
Consumptive			
Providing habitat for NTFPs maintenance of organic agriculture and native crop diversity	Numerous NTFPs are being used, some even without any acknowledgement, sustainability of organic culture is largely forest based, and crop diversity is dependent on forest-derived soil organic matter	Local and Regional	Working out a strategy to maximize profits on a sustainable basis at collectors level in case of NTFPs, popularizing organic agriculture and raising awareness about the true value of forests.

B. Few Pragmatic Steps

The government of Uttaranchal realizes several of these aspects and vigorous attempts are being made to enhance the pace of development of the state. Yet, these processes are only marginal and do not reflect the urgent need for significant changes in the processes and to ensure that systems which are already proving to be unsustainable are not blindly adapted.

In order to work out development plans that benefit the people as well as earn revenue for the state on the one hand, and protect and conserve the environment on the other hand, it is imperative that the environment and people are kept central to the planning process. A few suggestions are made below:

Institutional changes for Environment Management

Based on the sensitivity of Uttaranchal's eco-systems and the challenges of development posed by the unique nature , some changes in the institutional structure are proposed for Uttaranchal. There are prediced on the following key factors

- Separation of the regulatory and policy making functions of the state
- Integrating Environment considerations into the development policy process

Department of Environment

The responsibility for the Policy development process in Uttaranchal needs to be with the State Adminsitration. Given that the Adminstration itself may not have the technical and sector specific knowledge, it is proposed that the State create a Directorate or Department of Environment that is independent of the UEPPPCB and is vested with the following roles

- Development of a State Environment Policy (a draft is provided in Annex)
- Technical inputs to the state administration on framing new legisltation and rules
- Creation of standards and guidelines for development in the state. This would include
  - Air and water (and other) emission and ambient quality standards and the need to deviate from National standards (more stringent standards where considered relevant to the State)
  - International Best practies and technology guides for sectors that are being encouraged in the State such as Power, tourism, forest and agri based industries etc.
  - Pre-screening and identification of areas in the state that are suitable for industrial development as a guide/support for development planning
  - Framing and development of Market Based interventions to reduce transaction cost and improve effectiveness of governance

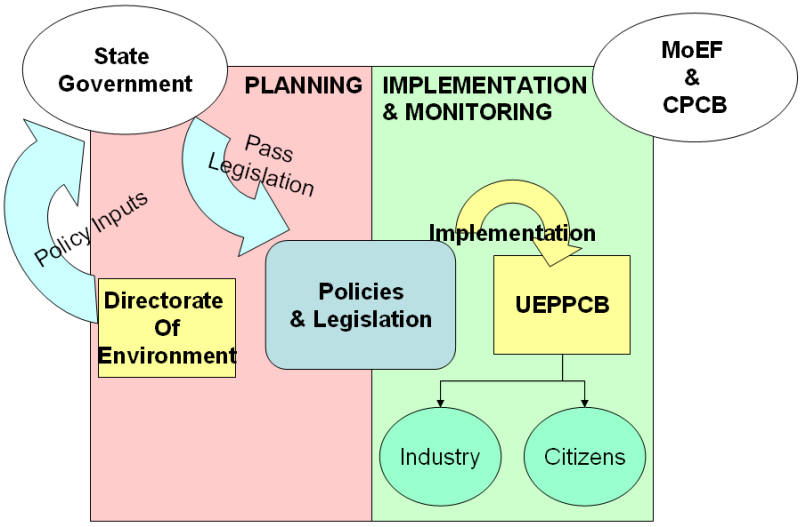
Uttaranchal Environment Protection and Pollution Prevention and Control Board.

UEPPCB should be solely vested with the regulatory role of Environemnt management in the State. This would include implementation and enforcement of all national and state environment rules including

- Issuing permits and consents to industries
- Ambient and industrial discharge monitoring
- Dealing with citizen complaints
- Collection of taxes, cess and other environment related charges

- Feedback and inputs to State and National Policy makers on requirements for modifications to policy for better environment outcomes

The suggested structure is provided below



C. *Conclusion*

Instead of the State of Environment being a one-time effort it has to evolve and integrate with the very processes of sustainable development. Sustainability must be the key basis for development of this complex, fragile and risk prone state with a well-conceived and articulated definition of Sustainable Development. Even though the term has today become a cliché and its popularity is beginning to wane, the concept of sustainable development has however offered a challenge to find some unifying principles for human organization.
Sustainable Development at the broadest level could be conceived as a process of using resources that do not deplete the options for the future generation – more cryptically – it means generating more alternatives while conserving existing options.

If the processes for Sustainable Development of a community have to lead to its being in harmony with its ecology, then it should demonstrate at least four principles which have been clearly identified which characterize sustainable development viz.

- It has to be environmentally sound and demonstrate the potential to renew;
- It has to be enabling the evolution of a more equitable community;
- It has to be creating a community which is self-reliant or endogenous in accessing its needs and investing into its future and
- It has to be economically efficient.

It is also widely recognized that all these principles have to be concurrently adhered to and addressed at various scales (individual through community to the global scales) and different levels of human intervention (policy, programme and practices).

The current impasse that we are really faced with arises out of the precarious situation where developmental activities of the past have had a massive impact on deepening widespread poverty, squalor and environmental degradation, but a feeble impact on sustainable development of local communities and their capacities to maintain/improve their environment and well being.

The real challenge that stare us in the face, is the challenge to hone our skills, choose our technologies and build our resources in such a manner that it provides for the human needs of Food, Clothing and Shelter and enhance the quality of Water, Energy and Biomass systems. This demands that walk beyond institutions and sectors to seek solutions and it is becoming clear that this can only happen as an accretionary process. While in several parts of the world the Community, Government and Markets have colluded and mutually destroyed the unified Society that represented the best of the republics of the past, the challenge today beyond the basic needs is that the Community, Government and the Market should be able to provide the basic inputs for societal development i.e. health, education and occupation.

XV. SUGGESTED ACTION PLAN

The government of Uttaranchal realizes several of these aspects and vigorous attempts are being made to enhance the pace of development of the state. Yet, these processes are only marginal and do not reflect the urgent need for significant changes in the processes and to ensure that systems which are already proving to be unsustainable are not blindly adapted.

In order to work out development plans that benefit the people as well as earn revenue for the state on the one hand, and protect and conserve the environment on the other hand, it is imperative that the environment and people are kept central to the planning process. A few suggestions are made below and have been addressed as

- Policy and Institutional issues
- Sectoral issues

Policy and Institutional strategies

Institutional changes for Environment Management

Based on the sensitivity of Uttaranchal's eco-systems and the challenges of development posed by the unique nature, some changes in the institutional structure are proposed for Uttaranchal. There are predicted on the following key factors:

- Separation of the regulatory and policy making functions of the state
- Integrating Environment considerations into the development policy process

The significant environmental issues have been categorized in three categories. This categorization has been based on the analysis of the information collected and the developmental needs of the state. Most urgent are the issues that require immediate intervention by the state and other stakeholders to control and reverse the trend to the state and its people's advantage.

The most urgent issues identified are forest depletion, unplanned urban development and natural disasters which draw immediate attention for addressing it. Issues that are moderately urgent and need to be addressed are degrading land, dwindling biodiversity, solid waste management, air and water pollution and alternative energy system. Long term or less-urgent but significant issues are decreasing biomass energy, food security, ground water depletion and industrialist pollution.

Controlling of retail pollution

The State of Uttaranchal can consider ways to check urban pollution from retail food and other products by introducing supplier based cess and taxes that require companies selling products in the state to also pay for them. This can either be through a number of options

- through product based charges that provide the end user a refund for return or proper disposal of the product packaging
- having the companies set up (or contribute) to recycling facilitates such as soft drink suppliers setting up facilities for PET collection and recycling.

Decentralized Infrastructure: An alternative model for consideration

Conventional approaches to infrastructure development consider large solutions to be the only answer to problems. For instance, approaches addressing the shortage of power in the country automatically consider large-scale generation as the first and possibly only option. Urban Infrastructure requirements such as waste handling and disposal, water supply and sanitation are also approached in the same manner. There is a strong orientation towards the large-scale creation of centralized infrastructure for all situations.

Centralized approaches have however largely failed to provide access to infrastructure services at the last mile. For instance, 80,000 villages in India are yet to receive electricity and of the 'electrified' villages, only 31per cent households have power in their houses. This coupled with the long gestation period, high costs, environment and social issues and time and cost overruns have raised issues about the relevance and viability of this approach for all situations.

There is also the urgent need for ensuring that development impacts reach the 'last mile' to directly benefit the community at large.

Thus the case exists for considering complimentary, more locally focused approaches to development based on commercial principles as a supplement to conventional centralized infrastructure development. It is with this perspective that Uttaranchal can explore an alternative model for development predicated on commercial principles

Promotion of Eco-Industrial Parks

As a state where the ecology and environment are precious, Uttaranchal can convert this apparent constraint into an advantage by positioning itself as an ecologically sensitive industrial development destination. While this will also provide a rationale for avoiding hazardous and potentially ecologically damaging activities, it will enable selected investment to come in which can in the long run provide both economic development options as well as protection of the state's natural resources. One strategy could be to develop eco-industrial parks

New models for Environment Monitoring

The state can and should actively consider alternative models for environment monitoring and enforcement that reduce transaction cost and improve environment outcomes. Two specific suggestions are provided below

The State has already introduced voluntary compliance with the Air and Water Act by way of automatic renewal of consents issued under these acts to facilities that have valid ISO 14000 certificates. This is a sound initiative but the penalties associated with industries found in breach of this body of trust should be severely penalized. At present, the penalty proposed is double of the existing penalty for violation. This is seen as too small a deterrent and it is proposed that a 2 year closure and a penalty upto one year turnover be levied on any facility that violates after opting for the self declaration ISO14000 based consent renewal process

The State should, given the high degree of community awareness and interest in Environment, consider community based monitoring. This should be based on the following steps

- Social consent (following tangible disclosure and communication) at the time of setting up of a new project. This would involve local communities being part of the consent process
- Annual consent renewal following social consent
- In certain high industrial density areas, citizens monitoring committees can be set up to monitor local pollution from industries with the requisite capacity being built to address the technical requirements of these tasks

The state should look for pragmatic ways of cutting down its own governance costs, while at the same time, enhancing innovation. It is worthwhile to mention that the convergence of sectoral activities has begun in some manner with the creation of the unified Forests and Rural Development Commissioner (FRDC). It would be necessary to explore this model boldly with the integration of all Natural Resources related sectors into a NRDC. Similarly, efforts are needed to bring together Financial and Human Resources in the first instance to form three major administrative domains of NRDC, FRDC and HRDC. The state should constitute a committee to explore the potential of such a process and integrate it with the ongoing fiscal reform assessment being undertaken with the support of USAID.

Institutionalize Agro-Climatic Planning Systems in panchayats

Given the need for diverse responses at the local level to meet the diverse local ecological conditions, the panchayats need to be truly empowered to plan and execute development activities. Such a pilot for Agro-climatic Planning Process was initiated in the Tehri District and the institutionalization process was fairly ahead in the mid-nineties in the Chamba Block with the active participation of the Planning Commission30. Under this programme, the local panchayats identified the resource potential and the specific interventions that would enable them to make optimum use of the natural resources to generate local income and employment and meet basic needs. The plan also identified the specific inputs such as finances, technologies, and skills needed to realize these plans. One of the important elements of the programme was not to look for a new project in the framework of conventional project based development model, but to identify the existing different sectoral allocations and resources that could be accessed and dovetail the development activities identified into these.

Making more effective use of resources without destroying the environment.

The state of Uttaranchal has already been attempting to make more effective use of resources while not sacrificing the environment. The significant initiatives that reflect the resource potential of the state and the current global economic scenario include the thrust in organic agriculture, medicinal plants, bamboo and fiber development, creating infrastructure for software industries and eco-tourism. Besides these, several other measures are needed. However as the government is realizing quickly, these efforts need not just the technology but also financial and institutional mechanisms for handholding to achieve significant results. The government must function as a true facilitator. In order to ensure that the wealth created while safeguarding the environment is retained locally, the government must ensure that the new initiatives are

truly people oriented, rather than centralized initiatives. These may often require a major attitudinal change amongst policy makers and the private sector. A few illustrative suggestions are made here:

Evolve assessment methods and make information public

Given the high levels of literacy and environmental awareness in the state, in order to enhance people's participation and contribution, the government must regularly publish the basis of its planning and the actual resources available. Such a disclosure by the government will foster better institution building at the local level and also help the government reflect the perspective of the people in its planning. This will also ensure that the process stays decentralized.

Sectoral strategies

Make a conscious attempt at bringing about convergence of various sectoral plans to meet the overall targets of the state at both local and state levels.

Conservation of natural resources and management of the economy will need placing environment and the community at the centre of planning in each sector. At the local level, the Agro-Climatic Planning Process aims at this. This needs to be reflected at all levels of planning and prioritizing of activities. The following are some examples of how this could be done.

Organic agriculture: the promotion of organic agriculture is a state priority. It is also an imperative to maintain the ecology of the soil as well as promote moisture prudence in agriculture. This then must be central to the state agricultural policy, which must necessarily make available resources and technology to those aspects of agriculture that ensure it is organic while meeting the state's food security needs – banning the use of chemicals and HYV's, promotion of indigenous seed saving, mixed cropping, decreasing the emphasis on just two crops – rice and wheat, enlarging the PDS basket to include millets, local sourcing of PDS stocks to ensure that farmers are given a good price for their products. All this will require attitudinal changes not just on the part of the bureaucracy, but of the farmers, the truckers, the market, and middlemen as well as consumers, making the task even more challenging.

Medicinal plants: the promotion of medicinal plants would require that the forest department should have enabling laws so that people can use their van panchayat for more explicit livelihood uses. Concurrently, it would need the banks and rural development departments to increase the resource availability to the people, and scientific and technical departments to provide the requisite inputs for generating high quality products. The industrial and resource policies should also reflect this by recognizing the overarching intellectual rights of communities to the resources and knowledge, so that the fruits of the effort put in by communities and public sector institutions are not captured by corporations.

Tourism: in the tourism sector, the plans of various sectors such as urban development, transport need to converge when developing destinations, so that the local communities have a say in the planning process, and benefit economically from such development. Instead of having large external investment oriented tourism development, government

owned/operated tourism ventures, which are currently being planned, widespread development of destinations all across the state will benefit local communities and reduce the need for importing goods and services. Conscious reorientation of tourism to reflect local culture and values has to be undertaken as against infrastructure development merely to cater to demands of so-called tourists. This will enable sourcing of local materials and skills and change the complexion of nature of tourists that the state currently draws, unlike the ski resort Auli, where tourism is more a bane to the local community rather than a benefit. Moreover, ski resorts are in places where there are no permanent human habitations so there is neither a community to support nor to ensure that adequate environmental safeguards are in place.

Make effective use of local financial resources to create people- and environment-friendly industries rather than look for outside investments

The credit-deposit situation in the banks of Uttaranchal have historically been showing huge surplus, which has not been reinvested within the state. The huge surplus with banks of Uttaranchal have been attracting even foreign financial institutions, such as Merrill Lynch, which are seeking to receive investments from the banks in the state. Designing and handholding small enterprises in all sectors of the economy, such as those mentioned above, rather than financing corporates, and creating a policy environment so that people can get easier access to financial resources and appropriate technologies should be a major thrust of the state's development agenda. This will require a lot of attitudinal and procedural changes where government should take the lead role.

Redefine PPP (Public Private Partnerships) to include People

In the short run, one of the important shifts occurring in the economic reform process is the idea of Public-Private partnerships and a number of initiatives have been taking place with the formation of the State Industrial Development Corporation and other promotional institutions. The word "Public" is almost always interpreted as the state, and not the people. Thus such partnerships become a mechanism for transferring people's wealth to the private industry, with the state acting as the conduit.

A truly public private partnership would be a partnership between the people as a community and the private sector, with the state acting to ensure that the rights of the people are not ignored or trampled upon. Such partnerships will be built only where the people identify the need for inputs from the private sector to meet their social and economic needs, unlike the partnerships where the private sector pursues its goals of profit making without any regard to the needs of the community, and state only legitimizes the process.

Address situation specific environmental concerns

While sectoral changes and integration will take time it is important to address situation specific concerns, with a mosaic of which based on the geo-ecological zones.

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