VI. Management of Urban-Industrial Growth

From a small beginning as a quiet pensioners' settlement, Dehradun has now emerged, over the last 100 years, as the 12th largest Class One city in the State of Uttar Pradesh, the largest and most populous State in India. The Dehradun urban (regulated) area spans over 27,190 hectares and, according to the 1981 census, has a population of 416,430. The population of this urban area is projected to go up to 500,000 in 2001 and to 635,800 in 2011. The quantitative as well as the qualitative nature of this expansion is no different from that of other fast growing towns and cities in India. Nor are the environmental impacts of such spontaneous urban growth absent in this well-endowed valley.

A distinct expression of the environmental decay and crises associated with this mode of urban growth can be found in the Dehradun municipal area which houses, at present, an estimated population of about 330,000 on 3108 hectares of land, a density of about 10,000/km^2*. In this one time paradise of pensioned settlers, today, slum areas are providing shelter to close to half of the population of the city. The population of the urban agglomeration of Dehradun grew at considerably higher rates during the last few decades and this trend is expected to increase (see Table 7 below).

The nature of the urban crisis is slightly different in the case of Mussoorie, which has not grown to such a significant extent, in terms of permanent residents, compared to Dehradun. However, the pressure of tourists and summer holiday makers has generated a different type of problem for the management of urban growth in this hill station. Inspite of both being established in the early 19th century after the arrival of the British, and in spite of the similarity of their early growth as peaceful and tranquil towns, the basic characteristics of the two settlements have evolved in very different directions. In 1905, the population of Mussoorie was reported to be 14,685, and in 1981 the latest census puts the population figure at 18,241 showing very little increase in the permanent population. The crisis of Mussoorie is brought on by the tourist population which reaches more than 100,000 in the season. In contrast to the level and extent of urban growth in other settlements, the growth of Dehradun has been more significant. In fact the demographic scene throughout the whole of Doon Valley is dominated by Dehradun, where the issues of management of urban-industrial growth are most important for this study.

Table 7: Decennial Population Growth Rate in Dehradun

Year	Decennial Growth Rate (p.c.)	Comments
1941-51	78	high due to post-independence in-migration
1951-61	8	low due to epidemic
1961-71	30	higher than national average
1971-81	44	,,
1981-91	56	projected
1991-01	70	,,

* The author acknowledges the help of M. Kothari in the analysis of urban growth problems in Dehradun.

Stages of Urban-Industrial Growth

The process of urban-industrial growth, that brought the valley to its present state, can be divided into several distinct stages. In the earliest phase, this growth was characterised by official encouragement to Europeans to settle in the valley and take advantage of the healthy and salubrious climate. This was supported by the opening of a number of schools in Dehradun and Mussoorie, mainly for children of European origin. In fact, British Officers liked the climate of the Doon so much that as long ago as 1853 Sir George Campbell, in his **India As It Might Be,** selected the Doon, "as the most fitting spot for the future capital of India".

Though the Doon Valley did not become the political capital of India, the British encouragement of institutional growth made it the capital of natural resource management in the country. The establishment of the headquarters of the Survey of India and the Imperial Forest School initiated a particular type of urban growth that was maintained for a long time. The new urbanisation process did not gain the aesthetic approval of the then residents. The process was, however, so invincible (and it still is) that urbanisation continued, and along with it arose an intense concern about congestion. The following comment by Baker (1886), made more than 100 years ago, could easily be taken as that of a present day environmentalist in the valley:

The Dehradun of the present day is a long straggling collection of buildings from south to north... fresh houses are constantly being built and land and house properties have increased very rapidly in value in the last twenty years.

The second phase is characterised by more rapid growth of the settlement and the tourist industry caused by the opening up of the railways connecting Dehradun in the 1900s. At this stage a large number (40,000) of European settlers were staying in the valley. The area also grew as a major market centre for the hinterlands of Garhwal having easier connections through Mussoorie. With easy transportation, industrial growth commenced, although on a very small scale. The industrial history of the valley started in 1904 with the establishment of the Himalayan Glass Works. A relatively higher level of economic activity, mainly based on tourism and institutional growth, characterizes this phase of urbanization.

The third phase of growth started in 1947 when India and Pakistan became two independent countries. The influx of population, described earlier, drastically changed the nature of the settlement and the dominant economic activities. While retaining its central place as a market for the whole Garhwal hinterland, with much higher volumes of trade, small scale industries and lime stone quarrying changed the face of the city. Another important aspect of the post independence expansion of Dehradun was the continual establishment of new institutions, and this was epitomised by the opening up of the mammoth national headquarters of the Oil and Natural Gas Commission (ONGC), the Central Soil and Water Conservation Research and Training Institute (CSWCRTI), Wadia Institute of Himalayan Geology, and Forest Survey of India, that resulted in the in-migration of about 100,000 people to the valley.

The fourth distinct phase started in the late 1970s and can be identified with the quick growth of large-scale industries. During this period, the district of Dehradun and many other districts in India were declared "industrially backward". This opened up opportunities to obtain liberal funding for establishing industries in the region. During the process of ushering in a period of industrial growth, environmental considerations were of least significance. As a result, environmental pollution from industrial growth soon became a major issue of conflict. The extent of this industrial growth is shown in Table 8 in which the yearly breakdown of industrial units set up in the valley is given for the 1980s.

Table 8: The Number of Industrial Units Established in the Doon Valley in the 1980s

Year	Number
1980-81	105
1981-82	110
1982-83	157
1983-84	202
1984-85	250
1985-86	312
1986-87	336
1987-88	351

Among the new units established there were sixteen large industries of which seven were chemical, three mineral based, three engineering, and the other three agricultural. These large industries provided 2700 jobs and the small industries provided 10,000. This placed extra pressure on the limited urban facilities. To coordinate the fast expansion of urban settlements in and around Dehradun, and to control the establishment of industrial units in proper locations, the Town and Country Planning Organisation of the State Government had prepared a Master Plan for the urban (regulated) area of Dehradun. Bandyopadhyay et al. (1983) noted certain problems in this plan from the environmental perspective and also clarified the fact that three obnoxious and polluting industries were spot-zoned in the upper parts of the valley. Normally, they pointed out, methodology for regional planning in the valleys would not include such industries because of environmental concerns.

The fifth, and the current phase, of urbanisation and industrial growth is characterised by environmental criticism and modifications in the plans. The beginning of a citizens' movement against the proposed Master Plan was actually sparked off by the inauguration of a cement factory that had been spot-zoned near Rajpur. Several leading citizens of Rajpur wrote to the Chief Justice of India about the environmental problems caused by industrial pollution, and they requested that their letter be treated as a petition. It was the second time in approximately two years that environmental conflicts in the Doon Valley had reached the Supreme Court of India (Rastogi et al., 1985).

Industrial Pollution in the Valley

There are some physical limitations, imposed by ecology, to industrial growth in valleys such as the Doon. Throughout the year, the limited water supply and the inversion effect of air renders water intensive and air-polluting industries unsustainable. Pollution measurements reported by Bandyopadhyay et al. (1983) were the first quantitative information processsed on the high particulate matter suspended in and around the numerous lime kilns of Dehradun. They reported an ambient particulate content of 350 micrograms/m^3, while the permissible maximum of a sensitive area such as the Doon Valley is only 100 (Panesar and Deepak, 1983).

Air pollution hazards in the Doon Valley become extra critical due to the characteristic valley winds and the phenomenon of temperature inversion. The valley winds are caused by the topographical effects of the valley-mountain system. Air tends to flow down the valley at night since the air is cooler at higher elevations. The driving force for the air flow is a result of differential cooling (katabatic wind). During the day, the opposite flow occurs as the heated air, adjacent to the sunwarmed ground, begins to rise and flows up the mountain system (anabatic wind). This regularly changing wind pattern can keep the emission from industries trapped in the valley. During the day the plume moves up the valley only to return at night as the wind shifts. Concentrations of pollutants can build up to dangerous levels under these conditions. The legally maximum permissible pollutant in ambient air is given in Table 9.

Table 9: Maximum Permissible Pollutants in Ambient Air Quality (microgram/m^3)

Category Area	Pollutants			
	SPM	SO_2	CO	NO_2
Sensitive	100	30	1000	30
Residential	200	80	2000	80
Industrial	500	120	5000	120

Even when there is no wind, warm air currents will carry away and dilute pollution. During a warm day the sun heats up the ground, which in turn warms the air near it. This hot air rises until it cools to the temperature of the surrounding air. On a typical summer day warm air currents can travel up to several thousand metres, greatly diluting the pollution they carry with them. Sometimes this natural mixing of the air is blocked by what is known as temperature inversion. Normally, the warmest air is near the ground and the air above it is progressively cooled. In an inversion this process is reversed and a layer of cool air is trapped underneath the warm air. Inversions are quite common in valleys, especially at night. If pollution is caught underneath an inversion the normal dispersion and dilution of emissions is prevented. This forces the concentration of contaminants into the lower parts of the valley which, in the case of Doon Valley, happens to be the highest density pocket of the urban settlement hazard for the citizens of Dehradun.

The advance caution concerning the serious threat from air pollution that was given in the ecosystems report emanated from anxiety about two sources of pollution. Firstly, the obnoxious and hazardous industries spot-zoned in the Rajpur area and secondly the large number of kilns and crushers distributed in many nooks and corners of the city. A third important source of pollution from the large number of automobiles was noted. However, their quantitative contribution was not ascertained until recently. Later, the Pollution Controls and Research Institute (1988) made detailed studies on ambient air pollution in various parts of the city. The results of these are shown in Table 10. These figures, when compared with the legally maximum permissible levels, speak of the situation in the valley.

In tune with the environmental protests against limestone quarrying, concerns about the uncontrolled growth of polluting industries received equally serious attention both at the State and Central Government level. The environmental review of the proposed Master Plan of Dehradun City, made by the Department of Environment (Anon 1984), commented that:

A large number of lime kilns exist in DehraDun which have polluted the environment. Their location has unfortunately been spot zoned and provision made for further expansion of industry in the same area. This is going to further pollute the environment. A chemical industry is proposed to be established in the vicinity of the Cement Plant. It is feared that this industry will gradually affect the water, air and flora and fauna. Besides, the Master Plan proposed a total of 845.00 ha. (11.21%) of land for industries. This appears to be abnormally high landuse. The recommended percentage for industrial cities with a population of one lakh and above is 1.25 to 2%. The existing industrial area which is 2.98% itself is on the higher side compared to new industrial towns being developed in the country.

Table 10 : Results of Ambient Air Monitoring in Doon Valley (microgram/m^3)

SAMPLING SITES	SPM	SO_2	NO_2	CO	HC
Hotel Drona Stand	723	60	102	3432	5.0
Parag Dairy Raipur Road	972	41	29	458	1.0
U.P.C.C.L Mussorie Road	786	29	13	1144	N.D.
Venus Cement Rani Pokhari	409	46	38	1030	N.D.
FRI Kaulagarh	266	8	4	114	N.D.

The Ministry of Environment and Forests of the Government of India, after these various contributions, finally introduced severe restrictive measures on the growth of polluting industries in the valley (Geethakrishan, 1989). According to this notification, only selected non-polluting industries are to be permitted in the valley. Further, these Industries should be established in five industrial areas at Majri Grant, Chharwa, Ranipokhri, Shyampur and Selakui (Anon, 1989). These measures are creditable and will surely go a long way in controlling industrial pollution in urban settlements such as Dehradun. The impact is already visible because the cement factory in Rajpur, a major source of pollution, has stopped functioning.

Emerging Conflicts Over Land in the Doon Valley

The irresistible impact of the present pattern of transformation and demographic change in the Himalayan areas of the State of Uttar Pradesh has been quick urban-industrial growth in the foothills. The Doon Valley epitomises this process of urbanisation in the relatively even or level valleys with a pleasant climate and easy accessiblity to the plains. The urbanisation of Doon Valley has taken place extra quickly due to its easy and quick links with Delhi by rail, road, and, more recently, by air. The existence of good schools for children has been another favourable factor, especially for the wealthy and educated Garhwali families who migrated into the Doon Valley from the interior of Garhwal. The arrival of the rich draws in the poor, the establishment of industries attracts vast numbers of the unemployed from far and near. The case of Doon Valley is no different from many other cases of growing cities in the Himalayan valleys, as for example Srinagar, Kulu, Kathmandu, and Thimphu. In fact, the review and analysis of the case of the Doon Valley can surely be of significance in the management of mountain urbanisation in general.

While considering the management issues of urban growth in the valleys, the question most frequently raised is that of "carrying capacity". There is a continuous pressure of in-migration, and the response of those who already live among the comforts of the valleys is that the "carrying capacity" is being exceeded and in-migration needs to be controlled.

Because these valleys are relatively closed ecosystems, their "carrying capacity" should be calculated based on the availability of water, land, and other natural resources in order to determine the constraints to proper management. In the case of urbanised valleys, where food or even water can be transported from other ecosystems, it is not feasible to develop a methodology for the calculation of human carrying capacity even though conflicts over limited natural resources will be inevitable.

Conflicts over water resources have already been discussed, and there remains the question of land allocation for various competing uses as an important element of environmental management. How much land, where, and for what purposes should be allocated ? This is a management decision that should be based on an intrinsic understanding and long term perspective of the ecology and economy of the valley, elements which do not seem to have received serious attention during the formulation of the 1982 Master Plan for Dehradun. The problem is rooted in both methodological inadequacies and organisational weaknesses. In the absence of a well articulated methodology executed by a strong organisation, the processes of land allocation and transformation tend to be determined by irregular means. These may often include the use of money, power, or influence at higher levels. This makes efforts at serious natural resource management redundant.

Dehradun, other than being a fast growing urban settlement, is both physically and economically the gateway to the Garhwal region of Uttar Pradesh. As such, it has been (and is), inextricably linked with the ecology of the Garhwal region. Spatial planning is the integrating process of linking human activity patterns to natural and man-made resources. Land use planning provides the basic frame for weaving this linkage. In a broad sense, the rural-urban continuum is the hierarchy of this linkage and leads to a land use perspective placing both the urban and rural components within a single framework of overall development. The evolution of scientific criteria for land allocation according to use has become an important challenge for environmental management in the valley.

Conflicts over land use have, in the past, generated development in the agricultural sector at the cost of the destruction of forest resources. The clear-felling of large tracts of virgin sal forests to provide land grants for European settlers has a counterpart in the clear-felling of forests to provide land to resettle people displaced by the local Tehri dam. This trend of sacrificing forests for non-forest uses ceased after the Forest Conservation Act of 1980 came into force. There are, however, other emerging conflicts over land related to the urban transformation of Dehradun. Conflicting demands on the land resources also exist between agriculture and urban settlements and between industries and open areas.

With the establishment of the Doon Valley Special Area Development Authority, the need for ecologically sensitive regional development has been fully recognised. Yet, as with many experiments in the past, this one may also not be effective if future challenges are not comprehended in their totality. The proposed Master Plan for the growth of the Doon Valley is supposed to be a tool for the rational and optimum allocation of all land resources among the competing sectors. In the Doon Valley situation the environmental consciousness of the Valley residents, and the tendency of its administrators to give due weightage to public opinion (Bhargava, 1988), will surely reduce conflicts over land resources.