NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN, UTTAR PRADESH (U.P.) Coordinator

Coordinated by: U. Dhar

GBPIHED TEAM

S.S. Samant
Asha Tewari
R.S. Rawal

NBSAP, U.P. Members

Dr. S.S. Samant

Dr. B.S. Burphal

DR. Ipe M. Ipe

Dr. Arun Kumar

Dr. A.K. Singh

Dr. S.K. Srivastava

Dr. A.K. Sharma

Dr. K.N. Bhatt

Dr. Jamal A. Khan

Miss Pia Sethi

Dr. Satthya Kumar

Miss Reema Banerjee

Dr. Gopa Pandey

Dr. Bhartendu Prakash

Dr. Bhanwari Lal Suman

Dr. R.D. Dixit

Mr. Sameer Sinha

Prof. Ajay S. Rawat

Contributors

B.S. Burphal

Pia Sethi

S.K. Srivastava

K.N. Bhatt

D.K. pande

Jamal A. Khan

A.K. Sharma

CONTENTS

CHAPTER—1

National Biodiversity Strategy and Action Plan: Uttar Pradesh (U.P.)

1.1. Introduction

Conservation of nature has been on priority agenda throughout the world, especially in the later part of the 20th Century. However, conservation of biological diversity has received greatest attention among all aspects of nature conservation. In general, biodiversity includes the full range of species on earth, from unicellular organisms like bacteria, viruses and protozoa's to all the multicellular organisms like fungi, plants and animals. Also, it covers the complexities of interlinkages among different living creatures and the non-living elements. Current estimates of this diversity ranged from 5-50 million species; of which only humans know about 1.7 million. In India the recorded diversity of species is about 1,30,000. Scientists agree that the actual (unrecorded) diversity would be much greater.

India is one of the "megacentres" of biodiversity and embodies traditions of sustainable utilization and conservation of the bioresources as a part and parcel of its cultural heritage. India has been recognized among 12 mega diversity centers of crop origin in the world. As many as 167 species of crops, 320 species of wild crop relatives and several species of domesticated animals have originated here. Realizing the vast extent of biodiversity in the country and need for more concerted efforts for conserving the nature in general and biodiversity in particular, several governmental and voluntary organizations have been involved in the survey and inventory of these resources. Still, a holistic inventory of biodiversity is lacking. This is mainly due to the vastness, heterogeneity, and variations in topoclimates in the area, which ultimately results in diverse and unique floristic and faunal elements (with high proportion of endemism). Also, inaccessibility of certain areas for ground based surveys leads to gaps in accomplishing the task. Therefore, to understand the real facts of biodiversity at national level it is essential to accomplish surveys or analysis at state or district level and subsequently collate information for entire country.

Uttar Pradesh lies in north-central part of India. Nepal borders the State in the north, the Indian states of Himachal Pradesh, Uttaranchal, Haryana, Rajasthan and Delhi in West. The State covers 240928 km^2 area (nearly 7.0% of India). The State being one among largest and most populated States of India needs special attention with regard to developmental planning vis-a-vis conservation of biological diversity. Particularly considering the diverse range of wildlife habitats the state harbors and their dwindling status, a comprehensive biodiversity strategy is essential. The habitats in the State ranges from semi-arid thorny scrub to richest and most fertile Bhabar areas. The State harbors an enormous diversity of plants and animals, both domesticated and wild and an impressive variety of habitats and ecosystems. This rich biodiversity resource is being used traditionally for food, medicines, clothing, shelter, spiritual, recreational, fuel, timber and many other life support needs of the inhabitants of Uttar Pradesh. The rich biodiversity also ensures that essential ecological functions such as steady supply of nutrients, clean water and soil maintenance. It is the treasure house from which future needs essential for the sustenance of

life would be met. With the increasing human and livestock population of the state, the demand of economically important species is increasing fast. This has caused rapid decrease in the local population size of many species. Likewise, over exploitation of species and degeradation of habitats have led to the loss of indigenous biodiversity elements of the State. Conversely, many exotic species such as *Lantana camara*, *Parthenium hystrophorus*, *Argemone mexicana* and many other species have invaded the degraded lands and some presteine habitats of the State. The State, therefore, requires an immediate action to overcome from this loss and to conserve and maintain biodiversity for the present and posterity.

In the above context, Ministry of Environment and Forests (MoE&F), GOI, has taken an initiative to develop National Biodiversity Strategy and Action Plan (NBSAP). This is a two-year (2000-2001) exercise funded by the United Nations Development Program (UNDP). It aims to formulate local, regional, state and national levels Strategies and Action Plans (SAP) for conserving biodiversity, sustainably using biological resources, and achieving equity and fair benefits- sharing in such uses. The NBSAP was conceived of by MoE&F after extensive consultation and being executed through a Technical and Policy Core Group (TPCG) consisting of experts of different fields, coordinated by the environmental action NGO Kalpvriksha. The Biotech Consortium India Ltd. (BCIL) is handling its administration.

The present document is based on the review of the biodiversity related work carried out in the State and is an attempt towards developing the State's Biodiversity Strategy and Action Plan. This includes a general framework for the State's policy on conservation and sustainable use of biological resources, guidelines for future action and specific plans aimed at ensuring compliance with the proposed goals.

1.2. Scope of the SAP

Increasing population has caused tremendous problems for planning in the state along with the faulty development, inequities, bad planning e.g., of irrigation systems, alienation of people from their resources and so on. The resources are limited while the population is increasing continously. Therefore, while developing the SAP one must consider dependency of human population on the biodiversity elements. As aimed under NBSAP process, the gaps identified and Strategies and Action Points proposed in this document for the different ecoregions and biodiversity elements of biodiversity would be helpfull in planning for the development of the regions (i.e., eastern, western, central and Bundelkhand) of the U.P. Some broad cross- cutting themes like women empowerment, intersectorial approaches and gender issues have been also identified to facilitate the planning and implementation of the projects.

1.3. Objectives of the SAP

The main objective of the NBSAP is to produce a planning document dealing with the conservation of State's biodiversity, sustainable use of its biological resources, and equity including in decisions regarding access to such resources and the benefits accruing from them. The objectives of the SAP are:

(i) To establish prepare inventory of the biological resources and computerised database.
(ii) To document indigenous knowledge and conservation practices of the local communities
(iii) To identify biodiversity rich areas as preservation plots and monitor biodiversity elements
(iv) To identify fragile ecosystems, assess and monitor the biodiversity
(v) To improve the salt affected land through various management practices

(vi) Assessment of biodiversity using RS and GIS and generating information on changing scenarios
(vii) To explore the options for expanding/strengthening the network of protected areas through identification of buffer zones, corridors, community conserved areas,etc.; and to build biodiversity conservation into official land/water use programmes in areas other than protected areas.
(viii) To develop and implement eco-developmental programmes in order to meet the demands of local people and involve them in conservation efforts
(ix) To strengthen the research programmes in PAs by involving local research institutes, colleges and universities so as to develop base line data on biological and managerial parameters
(x) To ensure conservation of Biodiversity outside the PAs network common land and water bodies
(xi) To identify the indicators of loss of biodiversity and options to minimise and eliminate the activity leading loss
(xii) To study the impact of various factors on biodiversity of the State
(xiii) To expedite the formulation of management plans for the PAs and non-PAs.
(xiv) To support enterprise oriented approaches to biodiversity conservation of whole State and evaluate the effectiveness of these enterprise-oriented approaches to community based conservation of biodiversity
(xv) To develop effective networking among the government organizations ,NGO,s and community groups.
(xvi) To frame policies appropriate for the conservation

1.4. Contents of the SAP

The SAP document mainly contains the introduction, profile of the area, current range and status of biodiversity, statements of the problems relating to biodiversity, major actors and their current roles relevant to biodiversity, ongoing biodiversity related initiatives, gap areas, major strategies to fill up these gaps, required actions to fill up these gaps and in the last the follow-up/action plans.

Introduction (Chapter 1.) contains brief background of the SAP and its connection to the NBSAP process, scope, objectives, contents and methodology followed for the preparation of SAP. Profile of the area (Chapter 2) briefly gives an introduction to geographical coverage (location, longitudes and latitudes) of the State. It is followed by the socio-economic profile which includes demography, major ethnic groups, major occupations and other relevant details; the political profile covering information about the kind of governance and structure of administration (both general and relevant to biodiversity); the ecological profile includes the types of natural ecosystems, wildlife, agro ecosystems, wetlands, etc., Chapter 3 deals with the Current (known) range of biodiversity, covers the state of natural ecosystems, plant & animal species,State of agricultural ecosystems and domesticated biodiversity. Chapter 4 deals with the proximate and root causes of the loss of biodiversity e.g., habitat destruction and conservation, introduction of exotics and monocultures, poisoning, hunting/over exploitation, etc., Unsustainable models of development, alienation of citizens in particular local communities from natural resources, social, political and economic inequities; unclear or inappropriate land tenure systems; ethical moral changes; inappropriate or contradictory policies and laws; over – centralization of decision making and lack of administrative coordination.

Chapter 5 deals with the major actors and their current roles relevant to biodiversity, role of governmental organizations, citizens' groups, NGOs and local communities including rural and urban, donors and industries and corporate sectors. Chapter 6 comprises of all the

ongoing biodiversity related initiatives, under taken by the government (i.e., policy and legal measures, administrative measures, programms and schemes, integration into economic/social sectors, etc.); NGOs; communities and people's movements.

Chapter 7 deals with the gap analysis (i.e., gaps in information - existence and availability to key actors; gaps in vision - inability to look in the long term, or consider the inherent value of biodiversity; gaps in policy and legal structure and gaps in institutional and human capacity). Chapter 8 describes the possible strategies for bridging the gaps and to achieve goal of conservation and sustainable utilization of biodiversity. Chapter 9 deals with the required actions and follow up of the SAP. At the end bibliography has been appended.

1.5. Brief description of methodology used in the preparation of SAP

To begin the SAP process for U.P. various experts were identified. Each expert was contacted and consent was obtained to become the member of the SAP. After rreceving the consent of all the members, a meeting was convened by the coordinator at GBPIHED, Kosi- Katarmal on June 8, 2001. The following members and invitees attended the meeting:

1.	**Dr. L.M.S. Palni**	**Coordinator**
2.	Dr. U. Dhar	Member
3.	Dr. S.S. Samant	Member
4.	Dr. Ipe M. Ipe	Member
5.	Dr. Arun Kumar	Member
6.	Dr. A.K. Singh	Member
7.	Dr. S.K. Srivastava	Member
8.	Dr. Awdesh Kumar Sharma	Member
9.	Dr. B.S. Burphal	Member
10.	Dr. K.N. Bhatt	Member
11.	Dr. Jamal Khan	Member
12.	Miss Pia Sethi	Member
13.	Dr. V.K. Shukla	Special invitees
14.	Dr. Rajesh Sharma	Special invitees

While discussing the various issues, members agreed to contribute for the NBSAP – U.P. The points discussed, and the responsibilities given to each Member of the Working Group were as follows:

Profile of the area (Geographical size): For the profile of the area, the identified members will provide following information:

1. Latitude, longitude, altitude, forest flora and fauna, total area, along with map of Eastern U.P. (Dr. V. K. Shukla)
2. Basic information from U.P. Government Publications (GBPIHED)
3. Planning Atlas of U.P. along with two maps (Dr. K.N. Bhatt)
4. Forest types based on agroclimatic zones (Dr. Burfal)
5. Planning divisions of U.P. (Dr. Bhatt)
6. Remote sensing maps from FSI (Dr. Arun Kumar)
7. Maps of GSI 1985 and Survey of India (Dr. B.S. Burphal)

Socioeconomic profile

1. Statistical Report of U.P. Govt. has contained information (District and Tehsil wise) to be obtained (GBPIHED)
2. District wise detailed thematic maps be obtained from GSI, Lucknow (GBPIHED)
3. Information about major ethnic group (Dr. Arun Kumar and Dr. Jamal Khan).

Political profile

1. The information on political profile to be obtained from Forest Department (Zonal Chiefs), Pollution Board, Fisheries Department, Agricultural Department, Soil & Water Conservation Board and Panchayati Raj having developmental schemes (Dr. Burphal and Miss Pia to provide 2-3 page write up).
2. The members felt that information can also be obtained from Village Level Committees, U.P. forestry projects, articles of D.N. Dhanagre on Panchayat Forests of Uttaranchal and U.P., two series of World Bank Project on Swajal, Agricultural and fisheries departments, Ganga Action Board, Irrigation department and CFRI, Allahabad, NRSA wetland projects, SACON and UNDP Wetlands Projects may also be useful for information. For wetlands, Dr. Prasad, SACON, DehraDun may be contacted. Miss Pia Sethi agreed to provide information. (GBPIHED to take initiatives)

Ecological Profile

1. Identification of major Natural Ecosystems and Wildlife of U.P., maps on different forest types, forest cover (Dr. B.S. Burphal and Dr. Arun Kumar).
2. Information on vegetation types (Miss Pia Sethi).
3. Strategy for Forest Research Plan (Dr. Burphal)
4. Information generation on vegetation types (Dr. S.K. Srivastava)
5. Dr. Jamal A. Khan agreed to provide information on wildlife including impact and major characteristics of wildlife.
6. Dr. Awdesh Kumar Sharma and Dr. Rajesh Sharma will provide information on Bundelkhand and Vindhyanchal regions covering all the aspects.

Agricultural systems in U.P.

1. Dr. Rajesh Sharma and Dr. Awdesh Sharma will provide information on agricultural and other crops from Vindhyanchal region.
2. Information may also be obtained from Landuse Board (Dr. Mridula Singh).
3. Biogeographic zone wise information (Miss Pia Sethi).
4. Information on the Agricultural systems of Mirjapur and Jhansi (Dr. Awdesh Kumar Sharma).
5. The members felt that a common format will be developed to compile the data for different regions and at different levels. Macro and micro views need to be taken into account.

Brief History

1. Traditional knowledge of Gangetic plain and changes taking place in forest cover (Dr. Jamal A. Khan).
2. Historical background of Vindhyachal region (Dr. Rajesh Sharma).
3. History of Wildlife of U.P. (Miss Pia Sethi).
4. Decreasing forest cover in U.P. (by Dr. Jamal A. Khan).
5. Members felt that for policy documentation, Forest Policy of U.P., Gazette Notification of U.P., U.P. Academy of Administration and Forest History of Kumaun by Ajay Rawat may be useful (GBPIHED).

In response to various identified responsibilities, through members responded with desired material. But, in most of the cases the information provided by the members was not sufficient and or needed further inputs. To fill this gap, the coordinating institute (GBPIHED) conducted a thorough review of existing information in the Institute library and other relevant organizations. The available information on various aspects was collected, reviewed, compiled and finally organized as per the format developed for the State SAP.

CHAPTER — 2

Profile of the Area

2.1. Geographical Profile (Source: Burphal, 2001; Planning Atlas Uttar Pradesh 1987)

2.1.1. Location and Physiography

Uttar Pradesh, situated between 77.5° to 85.0 ^{0} E latitude and 23.00^0 to 30. 40^0 N longitude (Fig.1), lies in the close proximity of the central meridian (84º54' 23"E long), which approximately divides U.P. in two equal parts. Lucknow is the capital of the State and enjoys a vicinal location due to excellent connectivity. Uttar Pradesh covers 2,4.0,927 Km^2 area (Nearly 7% of India).

Fig. 1

State in its present form was reorganized on November 9, 2000 (Fig. 2). Geographically, Uttar Pradesh occupies the central position of Northern Plain of India. It is a land locked Border State with international frontiers of Nepal in the north and is bounded by Uttaranchal in the northwest, by Himachal Pradesh, Harayana, Delhi and Rajasthan in the west. In the east it shares borders with Bihar and Jharkhand States. Whereas in its south and southwest lies Madhya Pradesh and Chhattisgarh States.

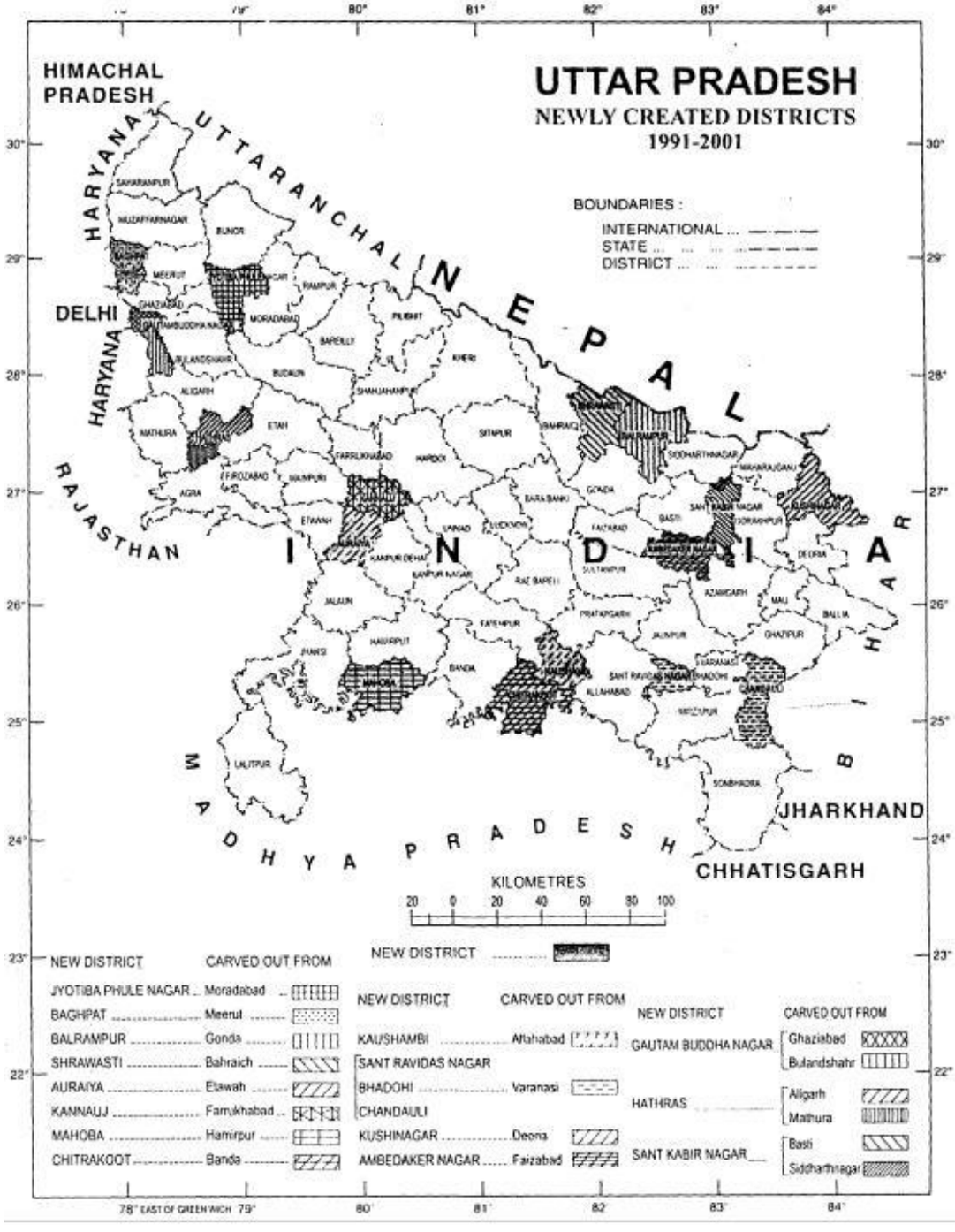


Fig. 2

Physiographically State can be divided into three regions: (1) The sub montane region between the Himalaya and the Plains; (2) The central plains of the Ganga River and its tributaries (part of the Indo-Gangetic Plains); and (3) The southern uplands.

The submontane region consists mostly of a narrow belt of gravel and alluvium called Bhabar. Along its southern fringes the Bhabar blends into the Terai area, a damp and marshy tract. About more than three fourth of the total area of Uttar Pradesh is within Gangetic plain, which is composed of alluvial deposits brought down from the Himalaya by the Ganges and Yamuna rivers and its tributaries. The southern uplands form a part of the highly dissected and ragged Vindhyan range, which rises generally towards the southeast. The elevation of this region rarely exceeds 300 m.

The soils in the State are mostly deep alluvium in the vast plains. The Vindhyan tract in the south has lateritic red soils. About 65 % of the land in U.P. is cultivated, of which 85 % is devoted to production of cereals and pulses. The remaining 15 % of the agricultural area is devoted to the production of sugar cane, oilseeds, potato and cotton.

2.1.2. Agroclimatic zones

The State can be divided into the following agro climatic zones:

(i) Terai and Bhabar
(ii) The Terai
(iii) The Gangetic plains (western)
(iv) The Gangetic plains (eastern)
(v) The Vindhyas

(i) The Terai and Bhabar Zone

The terai and bhabar zone lies at the foothills of the Himalayan range, from an altitude of 100 m to about 400m. The bhabar area adjoins the sub-montane track and the thin soil covers a thick layer of boulders and pebbles going down to great depths. The water table is very low going down to 30 m and more. It is a highly erodable region and has very wide stream beds becoming dry during the summer. This causes acute water scarcity in the summer. The temperature varies from a minimum of around 5^0 C to a maximum of 38^0 C during the summer months. The summers are very oppressive and hot winds are quite common. Winter frosts occur during the months of January and February. The rainfall varies from 1,300mm to about 1,900mm. The rain is quickly absorbed in the soil and charges the ground water. This water then finds its way down to the terai region where it comes out in many places as wells. The vegetation consists of sal and its associates. The terai region contains some of the best sal forests. The terai zone adjoins the bhabar area lying to the south of it, and has deep alluvium. The soil is very fertile. The forests in this belt are the richest, not only in composition but also for their luxuriant growth. They have thick ground flora, a dense middle-story, and tall tree in the upper story. The major species of the terai region are: semal (*Bombax ceiba*), gutel (*Trewia nudiflora*), Shisham (*Dalbergia sissoo)*, Khair (*Acacia catechu*), Kala siras (*Albizzia lebbek*), Heldu (*Adina cordifolia),* etc.

(ii) The Terai zone

This zone is the eastern extension of the terai and bhabar zone, but does not have a bhabar zone associated with it, as is the case with the western part. The temperature varies from 8^0 C in the winter months to a maximum of around 40^0 C in summer. The winters are cold but not severe. Frosts occur occasionally but are not a regular feature, especially in the eastern part like Gorakhpur. The summers are hot and uncomfortable and humidity is high. The rainfall

varies from 1,200 mm to 2, 500 mm and causes severe floods in the rivers. Most of the rain falls in the months of July, August and September. The region abounds in lakes and pools of a fairly large size, which overflow in the rains adding to the problems of the villagers. The area has some of the finest sal forests of U.P. The major species, apart from sal, are jamun (*Syzygium cumini*), shisham, asna, etc. Large-scale plantations of teak, sal, shisham, khair, semal and some other species have been carried out in these forests. Successful Taungya plantations of sal have been done in the Gorakhpur and Gonda forest divisions of this region.

(iii) The Gangetic Plains (Western)

The vast central portion of the Gangetic plains is the most fertile part of the State. Over 80 % of the area is devoted to agriculture. It is served by a vast network of canals. This has also been the cause of large parts of area, adjoining the canals turning saline and alkaline due to water logging caused by seepage from the canals. Heavy to medium Usar conditions affects a very sizeable proportion of land. The total usar area is estimated at over 11 lakh ha, both in the eastern and western parts. The temperature varies from a minimum of 5-8^0 C in winter to a maximum of 40^0 C in summer. Frosts are rare but the winter is harsh because of cold winds. There are pronounced hot wind in the summer. The western part of the zone has lower rainfall as compared to the eastern part. The rainfall varies from a 600 mm to about 1,200 mm. Some lands along the Ganga in Meerut and other adjoining districts are subject to periodic flooding and are known as ***Khadar and Kholas*****.** Efforts are being made by the Government to afforest these areas by various species including poplars. There are also areas, which are abandoned along the course of the Ganga. They are comparatively recent, very sandy, subject to severe wind erosion, and not very fertile. Such areas are good for large-scale tree plantations. Particularly in areas close to the watercourse several species such as shisham, poplars and khair are expected to give successful plantation results.

(iv) The Gangatic plains (Eastern)

There are some essential differences between the eastern and western parts of the Gangetic plains. For instance, the average rainfall is slightly higher in the eastern part. Forests in this area are rare and scarce. The winters are milder but the summer is oppressive. Region has very high population density. Rural poverty is more severe in the eastern part. Usars are as common in this area as in the western part.

(v) The Vindhyan zone

This zone consists of the Vindhyan palteau and the hills in the southern part of the State. The climatic conditions in this zone are, by and large, quite severe. The summer temperature goes up to 48^0 C in May and June. Hot soaring winds blow all through the day and sometimes even during the night. Water gets scarce in the summer and the small watercourses, dams and reservoirs, which impound the rainwater for drinking and irrigation, dry up. The rainfall varies from 750 mm to about 1,200 mm (most of the rainfalls in the month of August). There is a little winter rain also. The soil varies considerably but most of the areas have red lateritic soils with often pronounced nodules locally called ‘murram. The red clay content varies and in some places the soil is entirely ‘murram’ with very little red clay. These are poor soils and are associated with sheet rock underneath. The depth of the soil also varies a great deal. Much of the area has a soil depth of just a few cm deep and fertile soils are often found in the valleys between folds of hills.

Apart from the forests in the hills and adjoining belts of terai, sizeable forests occur only in the southern region of U.P. in the Mirzapur and the Bundelkhand areas. The Mirzapur district has the highest percentage of forest area. Forest is not rich as far as timber is

concerned. But they have rich bamboo and fuelwood resources, besides tendu (*Diospyros malanoxylon*). However, the opencast mining of coal has ruined vast forest areas. With expected increase in mining operations for the supply of coal to the super thermal power stations, more areas would be laid waste. Major constituents of the forests are sal, asna, mahua (*Madhuca longifolia*), amla, (*Emblica officinalis*), tendu, Khair, bahera, kardhal (*Anogeissus pendula*), salai (*Boswellia serrata*), etc. There are pockets of rich bamboo forests.

2.1.3. Relief of the Area (Planning Atlas Uttar Pradesh, 1987)

The Ganga plain covers about three- fourth of the geographical area of the state and is characterized by a uniform relief and imperceptible slopes. The contour of 100m roughly marks the western limit of Eastern Uttar Pradesh (excepting Mirzapur district). The Ganga and its tributaries mostly fill it with deep alluvial deposits. The Bundelkhand region is dominated by isolated hillocks and uplands, which culminates in the Vidhyanchal range characterized by an escarpment varying in character and altitude. In these part 300m contours encircle isolated hillocks and serrated ridges. The Betawa, the Dhusan and the Ken have developed bud land topography.

2*.1.4. The Climatic Conditions* (Planning Atlas Uttar Pradesh, 1987)

Climate is varied, tropical monsoon in the central plains and the southern upland regions. During the cold season particularly in January, cold waves sweep over the Ganga plains accompanying the winter depressions. Uttar Pradesh receives most of its rainfall (nearly 90%) during the rainy season (Mid-June to Mid-October) from the summer monsoon. Its distribution clearly indicates the dominant influence of the Bay of Bengal current of the monsoon as it decreases from east to west (Gorakhpur 127 cm; Lucknow 99 cm; Kanpur 88 cm and Agra 77 cm). Similarly it bears the influence of the Himalayan ranges as it decreases from north to south (Roorkee 116 cm, Meerut 8 cm and Agra 77cm). This is the reason for isohytes of 80 cm, 100cm, and 120cm encompassing the Ganga plain which appear in the form of wedges. The highest coefficient of rainfall (40) is found in parts of Agra and Mathura districts but the zone of rainfall variability (30-40) covers a much wider territory in the southwestern U.P. (including the Bundelkhand region) where the rainfall reliability is low and irrigation is a pre–requisite for successful crop production. However, in eastern U.P. the rainfall variability is low with high rainfall.

The mean monthly maximum daily temperature for summer (May) varies from 42.5º C in the south to 35º C in the north (for the meteorological stations only), whereas the mean daily maximum temperature for cold month (January) ranges from 25º C in the south to 20º C in the north. The hottest place in U.P. is Banda (May 43º C), followed by Agra (42.8º C), and Kanpur (42.7º C), Jhansi (42.6ºC), Orai (42.6ºC), Fatehpur (42.3ºC), Allahabad (42.1ºC) and Mainpuri (42.0º C). These areas are occasionally engulfed in heat waves.

The mean minimum temperature for the hottest month of May ranges between 27.5º C in the south to 20º C in the north. Whereas the mean daily minimum temperature for the coldest month (January) ranges between 1-6º C and cold waves sweep over the Ganga plains causing the winter depressions.

2.1.5. Geology (Planning Atlas Uttar Pradesh, 1987)

The geological structure of Uttar Pradesh is characterized by formations ranging from the Archaeanera (the Bundelkhand Granite-Gneiss) to the recent area (the Ganga Alluvium). It has two distinct structural zones (*source* –Planning Atlas of U.P.):

1. The Ganga plain, which dominates the landscape of the State, lies between the Himalayan zone in the north and the rocky zone (including the Vinddhyas) in the south, is of most recent origin. It provides an example of a great crustal down-buckle of the fore deep formed between the mobile or genic belt and the stable peninsular block (which is a part of the ancient Gondwana land). It is filled with deep alluvium, at places more than 1,000 m thick, with an amalgam of silts, clays, and sands in varying proportions.
2. The Vindhyan scarplands comprise of the Gneissic Bundelkhand and the Vindhyan system in Mirzapur district. The Gneissic complex includes Granites and Gneisses of the Archaean era whereas the Vindhyan system carries sandstones, limestones, Shales and Phyllites as well as unclassified Gneisses in the southern portion of Mirzapur district.

2.2. Resources of Uttar Pradesh

2.2.1. Diversity of Soil Groups (Source: Planning Atlas Uttar Pradesh, 1987)

The main soil groups of Uttar Pradesh are as follows:

- **Terai soil:** This soil zone lies immediately south of the bhabar zone but is more extensive, extending in an elongated belt from Saharanpur district in the west to Deoria district in the east. The terai soils are noted for rich clayey loams with some proportions of fine sand and humus. They are mildly calcarious and carry good amount of nitrogen, well suited for sugar cane and paddy cultivation.
- **Alluvial soil:** Covers the entire Ganga plain of Uttar Pradesh, and constitutes the most important soil group as they support more than 90 % of its population and account for States rich agricultural wealth. They are composed of alluvium deposited by the Ganga and its tributaries. Soil varies in texture due to local and regional variations in the younger Khadar soils and relatively older Bangar soils with occasional Bhur tracts of usar (reh). In clayey areas nodules of concentrated lime (Kankar) appear near the surface, particularly in eastern Uttar Pradesh. These soils are moderately alkaline and calcareous, poor in nitrogenous matter but rich in potash, phosphorus and calcium.
- **Calcareous alluvial soil:** A variant group of the Bhat soils which occur in a tract in the Eastern Saryupar plain between the Gandak and the little Gandak in Deoria district. The soil is noted for a high proportion of calcium (25-30%); fairly well drained for tilt purposes and have alkaline reactions as well as good moisture holding capacity. They are particularly suited for sugarcane cultivation.
- **Medium black soil:** Cover nearly two third of the Bundelkhand region of Uttar Pradesh, extending from Jhansi district to Banda district. They are highly argillaceous and are noted for their moisture holding capacity. They are rich in iron, calcium and aluminium, but poor in phosphorus and organic matter. They are associated with Granitic and basic Gneissic formations and their black colour is attributed to the presence of iron. The soil is noted for their fertility and suited for cotton cultivation.
- **Mixed red and black soil:** This soil is confined to the southwestern portion of the Bundelkhand in Jhansi and Lalitpur districts. The black soil occurs in low lying areas of flat topography and are noted for their black colour, clayey texture and moisture, holding capacity whereas the red soils occupy uplands and are light textured and well drained.
- **Red and yellow soil:** These are widely spread in Mirzapur district and associated with rock formations having large quantities of iron which, under uniformly high temperature, disintegrates and gives red or yellow hue to the soils. They are quite porous and light textured and fertile only where they are deep and fine-grained. Soil is usually poor in nitrogen, phosphorus and calcium.

- **Red sandy soil:** A variant group of red soils, associated with Crystalline formations in Southern Lalitpur district of Bundelkhand and in the Yamunapar tract of Agra district where red sandy soil overlies heavy sub-soils, usually on recent erosion surfaces in semi arid climate. In their chemical composition they are mainly siliceous and aluminous with free quartz as sand. Soil is generally deficient in calcium, phosphates, nitrogen and humus but are fairly rich in potash.
- **Reddish brown soil:** These soils are found in the southwestern part of Tahsil Kheragarh and some parts of Tahsil Kiraoli (Agra district) adjoining the chain of the Arovalli hillocks. They have developed from the detritus material carried by the streams. They are largely sandy with reddish brown colour and coarse texture. They are calcareous in nature with neutral to slight alkaline reactions. They have a low fertility status and are not suitable for good agricultural harvests.

2.2.2. Land Use Diversity

The land use diversity of the State is presented in Fig. 3

- **Net sown area:** As per the recent reports (Department of Information and Public Relation, U.P. 2002) the State has 175.85 lakh ha (72.98% of total area) area under net sown category. The net sown area which was 172.89 lakh ha, in 1961-62 rose to 173.05 lakh ha, in 1970-71 but declined slightly to 172.21 lakh ha, in 1980-81; the average for 1979-82 being 171.69 lakh ha, 168.01 lakh ha in 1998-1999 (excluding Uttaranchal). It is nearly 69.42% of the total reporting area of the State. However, there are wide regional variations, 12 districts i.e., Aligarh, Bareilly, Budaun, Bulandshahar, Mathura, Meerut and Rampur (Western region) and Azamgarh, Basti, Deoria, Ghazipur and Gorakhpur (Eastern region) carry more than 75% of their reporting area under cultivation. These variations in net sown area are attributed to climatic and edaphic conditions, irrigation facilities and land management practices.
- **Fallow land:** This category includes both current fallow (12.28 lakh ha) and other fallow lands (7.02 lakh ha) and accounts for nearly 6.50% of the reporting area of the State (year 1998-99). The comparative figures for 1961-62 (current fallow 1.54 lakh ha and other fallow lands 12.31 lakh ha), 1970-71 (current fallow 8.69 lakh ha and other fallow lands 5.44 lakh ha) and 1980-81 (current fallow 11.69 lakh ha, and other fallow lands 7.16 lakh ha) show an upward trend in fallow land indicating less efficient use of land. Allahabad district has the largest proportion, followed by Pratapgarh, Lucknow, Lalitpur, Hardoi, Mainpuri, Unnao, Mirzapur, Farrukhabad, Sultanpur and Jaunpur. However, the share of fallow land is very low in the most intensively cultivated districts in the Ganga plain.
- **Culturable Wasteland:** The culturable wasteland in U.P. accounts for 1.51 lakh ha (i.e., 3.87 %) of the total reporting area). It is potential agricultural land, which can be brought under cultivation by improved farming techniques. The largest proportion of culturable wastelands is in Lalitpur district, followed by Jhansi, Etah, Rae Bareli, Farrukhabad, Banda and Lucknow. The factors responsible for the regional variations in culturable wasteland are hilly terrain, scanty of rainfall and inadequate irrigation facilities. The intensively cultivated district carries low proportion of culturable wasteland. In U.P. culturable wastelands (1961-62:16.05 lakh ha, 1970-71:13.44 lakh ha and 1980-81:11.48 lakh ha) shows a down ward trend which implies that some of the former culturable wasteland has been reclaimed for extension of cultivation and certainly more wasteland can be reclaimed by suitable package programmes for different regions.
- **Non- agricultural land:** This category includes non-agricultural land, usar and uncultivable land as well as groves and tree crops which together account for 13.64% of the total reporting area of the State. The proportion of usar and uncultivable land is high

in the district of Mainpuri, Aligarh, Farrukhabad, Rae Bareli, Unnao, Jhansi and Allahabad. Non-agricultural land has a pronounced spatial pattern as it is correlated with, (a) general economic development, and (b) Physical limitations, which have varied impact on the land use pattern.

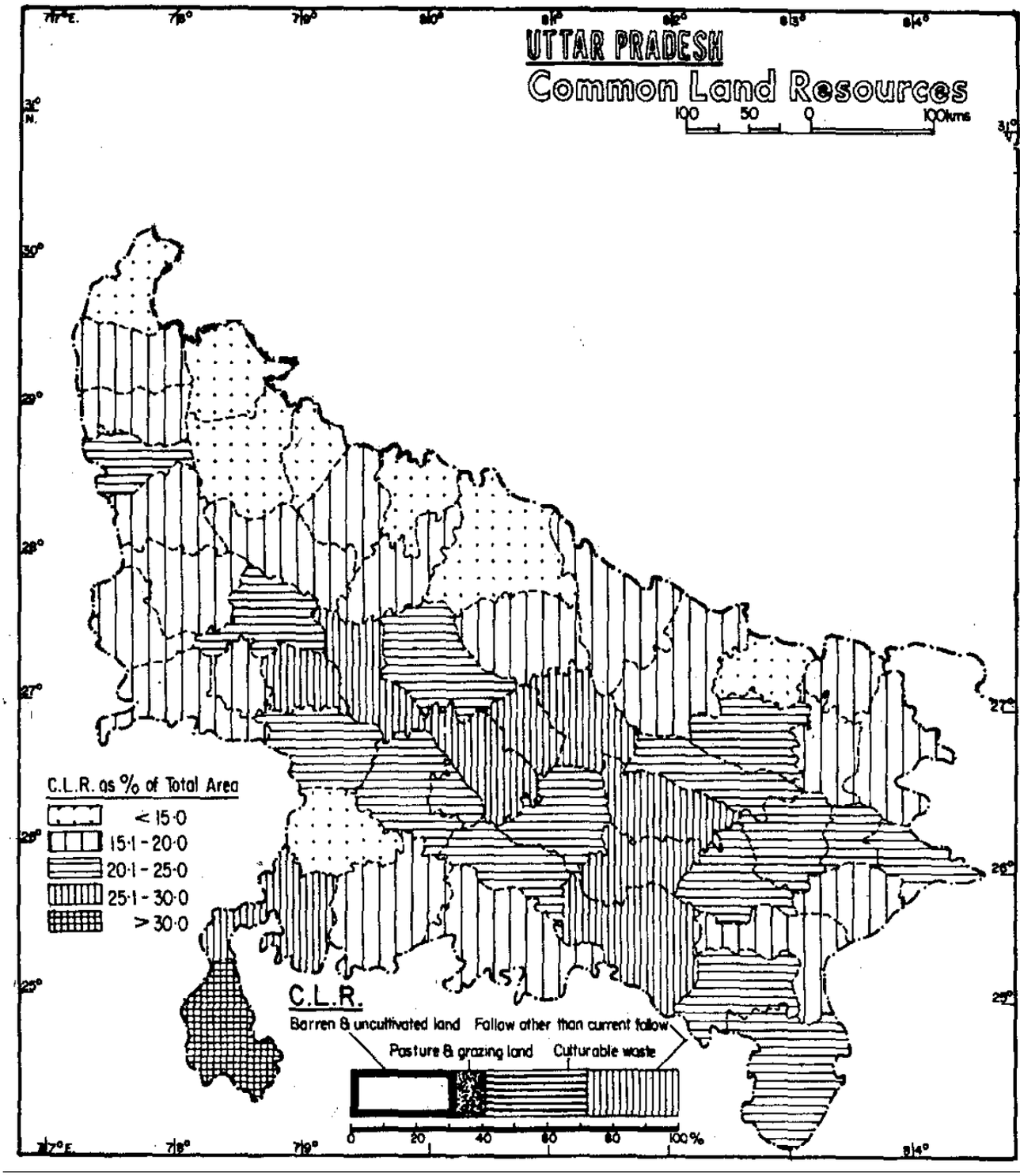


Fig. 3

- **Forest:** Presently the State has only 17.25 lakh ha (7.2% of total reported area) area under forests, which is considerably, lower than the national average of 21.5%. In fact, according to the National Forest Policy of 1952 efforts should be made to bring 60% of area under forests in the mountainous tracts and 20% in the plains. Most of the forests of U.P. are found in two districts (Pilibhit and Kheri in the Ganga plain. 12 districts of the Ganga plain have forest cover less than 1%. In the Bundelhand region the forest cover varies from 5.25% (Hamirpur) to 13.37% (Lalitpur) whereas Mirzapur claims a forest cover of 40.37%.
- **Permanent pastures and other grazing lands:** This category covers hardly 1% of the whole State, in Banda districts 0.02% area falls under this category.

Land use pattern (1998-1999) of Uttar Pradesh (Excluding Uttaranchal)

Net sown area	57.75%	6801073
Fallow land	6.50%	1692355
Culturable wasteland	3.87%	571297
Non-agricultural land	13.64%	2389733
Forest	17.24%	1714381
Permanent pastures and Other grazing land	1.00%	67240
Total	100%	24201157

Table 2.1: Desirable Land Use by 2001 A.D. in the State (lakh ha)

Land use category	Existing area	Desirable label of area
Forest	51.3 (17.2)	66.3 (22.3)
Barren and unculturable land	11.0 (3.7)	6.0 (2.0)
Land put to non –agricultural uses	23.8 (8.00)	26.7 (9.00)
Permanent pasture and other grazing land	3.5(1.2)	6.0(2.0)
Culturable waste land	11.2(3.8)	3.0 (1.0)
Land under miscellaneous, trees, crops and	5.5 (1.8)	9.0 (3.0)
Current fallow	10.9 (3.7)	3.0 (1.0)
Old fallow	8.4 (2.8)	3.0(1.0)
Net area sown	172.4 (57.8)	175.0(58.7)
Total	298.0 (100)	298.0 (100)

Source: Souvenir'2000

2.2.3. Problem Areas of the State

In view of their potential on conversion into different land use category the problem area (Table 2.2) of the State assumes high significance.

Table 2.2. Problem area in the State

Problem	Area (lakh ha)
1. Eroded and degraded land	
(a) Agriculture area	68.41 (50.93)
(i) Rainfed nonpaddy area	54.50 (40.14)
(ii) Current fallow	2.23 (1.64)
(iii) Other fallow	3.01 (2.22)
(iv) Culturable waste	7.12 (5.25)
(v) Land under Miscellaneous. Trees, etc.	1.55 (1.14)
(b) Non agricultural area	19.94 (14.69)
(i) Forest land	12.12 (8.93)
(ii) Pastures	1.11 (0.82)
(iii) Barren land	1.83 (1.75)
(iv) Other than agricultural uses	4.43 (3.19)
2 Special problems lands	47.40 (34.92)
(i) Ravinous	12.30 (9.06)
(ii) Desert	- -
(iii) Jhum Cultivation	- -
(iv) Coastal Cultivation	- -
(v) Land under usar and reh	12.00 (8.84)
(vi) Diara and Khadar land	15.00 (11.05)
(vii) Torrents	N.A
(viii) Water logged	8.10 (5.97)
Grand Total	**135.75 (100.0)**

Source: Souvenir'2000

- **Wasteland:** The problem of wasteland has acquired a crisis situation because of its magnitude as well as complexity, however, as there is no accepted definition of wasteland, its estimates vary widely. There is urgent need for the scientific assessment and preparation of inventory of wasteland in terms of their origins, characteristics and spatial distribution. The Wasteland Survey and Reclamation Committee appointed by the Government of India in 1959, defined the wasteland as those lands which are either not available for cultivation or are left out of cultivation without being cultivated like fallows and culturable waste. It is rather loose because it includes the area not available for agriculture, e.g. settlements and roads, permanent pastures and other grazing land, under miscellaneous trees and groves and fallow land. The wasteland of U.P. should be assessed on the basis of its degradation by specific problems as follows (Souvenir 2000):

(A) Culturable wasteland

(i) Salt affected land
(ii) Gullied or ravinous land
(iii) Water logged or marshy land
(iv) Jhum or forest blank
(v) Sandy area (Bhur)

(B) Non- culturable wasteland

(vi) Barren hill-ridge or rock out crop

(i). Salt affected land

The problems of salinity and alkalinity have rendered nearly 11.4 lakh ha land As barren and uncultivable land which is quite preponderant in the lower Ganga, Ghaghra Doab and the lower and middle Ganga-Jamuna Doab field investigations indicate that salinity is caused either by capillary action, which raises the sub soil salt on the ground or indiscriminate use of canal water. The progress of reclamation of salt-affected land and Usar land is not very satisfactory as hardly 1.50 lakh ha i.e., nearly 13 % of such land has been reclaimed under successive five-year plans in Uttar Pradesh.

(ii). Gullied or ravinous land

The areas that have recently become ravines, classified as wastelands. The problem of soil erosion has assumed alarming proportion as nearly 37 lakh ha of agricultural land suffers from it and nearly 12.50 lakh ha are deeply gullied or ravinous land the banks of Jamuna, the Chambal, the Sind, the Betwa, the Dhasan and the Ken are infested with such gullies or ravines (Table 2.3). The available statistics reveal that nearly 4.14 lakh ha of such gullied or ravinous land has been reclaimed by 1982-1983.

Table 2.3: Ravinous area under catchments of different rivers in Uttar Pradesh

Name of River area	Ravine area of U.P. (Lakh ha)	% against total
Yamuna	3.89	31.6
Chambal	0.79	6.4
Kali	0.89	7.2
Ken	0.20	1.6
Gomti	0.32	2.6
Sengar	0.51	4.1
Betwa	2.27	18.5
Dhasan	0.51	4.3
Pahun	0.53	4.4
Sai	0.29	2.3
Ganga	0.35	2.8
Son	0.77	6.3
Kuwari	0.50	4.0
Sindh	0.48	3.9
Total	**12.30**	**100.00**

Source: Souvenir 2000

- **Water logged or Marsh land:** Uttar Pradesh, Particularly Eastern part, is frequently menaced by floods and water logging and such area is approximately 18 lakh ha. This area in critical years rises to 40 lakh ha and is subjected to large scale devastation. In fact in 1978 as many as 74.17 lakh ha and 23 % population of the State was affected by floods and the total loss of life and property was of the magnitude of Rs. 300 crores. The naturally affected by this i.e., for a long time are important habitats for the biodiversity elements, hence not considered waste lands (Details please see under wet lands).
- **Jhum or Forest Blank land:** The degraded forest land is quite limited in U.P. and it is very difficult to estimate its incidence except by use of land satellite imagery figures pertaining to forests. It is mainly confined to scattered patches in the terai region.

- **Sandy area (Bhur):** Bhur is a wasteland because of excess of sandy deposits and a part of it is certainly fit for reclamation, The Bhur land is quite conspicuous in the Kachnar land of the Ganga in the districts of Moradabad, Budaun, Bijnor and Furrukhabad.
- **Barren Hill- Ridge or Rock out-crop:** They are associated with the Vindhyan Highlands and occur in the districts of Allahabad (Shankargarh), Banda, Hamirpur, Jhansi, and Lalitpur.

2.2.4. Mineral Resources of Uttar Pradesh

Uttar Pradesh is deficient in mineral wealth as its geological formations, excepting those in the Bundelkhand region and the Vindhyan scarplands do not favour their occurrence. However, the State Directorate of Geology and Mining, since its inception in 1955 has carried out several geo-chemical and geo-physical surveys and has explored the proved mineral resources of the order of 422.19 million metric tones.

- **Metallic minerals:** The State is deficient in metallic minerals. There is one important bauxide mine at Rajahaun (Manikapur-Banda District). Diaspore and Pyrophyllite resources are found in a few scattered locations in Hamirpur, Jhansi and Lalitpur districts.
- **Non-metallic minerals:** Uttar Pradesh has rich resources of non-metallic minerals, which are mostly used as industrial minerals. Dolomite, an important refractory mineral occurs in Mirzapur district where Bari Dolomite mine (near Chopan) is being worked to give a production of 180,00 TPY. Gypsum is mostly associated with dolomite and limestone formations in Hamirpur District in the Bundelkhand region. Mirzapur district has rich limestone deposits in the Son-valley where Bhalua limestone mine (near Obra) is in operation.

There is a rock phosphate project at Sonan (Lalitpur district). Silica sand is a valuable raw material for the glass industry. Its most important deposits occur in Shankargarh (Allahabad district) with their extension in Manikpur (Banda district). Their annual production is nearly 1.90 lakh metric tones. The State Mineral Corporation has set up the Silica Sand Project in Shankargarh. Coal deposits occur in Singrauli area in Mirzapur district but its main extension is found in Madhya Pradesh. Uranium has been recently traced in the southern part of Lalitpur district.

Building stones are found in Mirzapur, Banda, Hamirpur, Jhansi, Lalitpur, Mathura and Agra district. Sultpeter, Reh and Kankar are widely scattered in the Eastern and Central parts of the Ganga plain in Uttar Pradesh.

Table 2.4: Major distribution areas of minerals in Uttar Pradesh (Map)

Mineral resource	***Area of distribution***
Lime stone	Guruma Kanach Bapuhari in Mirzapur district, Kajaraht in Sonebhadra district
Dolomite	Mirzapur, Sonebhadra, Banda district
Copper	Lalitpur
Glass sand	Karchhana Tehsil in Allahabad, Karbi, Banda & Mau district.
Marbel	Mirzapur, Sonebhadra
Bauxite	Rajhgawan in Banda
Non-plastic fire clay	Bans- Makri, Khoh in Mirzapur district
Uranium	Lalitpur
Berites, Adalusite	Mirzapur, Sonebhadra

(Source: Burphal, 2001, Planning Atlas Uttar Pradesh, 1987)

2.2.5. Agricultural Resources

Agriculture is the main stay of the State's economy. The chief crops are rice, wheat, millets, barley and sugarcane. Since the late 1960, with the introduction of high yielding varieties of seeds for wheat and rice, greater availability of fertilizers and increased use of irrigation, the State has emerged as the largest producer of food grains in the country. The major agricultural resources of the State include:

- **Wheat:** U.P., the most important wheat growing state, with nearly 34%wheat area of the country, accounts for a production of nearly 35% of the total wheat production of the Country. Main Wheat lands are concentrated in the Doab between Ganga and Ghagra rivers and between the Ganga and Yamuna rivers. It is also grown in areas west of Varanasi (less grown east of city due to high rainfall). Major wheat producing districts are Gorakhpur, Meerut, Etawah, Bulandshahar, Budaun, Moradabad, and Sahajahanpur. Wheat is also grown in Jhansi, Hamirpur and Banda. In Hardoi, Bahraich, Kheri, Gonda and Basti districts Wheat is grown in south of terai.
- **Rice:** U.P. is the second largest rice producing State of India, and shares about 13% of national production of rice. The crop is widely grown in the eastern and northeastern parts including the Varanasi, Gorakhpur, Faizabad and Rohilkhand divisions where annual rainfall is more than 100cm.
- **Maize:** The leading districts in maize production of Uttar Pradesh are Bahraich, Gonda and Bulandshahar. Besides Kheri and upper Ganga-Yamuna Doab, these districts together account for 77% of the production.
- **Sugarcane:** U.P. is the largest sugar producing State of India with a national production of about 45%. State has about 52% of area under this crop. The leading producer of the State is Shahjahanpur, Saharanpur, Bulandshahar, Meerut, Aligarh, Azamgarh, and Ballia, Faizabad, Moradabad, Jaunpur and Varanasi districts. About 70% of the cane of the State comes from these districts. Rest 30% share goes to Kheri, Basti, Sitapur, Pilibhit, Jalaun, Banda and Hamirpur districts
- As such, the state government has proposed to increase the productivity and cropping intensity in the State. The policy planners have set a target of achieving a growth rate of 5.1% in agricultural production from the present level of 3.4%. The crop area would be increased from 17.4 million ha to 17.7 million ha mainly by treating problematic and alterable wasteland, which can be made arable. At present a staggering total area of nearly 12.95 lakh ha of waste Usar land is lying unutilized in U. P.

A general profile of State's agriculture can be understood from the following table:

Table 2.5: General profile of agriculture and related fields in Uttar Pradesh

Particulars	Area (Lakh ha)/production etc.
Total area	242.01
Area under cultivation	167.31
Gross cropped area	248.05
Saline soil	7.63
Ravine lands	6.23
Degraded land	17.23
Gross irrigated area	167.92

Net irrigated area	116.21(69.82%)
Cropping intensity	148.25 (National 131.50%)
. Average size of land holding	0.90 ha
. Percentage of small farmers	15.55
. Percentage of marginal farmers	73.99
. Food grain production (1999-2000)	452.36 lakh tones (22.44% of total production of country)
. Milk production	129.30 lakh litres
. Fruit production	85.00 lakh tones
. Vegetable production	165.00 lakh tones (8%)
. Wheat productivity	27.64 quintal/ha
. Rice productivity	27.76 quintal/ha
. Agriculture production rate	5.10%
. Food grain production based on APR	18.52 lakh metric tones
. Seed replacement rate	12%
. Consumption of NPK	125.80K/ha

(Source: Dainik Jagran, December 23, 2000. Statement of Divakar Vikram Singh, Agriculture Ministry, Government of Uttar Pradesh)

2.2.6. Water resources

- **Rivers of Uttar Pradesh:** The State is well drained by a number of rivers originating either from the Himalaya to the north or the Vindhyan range to the south. The Ganges and its main tributaries the Yamuna, the Gomti, the Ghaghara and the Gandak are fed by the perpetual snows of the Himalaya except the Ramganga. The Chambal, the Betwa and the Ken, originating from the Vindhyan Range, drain the southwestern part of the State before joining the Yamuna. The Son, also originating in the Vindhyan range, drains the south- eastern part of the state and joins the Ganges beyond the State borders.

- **Ground water resources:** Uttar Pradesh is well endowed with both surface and ground water resources. Generally ground water is available in most of the State at a shallow depth of 4 to 5 m. In the rocky Bundelkhand region water table is above 12 m. The availability of ground water in the State is presented in Table 2.6. Ground water is extensively utilized for irrigation purposes. Nearly two-third of the area is irrigated through pump sets and tube wells. On the whole a little over one –third of rechargeable ground water has been exploited in the State. The stage of ground water development is relatively better in the western region. However, due to extensive use of ground water resources for irrigation purpose the water table is gradually receding, though the problem has not assumed a serious dimension so far. Out of the 897 development blocks in the State 638 are classified as white areas, 187 as gray areas and only 72 as dark areas, further exploitation of ground water is undesirable. Of the 72 dark blocks, 59 are located in the western region, where over 80% of gross cropped area are irrigated. Net availability of ground water resources in different districts of U.P. is shown in Table 2.6.

Table 2.6: Net availability of ground water resources in Uttar Pradesh (10 Lakh cubic meters)

District	Net Storage	Net discharge	Utilization of Ground Water (%)
Agra	7931	456	57.8
Aligarh	1174	889	53.7
Bareilly	1623	554	34.1
Bijnor	1302	607	46.6
Budaun	1207	678	58.3
Bulandshahar	1516	742	48.9
Etah	1146	502	43.8
Etawah	1174	304	25.9
Farrukhabad	799	494	81.3
Mainpuri	784	409	52.2
Mathura	818	442	84.0
Meerut	1693	721	42.6
Ghaziabad	1171	394	33.8
Moradabad	1888	841	60.1
Muzaffarnagar	1948	717	36.8
Pilibhit	1780	509	28.8
Rampur	889	374	43.0
Saharanpur	1777	697	39.2
Sahjahanpur	1480	816	42.2
Barabanki	2323	744	32.0
Fatehpur	1291	678	52.4
Hardoi	1758	847	38.8
Kanpur city	209	58	29.3
Kheri	2332	842	38.1
Lucknow	716	301	42.1
Rae Bareli	1847	811	31.0
Sitapur	2513	846	33.7
Unnao	1600	553	36.9
Allahabad	1388	848	34.8
Azamagarh	1311	556	42.3
Bahraich	1977	769	38.9
Ballia	1043	328	31.4
Basti	1575	493	31.3
Deoria	2493	578	23.1
Ghazipur	1216	367	30.2
Gonda	2291	850	38.2
Gorakhpur	1088	447	41.9
Jaunpur	1238	580	44.3
Mirzapur	723	84	13.0
Partapgarh	1119	444	38.7
Sultanpur	1534	413	26.1
Varanasi	1017	358	34.9
Banda	989	205	21.2
Hamirpur	838	172	20.5
Jalaun	883	114	13.3
Jhansi	670	188	23.3
Lalitpur	427	193	45.2
Firozabad	785	310	39.5
Kanpur dehat	1241	554	44.8
Bhadohi	318	98	30.4
Sonbhadra	678	72	10.6
Maharaj Ganj	1682	228	13.7
Faizabad	1454	818	42.4
Sidharthnagar	1139	341	29.9
Mau	494	223	45.1

(Source: Statistical Diary, Uttar Pradesh, 1995 pp. 146- 150)

2.2.7. Forest Resources

The forest resources of U.P. are presented in Fig. 4. As mentioned earlier, U.P. has hardly 7.05 % area under forests as compared to 21.5% in India. Among the districts, Mirzapur alone falls under the category of 30-40% and three districts of Pilibhit, Kheri and Varanasi under the category 15 – 30 % forests. Forty five districts have less than 15 % of their area under forests of which two districts (Ballia and Ghazipur) have been reported with nil area under forests and 12 districts (Aligarh, Barielly, Etah, Farrukhabad, Mathura, Sitapur, Azamgarh, Deoria, Faizabad, Jaunpur, Pratapgarh and Sultanpur) have less than 1% area under forests.

The per capita share in the forest area of each district of U.P. is barely 0.037 ha as compared to 0.1 ha in India. Two districts (Pilibhit and Kheri) in the terai region and three districts (Mirzapur, Lalitpur and Banda) in southern U.P. have per capita forest area in the range of 1.0 to 2.0 ha, in 11 districts the per capita forest area ranges between 0.01 to 0.05 ha, whereas the remaining 33 districts cannot claim more than 0.01 ha per capita forest area with the minimum of 0.01 ha in Jaunpur district. The average value for the per capita production of timber in U.P. is barely 0.0059 Cu.m. 15 districts claim less than 0.01 Cu.m. of timber per capita but 27 districts have been put in the nil category.

The per capita production of fuel wood in (1981-82 average) is 0.016 Cu. m. Among all districts, 8 districts fall in the range of 0.01-0.05 Cu.m. whereas the remaining districts of the plain have less than 0.01 Cu.m. and even nil per capita production of fuel wood. This acute problem is causing great concern.

Changes in forest area of U.P. are presented in Table 2.7, and Table 2.8 summarizes the distribution of villages under different forests cover categories.

Table 2.7: Area under forests in Uttar Pradesh (Lakh ha)

Year	Area under forests
1950-51	31.94
1960-61	37.94
1969-70	46.68
1970-71	49.52
1980-81	51.28
1990-91	51.65
1998-99	17.41
2000-01	7.05

(Source: Planning Atlas Uttar Pradesh 1987)

Table 2.8: Forests as land use in villages of Uttar Pradesh

Forest area	No. Of villages	Total forest area (ha)	Population
Less than 100 ha	21,567	3,14,463	2,10,33,146
100-500ha	1,906	4,27,168	22,30,548
More than 500 ha	427	26,33,034	6,91,174
Total	**23,900**	**33,74,665**	**2,39,54,868**

(Source: Burphal 2001)

In the recent years an increase in the forest cover has been recorded in the districts of Hardoi, Kheri, Saharanpur, etc. The increase is on account of the plantations and also due to effective protection measures. The decrease in forest cover has been observed in the districts of Banda, Jhansi, Mirzapur, Sonebhadra, etc., which is largely on account of biotic pressure.

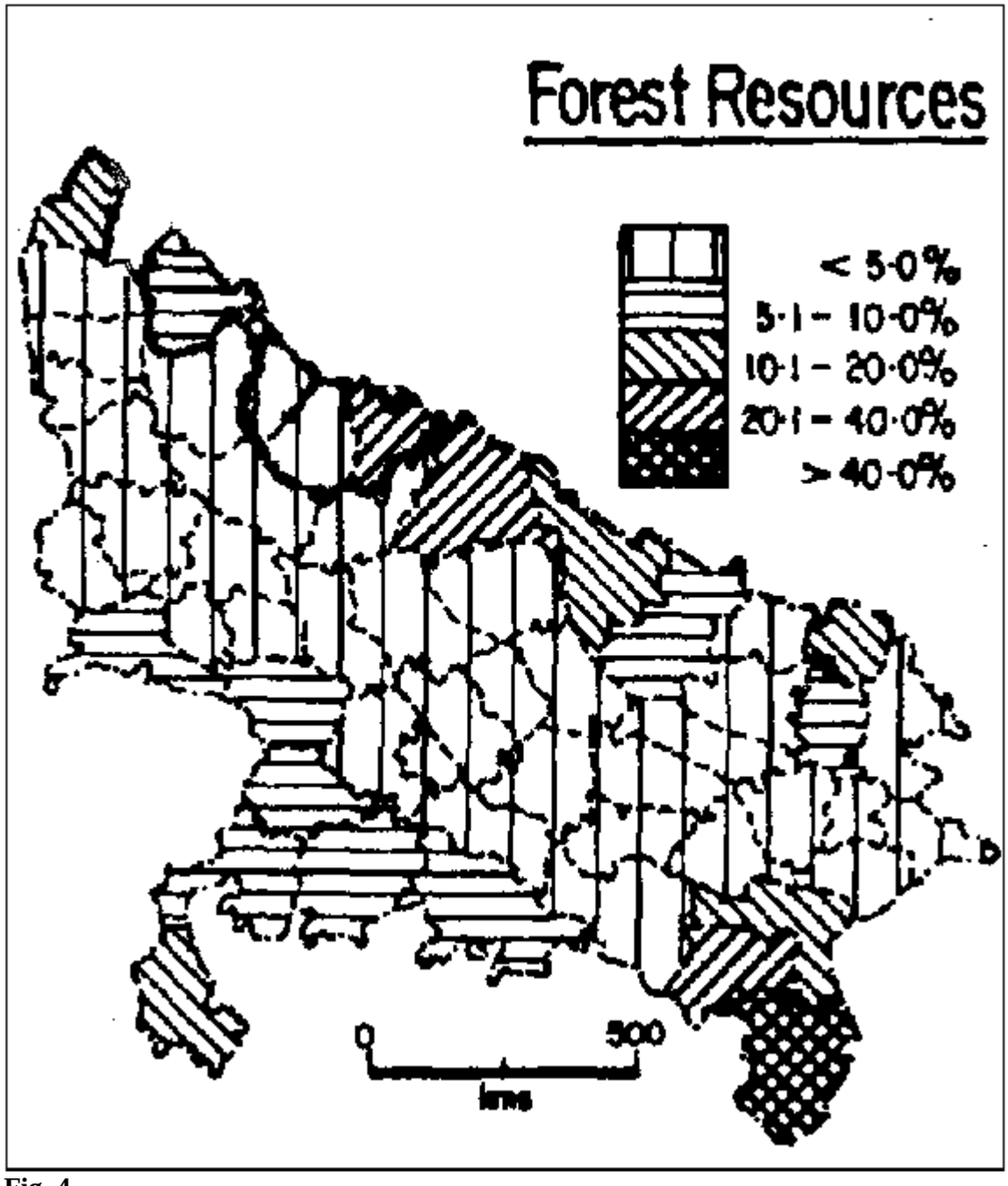


Fig. 4

2.2.8. Live stock resources

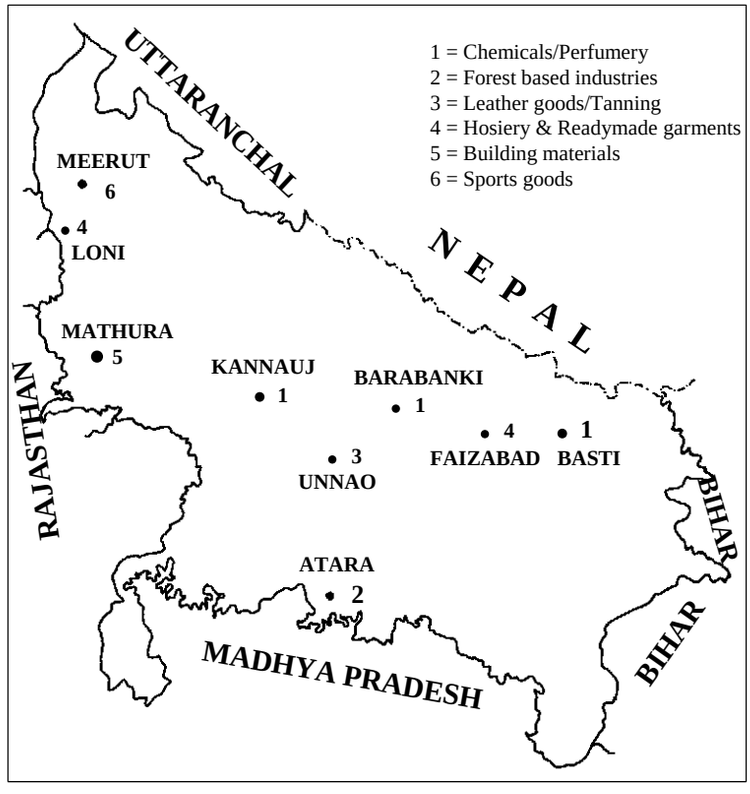
Animal husbandry is another important component of the economy of Uttar Pradesh contributing about one fifth of State's income. The State has the largest livestock population in the country, which engages 25% of the labour force (majority of the female force). The large number of livestock while contributing valuable food and non- food products and providing draft power also put a heavy pressure on the land and biotic resources. According to livestock census, 1993 total number of livestock in Uttar Pradesh was 70.2 million cattle and buffaloes account around 43 and 30% of total livestock, respectively. However, the full potential of milk has not been realized. The livestock consists mostly of local non-descript type of animals. Their productivity level is very low due to poor quality, shortage of feed and fodder and poor management practices. Thus, milk out put per day is estimated at only 2.3

liters per cow and 3.6 liters per buffalo. There is one milch animal per 100 persons in the State. The density of livestock is 238 km^2. It is relatively higher in three regions of Gangetic plain as compared to Bundelkhand region. The present number of livestock is clearly leading to inadequate nutrition and low productivity. In fact, availability of fodder is not sufficient even to maintain half of the livestock. The cattle are left free to graze causing damage to crop and vegetation and aggravating the problems of soil erosion and land degradation. There is an urgent need to adopt a strategy of livestock development aiming at reduction of their numbers and improving their quality and productivity through scientific animal husbandry practices.

2.2.9. Industry

Textile and sugar industry are long standing industries in Uttar Pradesh and employ nearly one third of the States total factory labour. Other resourcebased industries in Uttar Pradesh include vegetable oil, jute and cement. The Union Government has established a number of large factories that manufacture heavy equipment, machinery, steel aircraft, telephone and electronic equipments and fertilizers. An oil refinery at Mathura and the development of coalfields in the southeastern districts of Mirzapur and Sonebhadra are other major industrial establishments. The State Government has promoted medium and small scale Industries.

Industries that contribute most to the State's export include handicrafts, carpets, and brassware, footwear, leather and sporting goods. Carpets from Bhadohi and Mirzapur are prized worldwide. Silk and brocades of Varanasi, ornamental brassware from Moradabad, Chicken (embroidery) work from Lucknow, ebony work from Nagina, glassware from Firozabad and carved wool work from Saharanpur are other important industries. General distribution (Fig. 5) and status of different types of industries in U.P. is presented (Table 2.9).



Industrial complexes

Fig. 5.

Table 2.9: Status of Industries in Uttar Pradesh

Class	Production (in Crore Rs.)		
	1984-85	**1987-88**	**1988-89**
Agriculture based industry	1670	2780	3530
Cloth based industry	673	951	844
Livestock based industry	44	349	649
Forest based industry	6	23	34
Mineral based industry	885	1777	2107
Chemical based industry	857	1100	1851
Engineering based industry	2498	4383	5738
Others	1711	2508	1274
Total	**8443**	**13871**	**16025**

2.3 Socio-Economic profile

2.3.1. Population Patterns

As per the census of 2001, total population for U.P is 16,6052559 (male: 8,74,46301 and female: 7,85,86558). The decadal population growth (1991-2001) is 25.55% and presented in Fig. 6. Spatial pattern of population growth during 1971-81 was 25.49 % and against the all India growth rate of 25.00%. It may be mentioned that during 1951-61 the State's growth rate was 16.66% against the all India growth rats of 21.51%. Thus the population of the State continued to grow at a high growth rate and a substantial reduction in infant mortality. The average population density in the state is 689 ind/Km^2. Growth in population of U.P. State is given in the table 2.10.

Table 2.10: Population of State - by Rural-Urban population 1901-1991

Census Year	Total	Rural	Urban
1901	*48627670*	43237059	5390611
1911	*58154921*	43248248	4906673
1921	*46672411*	41735992	4936419
1931	*49779552*	44210763	5568789
1941	*56535170*	49518680	7016490
1951	*63219672*	54593973	8625699
1961	*73754573*	64274678	9479895
1971	*88341521*	75952925	12388596
1981	*110862512*	90963397	19899115
1991	*139112287*	111506372	27605915
2001	*16,6052559*	-	-

Among districts, in the highest category (above 35%) of growth rate, only one district (Ghaziabad) is included whereas in the next category (30-35%) eight districts (Saharanpur, Bijnor, Rampur, Pilibhit, Kheri, Mirzapur, Lalitpur and Jhansi) are included. In the third category (25-30%) 15 districts are included and the remaining 30 districts have recorded growth rate less than the State's average of which four districts (Gonda, Budaun, Mainpuri and Etah) have recorded the growth rate of less than 20% during the decade (1971-81).

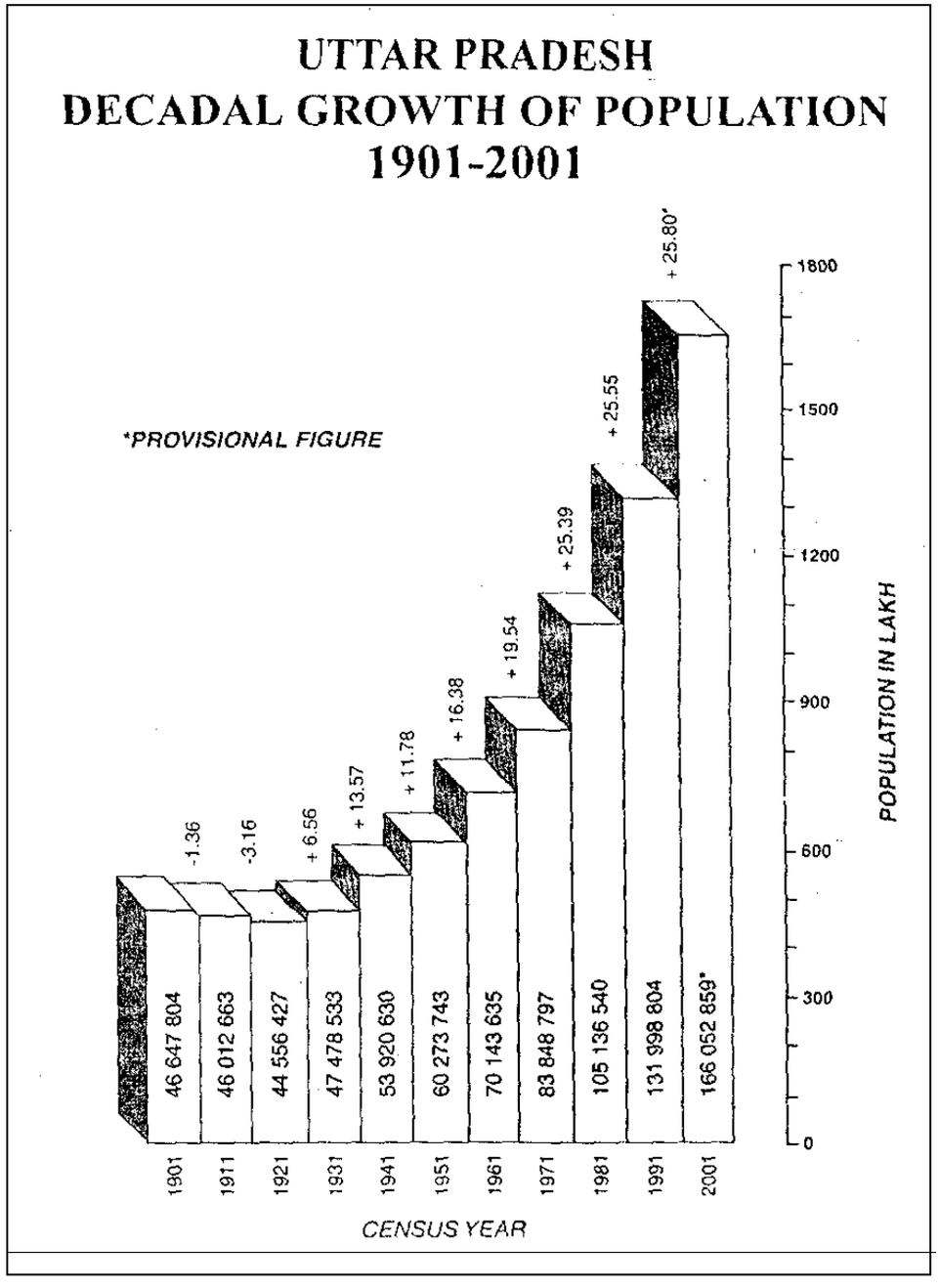


Fig. 6

Growth of urban population for the State has been +61.22 during 1971-81. During the decade 15 districts (included in the first two categories) have more than doubled their urban population whereas another 13 districts have recorded growth rate in urban population between 75-100%. 12 districts have recorded growth in urban population below 50% and the remaining 16 districts have recorded growth rates of urban population ranging between 50%-75%. The higher growth rates have been experienced by those districts where the levels of

urbanization were low to very low, excepting, Ghaziabad and Muzaffarnagar. The lowest growth rate (less than 50%) has been recorded in districts with the highest level of urbanization viz. Lucknow, Rampur, Agra, Varanasi and Allahabad and spatial growth patterns of rural population during 1971-81 in U.P. which was 19.70% for the State (i.e. less than the urban growth rate). In 11 districts (with the maximum of 33.95%) the growth rate in rural population has been more than 25% and in another 11 districts it has ranged between 20-25%. In the remaining 34 districts the growth rate in rural population is below the State's average and in two districts (Bulandshahar and Banda) it is less than 10%.

- **Distribution and growth of S.C. and S.T. population:** As per the census of 1991 the SC and ST population in U.P. is 29.57 million, SC –29.28million and ST-0.29 million. In three districts (Mirzapur, Sitapur and Unnao) their share in total population exceeds 30% and in another 7 districts (Kheri, Hardoi, Rae Bareli, Bara Banki, Etawah, Jalaun and Jhansi), their proportion lies between 25-30%. In 3 districts (Muzaffarnagar, Rampur and Bareilly) their share is < 15% while in the remaining districts it lies between 15-25%. With regard to spatial distribution of SC, three districts (Mirzapur, Sitapur and Unnao) exceeds 30% and in 7 districts it lies between 25-30% as in the case of the total SC and ST population. In the category of less than 15% of SC population are included 3 districts (Muzaffarnagar, Rampur and Bareilly). Accordingly the lowest proportion (below 15%) of the SC population is found in the districts of Rampur, Bareilly and Muzaffarnagar.

- **Patterns of population density**

  (i) The spatial patterns of arithmetic density which is nothing but simple man-land ratio of U.P. (1981) is 377 person/km^2 with the maximum of 799 persons/km^2 in Lucknow district. The highest arithmetic density (more than 600 persons/km^2) is found in 6 districts of Eastern U.P. (Deoria, Gorakhpur, Ballia, Azamgarh, Jaunpur and Varanasi), 2 districts of Central U.P. (Lucknow and Kanpur) and 2 districts of western U.P. (Ghaziabad and Meerut) and the lowest arithmetic density is of the Bundelkhand region (Lalitpur). The low density (150-300 person/km^2) is found in four districts of the Bundelkhand region (Banda, Hamirpur, Jhansi, and Jalaun) and Mirzapur, Kheri, and Pilibhit. The remaining districts carry arithmetic density of population in the range of 300-600 person/ km^2.

  (ii) Distribution pattern of population, which correlates the total population of the region with its arable land, is better measure of man-land relationship. The average State's physiological density of population is 644 persons/km^2 with the maximum of 1,406 persons/km^2 in Lucknow district, followed by Varanasi (1,142), Ghaziabad (1975), Meerut (889), Kanpur (878) and Jaunpur (870). All these districts lying in the highest category of more than 850 persons/km^2. In the second highest category (650-850 persons/km^2) are included 15 districts (including ten districts of Eastern U.P., five districts of western U.P.). In the Bundelkhand region the physiological density ranges between 237 persons/km^2 (Hamirpur district) and 379 persons/km^2 (Jhansi district). Kheri has physiological density of 434 persons/km^2. In the category of 450-650 persons/km^2 the remaining 20 districtsare included.

  (iii) Distribution pattern of rural density, which is 309 persons/km^2 for the State with the maximum of 600 persons/km^2 in Deoria, district. The highest category (more than 450 persons/km^2) is found in 10 districts of Eastern U.P. (Deoria, Gorakhpur, Basti, Ballia, Azamgarh, Faizabad, Pratapgarh, Jaunpur, Varanasi, & Ghazipur) and 3 districts of western U.P. (Muzaffarnagar, Meerut and Ghaziabad). The lowest category of rural density (less than 150 persons/$km^{2)}$ is found in the three districts of Bundelkhand region

(Hamirpur, Jhansi, and Lalitpur), which are mostly sparsely populated. The most frequent category (300-450 persons/km^2) is carried by 25 districts.

(iv) Distribution pattern of agricultural density of population, which correlates the total agricultural population of the region with its total arable land is a very significant density for the regions, which are predominantly agrarian. The highest agricultural density (more than 850 persons/km^2) is found in two districts (Lucknow and Agra). The second highest category (650-850 persons/km^2) covers 12 districts. The most predominant category (450-650 persons/km^2) occurs in 29 districts and the lowest category (less than 250 persons/km^2) is confined to only one district (Hamirpur)

- **Age and sex structure:** The pattern of sex ratio in U.P. is presented in Fig. 7.

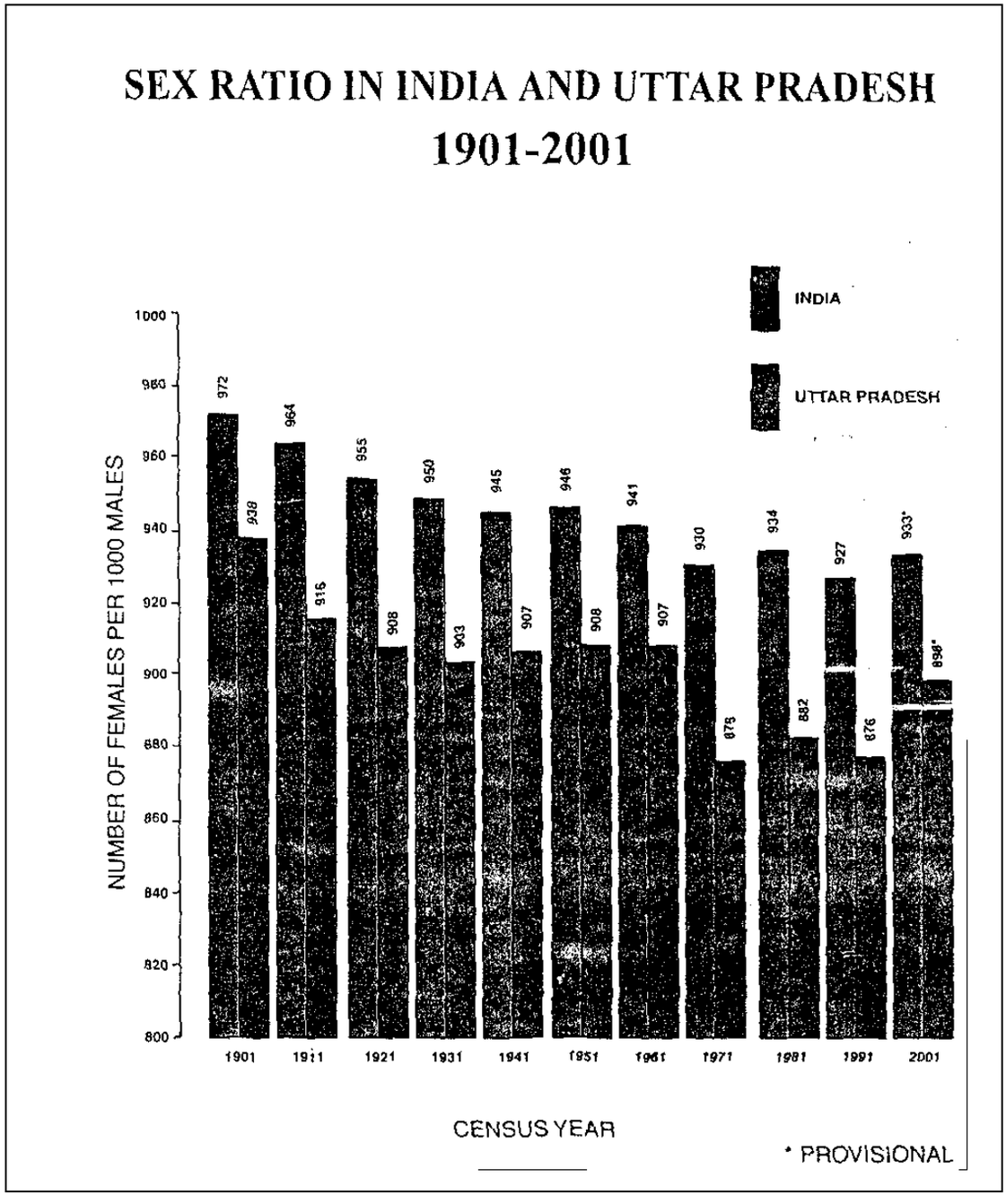


Fig. 7

- The sex- ratio of the total population of Uttar Pradesh (1991) was 876 but it has gone up to 898 (Year 2001). Ajamgarh district has highest ratio (1026). The other districts where female are more than males include Jaunpur (1021), Dewaria (1003). Whereas, Sahjahanpur (838), Mathura and Buduan (841) each, Gauttam Budh Nagar (842) and Hardoi (843) are the districts with poor sex ratio. The overall age sex structure of U.P. is given in table 2.11:

Table 2.11. Age-sex, structure of Uttar Pradesh (1971) & (2001)

MALE			**FEMALE**		
Age-group	**Total population (lakh)**	**Percentage of Total male Population**	**Total population (lakh)**	**Percentage of Total female Population**	**Sex ratio (female / 1000 males)**
0-14	197.86	42.08	171.79	41.57	869
15-34	135.13	28.74	125.88	30.46	932
35-44	52.70	11.21	46.41	11.23	881
45-59	51.56	10.97	42.21	10.22	819
6+	32.90	7.00	26.93	6.52	810
All age Groups	470.15	100.00	413.22	100.00	879

(Source: Planning Atlas Uttar Pradesh, 1987 and Provisional Census Totals of India 2001)

- **Literacy Patterns:** As per 2001 census the literacy rate in the State is 57.36% (National-65.38%), of which male literacy is 70.23% and female literacy is 42.98%. Changing patterns of literacy rate in U.P. from 1951 to 2001 are presented below:

Table 2.12: Changes in literacy rates in Uttar Pradesh (1951-2001)

Year	**Total literacy %**	**Male literacy %**	**Females literacy %**
1951	12.02	19.07	4.07
1961	20.87	32.08	8.36
1971	23.99	35.01	11.23
1981	32.65	46.65	16.74
1991	40.71	54.82	24.37
2001	57.36	70.23	42.98

(Source: Provisional Census of India 2001)

- **Ethnic & social groups:** The vast majority of the population in the State belongs to the Aryo-Dravidian origin, only a small minority displays Asiatic origin. Currently, according to 2001 census, of the total population in the State (i.e., 166,052,859) Hindus constitute more than 80%, Muslims > 15% and other religions communities (including Sikhs, Christians, Jains and Buddhists) together < 1%.

  Over 80% of the population lives in rural areas. The rural settlements are characterized by compact villages in the western part of the State, grouping of hamlets in the eastern part and a combination of both in central part. More than half of the urban population lives in cities. The five largest cities of Uttar Pradesh are Kanpur, Lucknow, Varansi, Agra and Allahabad.

2.3.2. Occupational structure

Rural economy dominates in the State (>80%). Sectorial structure of the work force is one of the most important indicators to comprehend the process of transformation. Majority of the main workers of the rural Uttar Pradesh i.e., 84.5% still depends on agriculture for their subsistence. Labour force has not been withdrawn substantially from agriculture. On the contrary, the pressure of agricultural labourers on this sector has increased in recent years. Increasing number of agriculture laborers reflects their landlessness and provides a basis for many of us to argue in favour of capitalist transformation in agriculture. However, growing pool of agricultural labourers does not necessarily imply that a process of capitalist differentiation is at work. Landlessness could indeed reflect such differentiation. But, it could also reflect the growing pressure of population on land, which gradually squeezes out peasants at lower end of the land holding strata to the class of landless agricultural labourers. However, microstudies suggest that the number of cultivating households has increased.

Table 2.13: Percentage distribution of rural main workers in Uttar Pradesh

Category	1961	1971	1981	1991
A: Total agricultural workers	78.8	86.5	86.1	84.5
1: Cultivators	71.1	67.3	69.9	62.6
2: Agricultural labourers	7.1	19.2	16.2	21.9
B: Household industry	5.6	3.1	3.0	3.2
C: Other workers	15.6	10.4	11.1	12.3

(Source: Social change in post independent India 2001)

With technological advancement, diversification of occupational activities has also been witnessed. There are evidences that technological progress has reduced the traditional base of employment and occupation in rural areas. At many places the labourers have been replaced by forced mechanization. However, the expanding network of communication has increased the mobility of rural labourers. Table 2.13 includes scenario of income and employment in economic sectors of U.P.

Table 2.13: Income and Employment in Economic Sectors of Uttar Pradesh, 1980-81 and 1995-95 (% share of sectors)

Sectors	1980-81		1995-96	
	Income	Employment	Income	Employment
Primary	52	75	42	73
Secondary	15	10	20	9
Tertiary	33	15	38	18

(Source: Social change in post independent India 2001)

2.4. Political Profile

Uttar Pradesh is known for its intellectual leadership since British administration. The British combined Agra and Oudh into one province and called it United Province of Agra and Oudh. The name was shortened to the United Province in 1935 and in 1947 the united province of the newly independent dominion of India. Two years later the Autonomous States and Rampur, both within its bordered, incorporated into the United Province with the adoption of a New Indian constitution in 1950, the United Province was renamed Uttar Pradesh and became constitute of the new Indian Union.

Uttar Pradesh has a parliamentary form of Government consisting of an executive, legislative and judicial branch. The executive branch consists of the Government, aided and advised by the Council of Ministries headed by a Chief Minister. The legislative wing consists of two houses the Legislative Council (Vidhan Parishad), which is a permanent body with one third of its members retiring every two years, and the Legislative Assembly (Vidhan Sabha), whose members are elected for five years term. The judiciary consists of a High Court headed by a Chief Justice. The State's High Court is located at Allahabad a bench at Lucknow. Below the State level, there are 13 administrative divisions, and 70 districts for local administrative activities.

Uttar Pradesh has now 70 districts, 11 Nagar Nigams and 300 tahsils, 809 C.D. blocks, 701 urban units and 107,166 villages. In U.P. a lot of jurisdictional changes had taken place after 1991 census resulting into creation of 16 administrative boundaries of 27 districts.

2.4.1. The Government structure (Dr. Jamal, 2002)

Under the Constitution of India, Uttar Pradesh has a Governor and a bicameral legislature. The Lower House is called Vidhan Sabha and the Upper House - Vidhan Parishad. The State also has a High Court at Allahabad with its bench at Lucknow. The executive power of the State is vested in the Governor who is appointed by the President of India. The Governor cannot be a member of either of the two Houses of Parliament or any House of the Legislature. He also cannot hold any office of profit and can use his official residence without payment of any rent. Besides, he is also entitled to such pay, allowances and privileges as prescribed by parliament by Law from time to time. In the absence of such a Law he is entitled to such pay, allowances and privileges as specified in the Second Schedule of the Constitution.

- **Council of Ministers**

There is a Council of Ministers headed by the Chief Minister to aid and advise the Governor in the conduct of Government business. Barring such matters, which are to be decided by the Governor in his discretion under the Law, the Council assists him in all the remaining business. If any question arises as to whether any subject fall within the purview of the Governor's discretionary power, his decision is taken as final. The Chief Minister is appointed by the Governor who also appoints other Ministers on the advice of the Chief Minister. The Council of Ministers is collectively responsible to the Vidhan Sabha. Before a Minister assumes office, he is administered oath of office and secrecy by the Governor as per form prescribed in the Third Schedule of the Constitution. Any minister who does not become a member of the Legislature for six consecutive months ceases to be a Minister after the expiry of the six-month period. The ministers are entitled to such pay and allowances as may be fixed by the Legislature by law from time to time. They are also entitled to other perquisites, including free furnished residence, & traveling and medical facilities.

All the executive business of the State is carried on in the name of the Governor. The Chief Minister has to inform the Governor about all the decisions taken by the Council of Ministers in regard to administration as also require the Council of Ministers to reconsider any matter on which a unilateral decision has been taken by a Minister. The Governor has been made a component part of the Legislature under Article 168 of the Constitution and has been assigned certain functions. He summons both or either of the Houses of Legislature and also prorogues them. He is also empowered to suspend or dissolve the Vidhan Sabha. He also nominates 12 members to the Vidhan Parishad and one Anglo-Indian member to the Vidhan Sabha. After each general election and thereafter before the commencement of the first

session of the Legislature each year, the Governor addresses the joint session of both the Houses. He can send messages to any House of the Legislature in connection with any bills pending with the legislature. The Governor gives assent to the bills passed by the Legislature or may reserve it for the assent of the President. Without assent no bill can become an Act.

Each year the Governor tables the annual financial statement of the concerned year, the report of the Public Service Commission, and the report of the Comptroller and Auditor General of India, pertaining to the accounts of the State of both the Houses of the Legislature. He is also empowered to promulgate ordinances when the Legislature is not in session provided he is satisfied that the situation requires immediate action. The ordinances thus promulgated have to be placed before the Legislature as soon as it meets and are subject to its approval or disapproval.

- **Vidhan Sabha**

The Uttar Pradesh Vidhan Sabha has a total of 404 members including one Anglo-Indian Member who is nominated by the Governor. Till 1967, it had strength of 431 members including one nominated Anglo-Indian Member. According to the recommendation of the Delimitation Commission, which is appointed after every Census, the State had been divided into 403 Vidhan Sabha Constituencies. The Term of the Vidhan Sabha is five years unless dissolved earlier. The election for it is held on the principle of "one adult one vote".

The Vidhan Sabha has the power to frame rules for regulating and laying down the procedure for the conduct of its business. All matters coming before the House are decided by a majority vote. The quorum of the House is one-tenth of its membership. The business of the Vidhan Sabha is conducted by the Speaker and in his absence by the Deputy Speaker. Both of these are elected by the members by a majority of votes. The main business of Vidhan Sabha is to enact laws, grant money for Government expenditure and exercise control over the activities of the Government through debates and raising matters of urgent public importance. The Language of the House is Hindi in Devanagri script. Legislative matters are placed before the House with the permission of the House in the shape of official or non-official bills. After this, the bill is taken up either for consideration of the House directly or referred to a Select or Joint-Select Committee. If the House passes the bill after clause-by-clause consideration, it is sent to the Vidhan Parishad, which may either reject or pass it with amendments. In any case, the Vidhan Sabha may pass the bill with or without amendments. In case the bill so passed for the second time is rejected or passed with amendments to which the Vidhan Sabha does not agree or is kept pending for a period up to one month by the Vidhan Parishad, the bill is deemed to have been passed by both the Houses of the Legislature and sent to the Governor for his assent. But, no money bill can be kept pending by the Vidhan Parishad for more than 14 days from the date of its receipt and if it is kept pending it is deemed as passed by both the Houses and sent to the Governor for his assent. Budget estimates are put to the vote of the House. According to the rules, the House can take 5 days for general debate on the estimates and another 24 days for passing them. The Ministers on the recommendation of the Governor put the estimates before the House for sanction. They are in shape of demand of grant department-wise. The opposition can move cut motion on these demands. The Constitution has made provision for introduction of proposal for supplementary or additional grants in the House if the expenditure exceeds sanctioned money.

Since the house cannot deal with every matter that comes before it or to examine it in detail, it works through the Committees. There are committees to deal with legislation matters such as the Select Committee on bills or the Delegated Legislative Committee, which examines rules, regulations, and by laws framed by the Government under powers vested in it under the various Acts and the Constitution. Besides, the House has three important Financial

Committees—the Estimates Committee, the Public Accounts Committee, and the Public Undertakings and Corporation Committee. The Estimates Committee examines the estimates presented in the House. The Public Accounts Committee examines the reports of the Comptroller and Auditor-General of India relating to this State and sees to it whether the money spent was actually available or not and had been spent for the purpose for which it was earmarked by the House.

Uttar Pradesh is the first State to accept the Principle that the Chairman of the Public Accounts Committee should be from the Opposition. The State has been following this convention since 1948 although the Lok Sabha adopted it only after 1967. The Pubic Undertakings and Corporation Committee was set up recently after the setting up of several public sector undertaking in the State. In view of the need for ensuring accountability of public undertakings to the Legislature and the same time preserving their autonomy, the Public Undertaking Committee examines their working and gives them directions.

Besides these Legislative and Financial Committees, there are other committees to assist in the conduct of the business of the House. The Assurance Committee examines the assurances given by the Government in the House; the Privileges Committee examines cases of violation of privileges raised in the House, while the Petition Committee looks into the petitions submitted to the Vidhan Sabha by the people from time of time. There is one more important committee of the House, the Business Advisory Committee, which allots and regulates time for business before the House. Uttar Pradesh also set up a Parliamentary Studies Committee a few years ago to study parliamentary affairs and give its suggestions. The committee has worked on issues regarding privileges of members, ordinance-issuing power of the Governor, inclusion of Vidhan Parishad members in financial and other committees and working of the committee itself. Another committee was set up to oversee the welfare of Scheduled Castes/Tribes and Denotified Tribes. In addition, there are 27 Standing Committees to advise the ministers.

- **Vidhan Parishad**

The State has had a bi-cameral Legislature since 1937. The Upper House or the Vidhan Parishad is a permanent House. Members are elected or nominated for six years and one-sixth of them retire every second year. It has 108 members, 12 of whom are nominated by the Governor. Thirty-nine members are elected each by the Vidhan Sabha and Local bodies and nine each by teachers and graduates. The Vidhan Parishad has no right to vote on demands for money, nor can any money bill be introduced in it. No other bill can become a law unless passed by both the Houses. The presiding officers of Vidhan Parishad are known as Chairman and Deputy Chairman. They are elected and hold their offices like the presiding officers of Vidhan Sabha. Both the Houses of Legislature have their own separate Secretariats and Secretaries. They function independently of the State Government Secretariat and Secretaries. Both the Secretariats have been divided into sections, which look after parliamentary, accounts and committee work.

Members of both the Houses and Committees have the same privileges, powers and immunities as those of the members of the House of Commons in UK. Besides, no prosecution can be launched against them in courts for anything said on the floor of the House. The Leader of the Opposition has been given a status at par with that of a minister. The leader of the single largest recognized opposition party, having the strength to make up the quorum, is recognized as the Leader of the Opposition.

- **The Secretariat**

Most departments of the Secretariat have Heads of Departments and Heads of Offices under their administrative control, which function as the executive authorities of the Government. All the Government orders are issued in the name of the Governor but are signed by the Secretary or Officers under him down to the rank of Under Secretary. The work of the Government is conducted in Hindi, in Devanagri script. The Principal Secretaries, Secretaries, Special Secretaries, Joint Secretaries, Deputy Secretaries and Under-Secretaries are appointed either from the Central or State Administrative Services. Some Deputy Secretaries and Under Secretaries are also appointed from the permanent Secretariat Services. As a matter of fact, mostly permanent officers of the Secretariat are appointed to the post of Under Secretary. Offices in Judicial and Legislative Departments are appointed from the Judicial Services. The work of the Secretariat can be divided broadly into the following categories: - (i) Personnel Administration, (ii) Financial Administration, (iii) Judicial and Legislative Affairs, (iv) Law and Order, (v) Levy and Collection of Taxes, (vi) Economic Development and Conservation of Sources of State's Wealth, (viii) Social Services, (viii) Public Utility Services, and (ix) General Administration.

- **District and Divisional Administration**

After the Secretariat and Heads of Departments, the Divisional Commissioner is responsible for law and order, revenue, administration and other matters pertaining to his division. He has to exercise supervision over the District Officers, local bodies and planning and development works. Each division consists of certain districts. Each district is under the administrative charge of a District Officer who is also called the District Magistrate or Deputy Commissioner. The District Officer is fully responsible for the law and order in his district and has extensive administrative, police and revenue powers. Besides maintaining revenue records, he has also to look after works relating to planning and development and land reforms. The district is further divided into tehsils, blocks and villages for administrative convenience and for collection of revenue and development works. The tehsils are headed by a Sub-Divisional Magistrate. He is basically a Revenue Officer who performs the multifarious duties of revenue collection, maintenance of law and order, implementation of Govt. schemes and coordination. He is the mirror image of the District Magistrate at the Sub-Divisional level. Most of the districts have 3-6 Sub-Divisions. The SDM is assisted by a Tehsildar who has basically revenue and magisterial functions. Below him are Nib Tehsildars, Supervisor Qanungos (Revenue Inspectors) and Lekhpals (Village Revenue Officers). Nearly all departments have their mirror officers at the Sub-Divisional level.

The Sub-Division itself is divided into Community Development Blocks. These form the basic core of all developmental schemes. The Blocks are headed by Block Development Officers (BDOs). Every Block has nearly 100 villages. The Block level planning is done by a Kshetra Panchayat (Block Development Council : BDC). The BDC is presided by the Block Pramukh who is elected by the Pradhans of the constituent villages. Each village elects its headman known as the "Pradhan". The Pradhan works within the parameters of a GAO Sabha. The members of the Gaon Sabha are elected by direct elections held once every five years. The Gaon Sabha administers the village through various committees consisting of its members. These committees look after health, education, irrigation, etc. The Gaon Sabha is assisted by a Village Development Officer. Recently a major exercise has been undertaken to decentralize governance. All functions of 11 departments have been handed over to the village level bodies for planning, implementation and monitoring.

- **The Judiciary**

The High Court is the apex court in the State in respect of civil and criminal cases. The Board of Revenue is the highest court in respect of revenue cases. Under Article 277 of the Constitution, the High Court has been given the power of superintendence over all others courts and tribunals. The High Court is Court of records, which means that its work and proceedings serve as perpetual evidence. Its records are of such high authority that their content cannot be challenged in any lower court. As a court of record, it has also the power to punish persons guilty of its contempt. The Chief Justice of the High Court is appointed by the President of India on the advice of the Chief Justice of the Supreme Court of India and the Governor of the State. Other Judges are appointed by him on the advice of the Chief Justice. Only such persons are eligible for the post of High Court who have worked as an advocate for at least ten years or held office in any Judicial Service for the same period. The High Court is empowered to issue writs to any person or office for protecting the fundamental rights enshrined in the Constitution. It has both original and appellate jurisdiction in civil as well as criminal cases.

Subordinate Judicial Service

The Subordinate Judiciary has been divided into two parts "The U.P. Civil Judicial Services" and "The U.P. Higher Judicial Services". The former consists of Munsifs and Civil Judges including Small Cause Judges and the latter of Civil and Sessions Judges (now Additional District Sessions Judges). The District Judge is the controller of the Subordinate Judicial Service at the district level.

The State is divided into judicial districts, each under the control of a District Judge. In certain cases Munsifs and Assistant Collectors and Assistant Session Judge are also present. The jurisdiction of the District Judge extends to more than one revenue district in some cases. On the civil side, the Munsif's Court is the lowest court. The next higher court is that of the Civil Judge. The highest court at the district level is that of the District Judge. In criminal cases, the Munsif has the powers of a Judicial Magistrate. From October 2, 1967, the Judicial Magistrates, who were hitherto under the Government, have been placed under the High Court. Thus there is now complete separation of judiciary from the executive except for revenue matters. On the revenue side, there are Assistant Collectors. Above them are additional Collectors and Collectors, who have appellate jurisdiction. Higher up is Divisional Commissioner and Additional Commissioners who exercise appellate jurisdiction. The Board of Revenue is the highest court in revenue matters. Under the Uttar Pradesh Panchayat Raj, Nyaya Panchayats have also been set up. On civil side, they can hear certain cases up to a value or Rs.500 in IPC and other laws. They are not empowered to give prison sentence.

Uttar Pradesh Public Service Tribunal

The number of service cases of Government servants in courts was constantly rising. Such cases involved time and money of State Government Officers and employees and of State Corporations and Companies. Keeping this in view, the Uttar Pradesh Public Service Tribunal was set up in 1976 with the objective of rendering speedy and cheaper justice to the employees.

- **Government institutions in the and biodiversity sector**

In the forest sector of the State the main governmental institutions are the Uttar Pradesh Forest Department (UPFD) and the Uttar Pradesh Forest Corporation (UPFC). The UPFD

advises the Government of Uttar Pradesh on forest policy and development along with the operational responsibility for management and protection of forests and wildlife in reserve forest areas and in afforestation and watershed management programmes both within and outside reserve forests and for the promotion of social and farm forestry. Other important departments include the Revenue Department and the Departments of Horticulture, Agriculture and Animal Husbandry through their involvement in reclamation of non-forest wastelands, watershed management programmes and livestock development activities. The wetlands are very good abodes for the fishes and various Government organizations have been promoting fish farming in wetland rich areas.

Structure of the UPFD

UPFD is headed by a Principal Chief Conservator of Forests (PCCF). The work of the Department is organized in 3 zones; each headed by a Chief Conservator of Forests (CCF). There are two CCFs for planning schemes. Each zone is divided into circles, divisions, ranges, and beats. There is a separate functional wing for wildlife management under the Additional PCCF Wildlife (the Chief Wildlife Warden). Publicity and Extension responsibilities are divided between a CF Publicity and Extension, under the PCCF, and a separate cell for Publicity and Extension headed by a DFO exists under the CCF Planning (Plains). A CF for Monitoring and Evaluation, another CF for Training and a Joint Director Statistics to look after Budget also form part of the CCF Planning (Plains) wing. In addition a PCCF Research and Training along with the CF Seed and Research and Director Forestry Training Institute Haldwani is responsible for research and training activities of the Department. The working plans are prepared by DFO, Working Plans and the work is supervised by two-CFs and a PCCF Evaluation and Working Plans.

The Position of UPFD in the State Budget

Total annual expenditure by the State Government of U.P. in 1995-96 was Rs. 17,816.50 Crore. Of this the UPFD budget of Rs.130.33 Crore represents 0.7% of the State expenditure. Since 1992-93 this has fallen from 0.9%. Of the 1995/96 UPFD budget of Rs. 130.33 Crore approximately 58% was from the Plan budget and 42% Non-Plan (UPFD, 1997). Of the Plan budget the allocation between budget items was:

Budget Item	**Rs. in Crores**
Forestry	62.27
Wildlife	4.19
Soil conservation	9.12
Research	0.24
Total	75.82

(Source: Data collected by Mr Sanjay Vani, World Bank, New Delhi as cited in UPFD, 1997)

Of the 1995/96 Plan budget, the allocation of expenditure for the Plains (now the entire area of UP) was (55.5%). [1]

[1] The modality for payment of royalties needs to be clarified it is currently unclear as to whether or not the UPFD budget is inclusive of royalty.

Structure of the Uttar Pradesh Forest Corporation

UPFC was established in 1975 as a local authority under the U.P. Forest Corporation Act. Its functions are to:

- Undertake removal and disposal of trees and exploitation of forest resources
- Prepare projects related to forestry
- Undertake research related to forests and forest produce and render technical advice
- Manage and develop forests transferred or entrusted to it
- Perform such functions as the State Government may require from time to time

The UPFC has a Gverning Body nominated by GOUP. The Managing Director, assisted by three General Managers is of the rank of CCF, whilst the eight regional managers are of CF rank. Divisional managers report to the regional managers. The total staff strength is about 3,070, of whom 44 are Category there are some 3,000 persons employed in a non-permanent capacity, however under the regulations of the labour laws of UP State, most of these people enjoy almost the same security of employment as permanent staff.

The activities of the Corporation are mainly focused on the collection and marketing of forest produce, both timber and non-timber forest products. The Corporation plays a major role in the marketing of forest produce in the State. UPFC buys all wood-based on a number of agreed principles. In 1995-96, the proportion of royalty paid to the State Government was approximately 43% of total sales. In 1995-96 the UPFC made a total profit of Rs. 37.1 Crores and retained profits from past allocation, order supplies, and retails sales. The majority of sales are by auction. Sales through allocation are based on a demand requirement from industries and allocation of various types of produce by Government Committee. Sale price for allotment is calculated on market price trends. Timber and firewood is also supplied by UPFC directly to various Government Departments and Corporations on direct order. Retail sales by the Corporation were initiated to fulfill UPFC's social obligation to provide good quality timber and fuelwood to common people at reasonable rates, but this has never been more than about 5 percent of the total sales of Corporation. The Corporation also has monopoly marketing rights for tendu leaves, the most important Non Wood Forest Produce. UPFC is; thus, in the privileged position of enjoying monopoly-marketing rights to forest produce from reserve forest land (UPFD, 1997)

2.5. Ecological Profile

Broadly the State can be divided into four ecoregions. (i) In the north (Maharajganj, Gorakhpur, Sravasti, Balrampur, Bahraich, Lakhimpur and Pilibhit) has Terai moist ecoregion; (ii) In the south on one side (Bundelkhand) and other side hills (Vindhayanchal) has dry ecosystem; (iii) the central part of the State has vast plains of the Ganga, Yamuna rivers; and (iv) Western part of the State has semi-arid ecoregion. The State has diversified weather and climate (see 2.1.2). Different ecoregions of the State include various types of ecosystems including forest ecosystems, agroecosystems, wetland ecosystems, fresh water ecosystem, river ecosystems and grassland ecosystems, etc. The primary goods and services provided by these ecosystems are given in the table 2.14.

Table 2.14: Primary Goods and Services Provided by Ecosystems

Ecosystems	Goods	Services
Agroecosystems	-Food crops -Fiber crops -Crop genetic resources	-Maintain limited watershed functions (infiltration, flow control, partial soil protection) -Provide habitat for birds, pollinators, and soil organisms, important to agriculture. -Build soil organic matter -Sequester atmospheric carbon -Provide employment
River ecosystems	Fish Fish meal (animal feed) Salt Genetic resources	-Moderate storm impacts -Provide wildlife habitats -Maintain biodiversity -Dilute and treat wastage -Provide harbors and transportation roots -Provide human habitats -Provide employment -Provide for aesthetic enjoyment and recreation
Forest ecosystems	Timber Fuel wood Drinking and irrigation water Fodder Non-timber products (vines, bamboos, leaves, etc.) Foods (honey, mushrooms, fruits and other edible plants) Genetic resources Microflora of the soil	-Remove air pollutants, emit oxygen -Cycle nutrients -Maintain array of watershed functions (infiltration, purification, flow control, soil stabilization) -Maintain biodiversity -Sequester atmospheric carbon -Moderate weather extremes and impacts -Generate soils -Provide employment -Provide human and wildlife habitat -Provide for aesthetic enjoyment and recreation
Fresh water ecosystems	Drinking and irrigation water Fish Hydroelectricity Genetic resources Microflora Aquatic flora and fauna	-Buffer water flow (Control timing and volume) -Dilute and carry away wastes -Cycle nutrients -Maintain biodiversity -Provide aquatic habitat -Provide transportation corridor -Provide employment -Provide for aesthetic enjoyment and recreation
Grassland ecosystems	Livestock (food, game, hides, fiber) Drinking and irrigation water	-Maintain array of water functions (infiltration, purification, flow control, soil stabilization)

	Genetic resources	-Cycle nutrients -Remove air pollutants, emit oxygen -Maintain biodiversity -Generate soil -Sequester atmospheric carbon -Provide human and wildlife habitats -Provide employment -Provide for aesthetic enjoyment and recreation

(Source: World Resources 2000- 2001)

More details of ecosystems in U.P. are presented in Chapter 3.

2.6. Historical profile (Burphal, 2001)

2.6.1. Changes in History

Due to the central position of the State in the Indo-Gangetic plain, it has been the focal point in the history of northern India. The history of Uttar Pradesh can be divided into following five periods.

(i) Pre history and Mythological period (Upto 600 B.C.)

The remains of several human skeletons found in the southern district of Pratapgarh have been dated to about 10,000 B.C. Knowledge of the area prior to 7th century B.C. has largely been gained through Vedic literature and the two great Indian epics, the Ramayana and the Mahabharata. The scene of the Mahabharata is the area around Hastinapur (Western part of the State), while the Ramayana is set in eastern Uttar Pradesh in and around Ayodhya, the birthplace of Lord Rama. Two other fountainheads of mythology in the State are the area around Vrindavan and Mathura where Lord Krishna (another incarnation of Vishnu) was born.

(iii) Buddhist Hindu (Brahmanic) period (600 BC-1200 A.D.)

At the end of 7th Century B.C., of the 16 Mahajanapadas (Great States) in northern India contending for supremacy, 7 fell entirely within the present day boundaries of U.P. The Buddha preached his first sermon at Sarnath near Varanasi and founded a religion that spread not only across India but also to many distant lands such as China and Japan. The Buddha is said to have attained parinirvana at Kushinagar located in eastern district of Deoria. From the 5th Century B.C. to the 6th Century A.D. Uttar Pradesh was mostly under the control of powers out side of its present boundaries first at Magadha (presently in Bihar) and later at Ujjain (presently in Madhya Pradesh). Among the great kings of this period who ruled over the State were Chandra Gupta (321-297 B.C.) and Chandra Gupta I (265-238 B.C.) both Mauryan emperors, Samudra Gupta (330-380 A.D.) and Chandra Gupta II (380-415 A.D.). Another of its famous ruler was Harsha (Reigned 606-647 A.D.) from his capital at Kanayakubja (near modern Kannauj). During this period Buddhist and Hindu culture flourished side by side. Sculptures and architecture symbolic of Buddhist art reached at Zenith during the reign of Ashoka. Hindu art saw its greatest development during the Gupta period. After the death of Harsha in about 647A.D. there was a gradual downfall of Buddism accompanied by a revivals of Hinduism.

(iv) ***The Muslim Period (1200 to 1775 AD)***

Although Muslim incursion into the area occurred as early as 1000-1030 AD. Muslim, rule over northern India established at the last decade of the 12th century, when Mohd. of Ghur defeated the Gahadavalas. For nearly 600 years Uttar Pradesh like much of India was ruled by one Muslim dynasty or another. In 1526 Babar defeated Sultan Ibrahim Lodhi of Delhi and laid the foundation of most successful of the Muslim dynasties the Mughals whose Empire dominated the sub-continent for more than 2000 years. The Mughal Empire centered in Uttar Pradesh, promoted the development of a new composite culture. Akbar was its greatest exponent (capital Fatehpur Sikri near Agra). The downfall of the Mughals in the 18th centenary led to the shifting of the centers of this composite culture from Delhi to Lucknow. The seat of Nawab of Avadh (Ayodhya) where art, literature, music, poetry flourished in the atmosphere of Communal harmony.

(v) The British period (1775-1947 AD)

The area of present day Uttar Pradesh was gradually acquired by the East-India Company over a period of about 75 years. Territories wrested from a number of northern dynasties the Nawabs in 1775, 1798 and 1801. The Sindhia's of Gwalior in 1803 and Gurkhas in 1816 were first placed within Bengal Presidency, but in 1833 they were separated to form the North Western province (initially called the Agra Presidency). The kingdom of Awadh annexed by the company in 1856 was united with the northwestern province in 1877 under the name-united province of Agra and Oudh. During the British period, there was extensive development of railways, canals and means of communications within provinces.

2.6.2.Historical changes in land and water uses (Post independence)

Post independence India withstand a shift land uses from agriculture to a non-agriculture sector in the wake of spreading urbanization fringe area (Ramchandran, 1989). It is argued in this context that the a process of urbanization has led to a gradual shrinking of arable land area whereas rapid growth of population has been raising requirements for higher volume of production of food grains to feed them. Regional variation in Uttar Pradesh also indicates that area covered under urbanization is still very low. Percentage of people living in urban area for west region was the highest followed by central U.P.and Bundalkhand. East U.P. followed by central U.P. however, has the lowest level of urbanization.

Table 2.15: Region –wise population, density and urbanization in U.P.

Region	Density of Population	Percentage Urban	
		Population	Area
East U.P.	611	11.20	1.49
Central U.P.	525	22.24	2.66
West U.P.	603	25.54	2.77
Bundelkhand	229	21.23	1.15
Total U.P.	**468**	**18.72**	**1.93**

(Source: Madhya Pradesh Journal of Social Sciences 2000)

- **Variation in land utilization**

State Land Use Board was formulated under the Planning Department Government of U.P. Lucknow for various land use programmes, with the gradual development of society the land uses pattern also changed from simple to complex. Net area sown increased from 162.31 lakh ha in 1950-51 to 173.04 lakh ha in 1970-71. Thereafter the net area sown remained almost constant i.e., horizontal expansion of cultivated land has almost reached a point of saturation. In this scenario, efforts are to be directed towards increase in cropping intensity and productivity. A considerable proportion of the reporting area (about 20 lakh ha) is under current and old fallow, lack of irrigation, water logging, salinity and poverty of farmers are some of the reasons for sizeable area remaining under fallow. The statistics (1994-95) suggests that out of 298.06 lakh ha reporting area about 173lakh ha (18.10%) be net sown.

During 1950-51/1980-81 the forest area in U.P. increased by 60.55 5 % and during 1969-70/1980-81 it increased by 3.30 % due to various programmes of afforestation. However, there are striking variations in percentage change in each district during 1969-70 and 1980-81. Barabanki district has recorded the maximum variation (+151.3%) followed by Pratapgarh (+79.4%), Sultanpur (53.7%), Basti (+43.8%), Lalitpur (+38.7%) which fall in the highest two categories of increase in forest area whereas 18 districts have recorded an increase in forest area ranging between 0-30%. On the other hand Etah has recorded the maximum decrease (-71.2%) in its forest area, followed by Muzaffarnagar (-62.3%), Hardoi (-51.9%), Mainpuri (-38.3) and Jhansi (-32.5%), all of which fall in the lowest two categories whereas in 17 districts the decrease in forest area has ranged between 0-30% in spite of the much publicized afforestation and social forestry programmes.

CHAPTER—3

CURRENT (KNOWN) RANGE AND STATUS OF BIODIVERSITY

3.1. State of natural Ecosystems

3.1.1. Forest Ecosystems

The state of Uttar Pradesh has been broadly categorized into three major eco-zones depending upon the forest and vegetation types:

(a) Terai region
(b) Gangetic plain (West and East Uttar Pradesh)
(c) Bundelkhand of Uttar Pradesh including Vindhyan ranges

(a) Terai region: The vegetation of the area is of Tropical moist deciduous type. It comprises one of the best natural Sal forests, apparently a climatic climax in Uttar Pradesh. These have been categorized into moist Bhabar Sal and moist plains Sal and further subtypes being Damar Sal and western light alluvium plain sal. These are confined to Kheri, Bahraich and stretching up to Gorakhpur. In this region sal forest covers most area either in natural or in plantation form. A characteristic feature of this region is that the wide stretch of forests is interrupted by grasslands locally called "dhantas". The composition of various forests and vegetation type of this region are as follows:

- **Sal forests:** Dominated by thick patch of Sal (*Shorea robusta),* the forests contain *Mallotus philippensis, Syzygium cumini, Ardisia solanacea, Callicarpa macrophylla, Murraya koenigii, Clerodendrum viscosum, Helecteres isora, Mitragyna parviflora, Maghania macrophylla, Grewia asiatica, Zizyphus mauritiana, A. oenoplia, A. xylocarpa, Carissa spinarum and Aegle marmelos* etc., as common associates.

  The herbaceous undergrowth commonly include: *Ajuga macrophylla, Alternanthera sessilis, Elephantopus scaber, Borreria brachystema, Majus pumilus, Hemygraplis hirta, Desmostachya bipinnata, Panicum palludosuj, Cyperus rotundus* and ferns viz. *Lygodium flexuosum* and *Ceratopteris* sp., etc.

- **Mixed Sal and Teak forests*:*** *Tectona granids* (Teak) is mixed with sal forests in such a way that it forms a natural condition. *Ficus semicordata* and *Acacia catechu* form almost pure formation with this associations. The other characteristic species are *Mitragyna parviflora, Haldinia cordifolia, Dalbergia sissoo, Mallotus philippensis, Aegle marmelos, Schleichera oleosa, Spondias bipinnata, Kydia calycina, Emblica officinalis, Casaeria elliptica, Desmodoium triangulare, D. pulchellum* and *Clausenia pentaphylla*. Trees of *Bombax ceiba* are occasionally seen.

- **Miscellaneous forests:** Representing no uniformity in composition and no species can be stated as dominant. The important constituents of this forest are Cassia *fistula, Kydia calycina, Mitragyna parviflora, Haldinia cordifolia, Terminalia bellerica, T. arjuna, Mallotus philippensis, Syzygium cumini, Acacia catechu, Tectona grandis, Emblica officinalis, Holarrhena antidysenterica, Helecteres isora, Ficus semicordata, Ficus racemosa, Murraya koenigii, Cordia*

dichotoma, Lannea coromandelica, Celtis triandra, Shorea robusta and *Spondias pinnata,* as common associates. In addition species of *Gymnosporia, Litsea, Aspidiopteris, Trachyelospermum* and swild citrus are found. Undergrowth consists of *Centella asiatica, Clematis gouriana, and Naravalia zeylainca.* Among stragglers and climbers *Tiliacora racemosa* is most conspicuous. *Bauhinia vahlii, Porana paniculata, Ipomoea cairica, Merremia dissecta, Dioscorea bulbifera, Cryptolepis buchanani, Ichnocarpus frutescens, Thunbergia grandiflora, Abrus precatorius, Wattakaka volubilis* and *Ventilago denticulata* are commonly seen.

Trees of *Ficus benghalensis, F. religiosa, Butea monosperma* and *Madhuca longifolia* are occasionally seen in all the three forest types. In addition to these forests pure patches of *Dalbergia sissoo* and *Eucalyptus* are also seen as a result of plantation.

- **Khair-Sissoo (Riparian Fringe Forests):** These forests are found on the bank of rivers near Dudhwa and elsewhere. *Acacia catechu* and *Dalbergia sissoo* are found associated with *Trewia nudiflora, Mallotus philippensis* and occasionally with *Syzygium cumini* and *Barringtonia acutangula*.

- **Grasslands (Phantas):** The wide stretches of mesophyllous grasslands are distributed throughout the Terai region. These grasslands are usually formed by forest clearing. Common perennial grasses are *Saccharum benghalensis, S. spontaneum, Phragmites karka, Themeda arundinacea, Vetiveria zizanoides, Cymbopogon flexuosus, Desmostachya bipinnata, Dichanthium annulatum, D. glabrum, Pseudosorghum fasciculare, Cymbopogon jwarancusa,* and *Hygrorhiza aristata* (an aquatic grass), and *Panicum paludosum* is frequent on the margins of ditches.

- **Aquatic vegetation:** The submerged and low lying areas support small aquatic *Spirodela, Lemna, Azolla* and also a number of submerged species of *Potamogeton, Ottelia, Hydrilla*. Beside this *Saccharum benghalensis* is typical indicator of marshland vegetation. *Typha angustata, Bacopa monieri, Centella asiatica, Acorus calamus, Pistia stratiotes* and *Aeschynomene aspera* are frequently observed in the marshy land and adjoining water bodies. However, water pools and puddles provide habitat to many aquatic species. The banks of rivers and water courses with alluvial soil and loose boulders help in the growth of *Bischofia javanica, Syzygium cumini, Barringtonia acutangula, Acacia catechu, Terwia nudiflora* as woody plants along with *Eclipta rostrata, Phyla nodiflora, Xanthium strumarium,, Ammania baccifera, Blumea mollis, Salvia plebeia, Carex fedia, Cyperus brevifolius, Gnaphalium luteo-album, Rumex dentatus, Sphaeranthus indicus* along with large forest cover of *Syzygium cumini.* The low bank of water bodies represents *Polygonum hydropiper, Sagittaria trifolia, Cyperus flavidus, Pogonatherum crinitum* etc. Among the shallow water bodies which forms a temporary aquatic zones where cyperus sp., *Pogomogeton indicus, Nymphoides indicus, Hydrilla verticellata, Ceratophyllum demersum* and *Fimbristylis species* are dominate.

(b) Gangetic Plains (West and East Uttar Pradesh)

Most of the Gangetic Plains are under cultivation since time immemorial. The vegetation is generally of tropical dry deciduous type with degraded to open scrub jungles. Some area in the western part falls under the Siwalik zone near Saharanpur, which represent a characteristic vegetation dominated by Sal forest in association with *Anogeissus latifolia, Terminalia tomentosa, Haldinia cordifolia, Mallotus phillipeniss, Litsea glutinosa,* and *Phoebe lanceolata*. The common shrubs and herbs are *Colebrookia oppositifolia, Murraya koenigii, Woodfordia fruticosa, and Thysanolaena maxima.*

The forests and other vegetation of the Gangetic plains can be described as follows:

- **Sal forests:** Sal is scattered throughout the western to eastern part of the State but in very low densities, the common associates are *Lagerstroemia parviflora, Miliusa velutina, Cassia fistula, Semecarpus anacardium, Buchanania latifolia, Kydia calycina, Diospyros tomentosa* and *Dillenia entagyna* with common climbers like *Bauhina vahlii, Milletia extensa, Acacia pennata, Porana paniculata,* etc. The shrubby elements are *Clerodendurm viscosum, Croton oblongifolium, Flemingia chappar, Murraya koenigii* and *Ardisia solanacea*.

- **Mixed forests:** These are characterized by number of species, which vary from place to place depending upon the local factors. They pass into drier types of forests on one hand and to Sal forest on other. Common species are *Bombax ceiba, Lagerstroemia parviflora, Emblica officinalis, Pterocarpus marsupium, Ssterculia urens, and Holarrhena antidysentrica and Anogeissus latifolia.*

- **Mixed deciduous forests:** A characteristic type of mixed forest in Gangetic Plains commonly comprises of *Terminalia tomentosa, Cordia myxa, Dalbergia latifolia, Acacia catechu, Madhuca longifolia, Diospyros tomentosa, Schrebera swietenioides, albizia lebbeck, Flacourtia indica* and *Lannea coramandelica,. Dendrocalamus strictus* is common bamboo often occurs in patches.

- **Dry thorn forests:** Represented in dry region of eastern Uttar Pradesh, the common species of these forests are *Ziziphus xylocarpus, Z. mauritiana, Z. mummularia, Butea monosperma, Calotropis procera, Prosopis spicigera, Capparis aphylla, Balanites roxburghii*, etc.

- **Swamp forests:** Confined in water logged swampy areas, the forest exhibits diversity in composition of the species with the degree of water logging. The characteristic species are *Syzygium cumini, Trewia nudiflora, Drypetes roxburghii, Bischofia javanica, Terminalis arjuna, Trema orientalis* and *Albizia procera.* Along the edges of water *Salix tetrasperma, Barringtonia acutangula* and shrubs like *Daedalacanthus nervosus, Ficus heterophylla* and *Ardisia solanacea* are frequent. The bushes of *Cephalanthus nucleoides* occurs in compact groups in shallow part of jheels in eastern part of the Uttar Pradesh. *Rosa involucrata* is sometimes found in open grassy swamps.

(c) Bundelkhand region (including Vindhyan ranges)

The region of Bundelkhand in Uttar Pradesh, which falls between the western Gangetic plains and the Deccan peninsula in the south, mainly consists of low rising hills, valleys and plateaus. Jhansi, Lalitpur, Jalaun, Hamirpur, Banda (including Sahuji Maharaj Nagar) and Mirzapur district stretching along Vindhyas and Kaimur hills mainly fall under Bundelkhand. The vegetation of this region is tropical dry deciduous type, which can further be divided into two types:

- **Mixed deciduous forests:** The common constituents of these forests are the taller and dominant trees of *Terminalia elliptica, T. bellerica, Tectona grandis, Pterocarpus marsupium, Bombax ceiba, Cochlospermum religiosum, Diospyros melanoxylon, Lagerstroemia parviflora, Buchanania lanzan, Mitragyna parviflora, Sterculia urens, gardenia gummifera, Acacia catehu, Holarrhena antidysentrica, Ziziphus maruitiana, Calotropis procera, Adhatoda zeylainca* and *Woodfordia fruticosa*. Among the climbers and shrubs *Rhynchosia minima, Atylosia scarabaeoides, Mucuna pruriens, Cissampelos pareira, Ichnocarpus frutescens, Hemidesmus indicus, Tinsopora cordifolia, Dioscorea hispida* and *Cuscuta reflexa* (a parasitic climber) are seen. Several species of moist deciduous forest may also be found in the forest area of Karvi in Banda particularly in sheltered places. Stunted sal of dry type appears in association with several different species.

- **Dry thorn forests:** These forests are mainly found in Jalaun, Lalitpur and Hamirpur areas. The scrub vegetation is characterized by *Ziziphus xylocarpus, Prosopis spicigera, Butea monosperma, Acacia nilotica, Calotropis procera, Bombax ceiba, and Gardenia spinosa.* The intermixed shrubs are usually *Flacourtia indica, Grewia rothii, Ziziphus mauritiana and Z. nummularia.* The common climbers with twinning branches entangled with shrubs are *Abrus precatorius, Cissampelos pareira, Mukia maderaspatana, Mimordica dioica and Gymnema syvestre.*

3.1.2. Agroecosystems

The agro ecosystems comprise of various species of crops, their diverse associations and the agroforestry species. Crop associations reflect the variable positions of the individual crops among themselves as well as their integral complex and are useful for the analysis and synthesis of the crop land use patterns.

On the basis of the average for 1994-95 to 1996-97 the land occupancy strength of major crops at the state level is as follows:

Wheat	34.9%
Rice	13.5%
Pulses	18.0%
Ragi	7.7%
Maize	15.5%
Bajra	14.4%
Barley	46.0%
Jowar	4.2%
Total cereals	21.3%
Gram	14.8%
Total food grain	21.1%

(Source:Planning Atlas of Uttar Pradesh, 1987 and Agriculture Statististics, 1995)

The main crop association regions of U.P. are as follows:

- **Wheat-Sugarcane-Rice Region (WSR):** It includes the districts of Saharanpur, Muzaffarnagar, Rampur, Bijnor, Moradabad, Pilibhit and Kheri where these crops jointly claim about 70% of the total cultivated area and wheat is the first ranking crop excepting Muzaffarnagar where sugarcane (32.2%) out excels wheat (31.9) and Pilibhit where rice (36.3%) takes precedence.
- **Wheat-Sugarcane-Maize Region (WSM):** It is confined to three districts of Meerut, Ghaziabad and Bulandshahr where climatic and edaphic conditions, irrigation facilities, level of commercialization and land management practices favour the cultivation of wheat sugarcane and Maize. It is particularly noted for high proportion of non-food grain crops (47.3% against the state average of 17.2%) where sugarcane forage crops and vegetables have found increasing preference among the farmers.
- **Wheat-Bajra-Pulses Region (WBP):** This crop combination is suitable for the dry zone of western Uttar Pradesh (Aligarh, Mathura, Mainpuri, Agra, Etah, Budaun, Farrukhabad, and Etawaha districts. Here wheat is the first ranking crop in all the districts, followed by bajra and pulses excepting Farrukhabad district where maize and potato are the second and third ranking crops and Mainpuri and Etawah where rice claims the second place after wheat.
- **Wheat-Rice-Pulses Region (WRP):** It occupies an extensive area covering most of the districts of central Uttar Pradesh. Here pulses, maize and groundnut influence the sub-regional variations.

Sugarcane cultivation is important in Sitapur, Shahjahanpur, Bareilly and Hardoi districts in the northern part whereas Jowar, Bajara and Arhar are more important in the southern part.

- **Rice-Wheat-Pulses Region (RWP):** It covers the remaining districts of Eastern Uttar Pradesh where food grains are predominant and rice occupies the first rank because of the climatic and soil conditions but in recent decades wheat has made much heading and has actually outcelled rice in Basti district. In Deoria district the RWS combination (rice 36.9%, wheat 35.4% and sugarcane 10.8%) accounts for 83.1% of the total cropped area whereas in Gorakhpur districts the RWP combination (Rice 41.20%, wheat-37.6% and pulses 5.86%) account for 84.66% of the total cropped area.
- **Pulses-Wheat-Jowar Region (PWI):** It characterizes the agricultural landscape of the Bundelkhand region where climate, soils and management practices have given a unique combination in which pulses dominate by accounting for 35.11% (Banda district) and 48.9% (Jalaun district) of the total cropped area. Among pulses gram carries the lion's share. Wheat is the second ranking crop (excepting Lalitpur district where it rises to the first rank) and Jowar is the third ranking crop excepting Banda district, where rice occupies the third place and Jowar is at the fourth rank. Arhar, another important pulse, is mainly cultivated as a mixed crop with Jowar or Bajara. Maize is important in Lalitpur district.

3.1.3. Wet land ecosystems (Ponds and lakes)

Uttar Pradesh consists of vast extent of water resources. As such, there are 2508 wetlands in the State of which 1193 are larger than 56.25 ha. The area covered by these wetlands is 328689.1 in post monsoon and 266731.61 ha in pre-monsoon. The wetlands in U.P. occur mainly in the vast Gangetic plains. Of these, twenty-five wetlands have been identified as fragile ecosystems. Many of these are the part of Wildlife Sanctuary, which are yet to be studie (Status and Strategy Report, BSI, 1999). The major wetland ecosystems of the State are Alwal Jheel, Macpherson, Phaphaman Dara Cant, Swamp-Allahabad, Pakri Tal, Ratoi Tal, Salona Tal, Kaisar Ganj Swamp, Garha Tal, Dhanari Jheel, Chand Jheel, Noorpur Jheel, Pipraicha Tal, Aranga, Badur Tal, Joghra Joghri, Parbatti Lake-Gonda, Gulari Tal, Mathiwa Tal, Kodia Tal, Panagpur Tal, Ramgarh Jalao, Sardhwa-Pokhrava, Saruwa Tal, Dhare Jheel, Gujar Tal, Noho Jheel and Samaspur-Rae Bareli**.**

The wetlands can be broadly classified into the Lentic (Stagnant) and the Lotic (Running water) categories. Both these categories are well represented in the PA network in the form of 12 Bird Sanctuaries and Riverine Sanctuaries like Chambal, Hastinapur (Gangas), and the Turtle Sanctuary (Gangas). Several rivers also pass through some of the Sanctuaries, part of Ghagara and Gandak rivers also lie within the Katarniaghat and Sohagi Barwa Sanctuaries, respectively. There are however a vast number of other wetlands in the Gangetic plains which have high value for bio-diversity conservation mainly for waterfowl.

The two major river systems of the State, the Ganga and the Yamuna originating from the Himalaya give rise to numerous tributaries before entering the plains of U.P. The floodwater lakes and reservoirs of the entire Terai region have been largely converted to cultivation. Deforestation of this region has reduced the water absorption capacity of the soil.

Construction of roads, railway tracks, embankments and link roads without proper drainage systems has created the problem of water logging resulting in the formation of several artificial wetlands in addition to the already existing natural wetlands. Further, the creation of irrigation canals, tanks, dams, reservoirs, etc. has also increased the number of artificial wetlands across the State. The primary purpose of these wetlands is to provide local people with water for irrigation and domestic purposes and to produce hydroelectric power. However, in course of time, they have begun to attract wildlife as well, and therefore their conservation value has increased. These wetlands, however, are now vulnerable to degradation and ecological deterioration resulting from human population pressures and related increases in the demand for natural resources.

- **Status and distribution of Wetlands:** A study carried out by the MoE&F in 1990, provides a listing of 54 wetlands in U.P. The BCPP study (Samant, 1999) also lists 100 other wetlands of unknown value, several of which overlaps with the MoE&F list. An extensive mapping of wetlands using IRS LISS 1 data of 1991-92 provides a district wise listing of wetlands in U.P. However, site names have not been provided. According to this data, Hardoi district (70) has the maximum number of wetlands while Siddharthanagar has the maximum number of Lakes (9), followed by Azamgarh (8) and Padrauna (8). Unnao has 29 ox-bow lakes of a total of 50 wetlands. Bahraich, Banda, Basti, Bijnor, Jhansi, Lalitpur and Mahoba have the most man made wetlands. Waterlogging due to canal irrigation is more in Sitapur, which leads in terms of seasonal waterlogged area (30), followed by Hardoi (29), Akbarpur (15) and Etawah (15). The most swamps/marshes were found in Rai Bareli (17), followed by Hardoi (15) Unnao (13) and Muzaffarnagar.

Various wetlands have been identified and prioritized for the State on the basis of diverse criteria. These studies are discussed below:

(i) Priority Wetlands

Under the Biodiversity Conservation Prioritization Project (BCPP) of the World Wide Fund for Nature-India, a wetland prioritization exercise has been undertaken incorporating both biological features (richness, distinctiveness, rarity, representativeness, keystone function and threats) and socio-economic criteria such as economic and non-economic utility and conservation feasibility. Sixteen priority sites (out of 158 in India) have been identified in the State. Four sites, all of them recognized as PAs (Dudhwa National Park and Rashtriya Chambal, Nawabganj and Suraha Tal Wildlife Sanctuaries), were ranked as high priority sites. Despite the low priority ranking, all the remaining 12 sites are very important wetlands, featuring in 1 or more wetland listings.

(ii) Sarus Crane sites

Uttar Pradesh supports the largest population of Sarus Cranes in the Country. A total of 1019 Sarus Cranes were counted from 46 sites in 20 districts in 1999 accounting for 50% of the Countries total. The largest number of Sarus Cranes in a Protected Area was from Parvati Agra Bird Sanctuary in Gonda district. Most of the other population, however, lay outside the PA network with protected areas currently, not contributing significantly to the protection of the species as a whole. From the perspective of Sarus Crane population, the important wetland district in Uttar Pradesh is Etawah, Mathura, Gonda, Etah and Aligarh (Choudhary etal., 1999).

(iii) Waterfowl counts

Another wetland data source is the annual Waterfowl census conducted by Wetlands International. The 1994-1996 Asian Waterfowl Census (the most recent published data) lists 11 sites (1PA) where counts was conducted in 1994-95. However, data in 1996 was not collected from U.P. Criteria on the basis of which these sites were selected have not been provided. The sites in 1994-96 include Amakhera Tank, Ashpan, Bijnor Barrage, Dak Pathar, Harevli Dam, Nawabganj WLS, Seohara Estate, ponds and wetlands, Shikha, and stretches of the Yamuna river in Agra (Table 6). Some sites earlier counted in 1993 were dropped in 1994-95.

(iv) Important Bird Areas Programme

Bombay Natural History Society's Important Bird Areas (IBAs) programme provides a listing of 25 confirmed important bird areas and 25 additional sites, which need to be confirmed. Of the

confirmed IBAs, the non- PA wetlands include the up and down stream of the Ganga between Chunar and Chuchakpur (Varanasi, Mirzapur), Sheikha Jheel in Aligarh, Kurra-Saman, Latwah (Etawah/Manipur), amongst the additional sites the non-PAs include Pili reservoir (Bijnor) and Narora reservoir (Bulandshahr/Budaun).

3.2. Plant diversity (Srivastava, 2002)

Summary of the diversity in different plant groups of U. P. is presented (Table 3.1)

S.No.	Taxonomic groups	Total species	Total genera	Total families
1.	Algae	698	-	-
2.	Fungi	500	-	-
3.	Lichens	26	11	9
4.	Bryophytes(liverworts)	19	8	6
5.	Pteridophytes	33	20	18
6.	Angiosperms	2711	1088	185

3.2.1. Angiosperms

The floristic status within the present political boundaries of Uttar Pradesh State reveals presence of 2711 species belonging to 1088 genera and 185 families of Angiosperms. Summary is presented in table 3.2. The species rich angiosperm genera of U.P. are listed (Table 3.3)

Table 3.2. Floristic analysis of Uttar Pradesh

Group	Species	Genera	Families
Dicot	2173	862	155
Monocot	538	226	30
Total	**2711**	**1088**	**185**

Table 3.3. Species rich Angiosperm genera in Uttar Pradesh

Genera	Family	Number of species
Ipomoea	Convolvulaceae	35
Ficus	Moraceae	32
Cyperus	Cyperaceae	28
Fimbristylis	Cyperaceae	27
Euphorbia	Euphorbiaceae	25
Blumea	Asteraceae	22
Crotolaria	Fabaceae	21
Acacia	Mimosaceae	19

3.2.2. Diversity in other Taxonomic groups

- **Algae:** Algae are highly diversified group of plants, placed at the lowest rank of the ladder of evolution of life with enormous economic implications not only as primary producers and pollution indicators, but also as source of several natural products, biofertilizers and chemicals. While dealing, with the algal diversity in Uttar Pradesh, many workers viz., Ahmad, 1967, 1972; Bendre & Kumar, 1975; Chaturvedi & Pandey, 1976; Chandra & Pandey, 1982; Das et al., 1965; Gupta, 1956, 1957, 1966; Gupta & Ray 1975; Kumar, 1970; Kamat, 1973; Mitra, 1951; Prasad, 1952; Prasad & Misra, 1979; Prasad & Asthana, 1975, 1976, 1978, 1979; Prasad & Mehrotra, 1978, 1979, 1980; Pandey 1965a, 65b, 1966; Pal, 1975; Prasad et al., 1978; Pandey & Pandey 1980, 1982; Pal & Yadav, 1974; Pandey & Chaturvedi, 1979; Pandey 1969; Prasad 1964-1965;

Prasad & Saxena, 1980; Pandey et at., 1981; Rao, 1935,1936, 1937; Rai & Kumar 1976, 1979, 1980; Singh 1959, 1961, 1963; Saxena, 1960; Singh et al., 1980, 1981; Shukla, 1966; Singh & Saxena, 1969; and Venkataraman, 1957, 1959 have given a good account of the distributional pattern of various groups of algae and recorded 689 taxa belonging to various classes (Table 3.4). Presently there is four major School of algal research in U.P. viz., Department of Botany-Lucknow University; Department of Botany- Allahabad University; Department of Botany-Banaras Hindu University, and NBRI, Lucknow. Earlier these centers concentrated on the floristic aspect of algae but subsequently have switched over their research work on the functional aspect of algae.

Table 3.4. Diversity of algal flora in Uttar Pradesh

S.No.	Class	Species No.
1	Chlorophyceae	285
2	Bacillariophyceae	228
3	Cyanophyceae	129
4	Xanthophyceae	12
5	Rhodophyceae	4
6	Euglenineae	28
7	Dinophyceae	12
	Total	**698**

While analyzing the distribution of algal flora, the Terai part of U.P. has the maximum number of taxa (426) as compared to eastern (314 spp.) and Western (125 spp.) part. The terai region represents varied climatic conditions and is comparatively better studied.

Some common algal taxa from Uttar Pradesh are *Chlamydomonas globasa, Pandorina morum, Eudorina elegans, Chlorococcum humicola, Pediastrum boryanum, P. tetras, Tetraedron trigonum, Oocystis borgei, Botryococcus braunii, Kirchneriella lunaris, Scenedesmus dimorphus, S. obliquus, S. quadricauda; Ulothrix tenerrima, Pithophora oedogonia, Rhizoclonium hieroglyphicum, Chaetophora elegans, Aphanochaete repens, Spirogyra rivularis, Closterium acerosum, C. dianae, C. moniliserum, C. parvulum, Pleurotaenium ehrenbergii, Micrasterias foliacea, M. Pinnatifida, Cosmarium auriculatum, C. granatum, Microcystis marginata, aphanocapasa grevillei, A.. roeseana, Aphanotheace castagnei, A.. microscopica, Coleosphaerium luetzingianum, Merismopedia galuca, M. punctata, Spirulina major, S. subdsalsa, Oscillatoria acumnnata, O. acuta, O. formosa, O. limosa, O. princeps, O. sancta, Phormidium corium, P. retzii, Lynghya aerugineo-coerulea, L. alloregei, L. martensiana, Cylindrospermum musicola, C. majus, Nostoc commune, N. punctiforme, Anahaena ambigua, A.. sphaerica, Scytonema bohneri, Calothrix brevissima, Hapalosiphon welwitschii, Melosira granulata, Cyclotella meneghinicana, Synedra ulna, Cocconeis placentula, Navicula cryptocephala, Navicula pygmaea, Pinnularia interrupta, Gomphonema laceolatum, G. parvulum, Amphora veneta, Cymbella ventricosa, Nitzxchia amphibia, N. frustulum, N. levidensis, N. plea, Euglena acus, E. pisciformis, Tribonema bombycinum, Compsopogon cooruleus and Ceratium hirundinella.*

- **Fungi:** Butler & Bisby (1931) were the first to compile the fungi of India. Later on many supplements to the Butler and Bisby's work were published culminating in fungi of India by Bilgrammi et al., (1991). Pathak & Ghosh (1962) have published the list of fungi from Uttar Pradesh (including Uttranchal). The present list of fungi comprising over 500 species commonly represented in Uttar Pradesh. Among the Myxomycetes *Arcyria, Stemonites, Didymium* are the dominant genera. The classes like the Chytridiomycetes (genera: *Chytridium Synchytrium, Physoderma*) and Oomycetes (*Pythium, Phytophthora, Albugo, Peronospora)* are also well represented. *Mucor, Rhizopus, Syncephalis* and *Pilobus* are among the dominant genera of

Zygomycetes. The Ascomycetes comprising the dominant orders like Eurolales, Erysiphales, and Pezizales are most commonly represented by genera like *Erysiphe, Sphaerotheca*, *Choetonium, Phyllachora, Hypoxylon, Nectria, Humaria,* etc. The genera *Phellinus, Oxyporus, Lanzites, Gloeophyllum* and *Phylloporia* are the dominant among wood rotting fungi. While *Mycena, Termitomyces Oudemaxiella, Macrolepiota, Marasmius, Lepiola, Agaricus* are interesting genera of Agaricales.

- **Lichens:** Before the creation of a new State of Uttaranchal, the State was represented by 471 species of lichens belonging to 88 genera and 46 families. At present most of the lichen rich sites are located in Uttaranchal. Uttar Pradesh comprises of 26 species belonging to 11 genera and 9 families of lichens (Dubey et al., 1999, Singh & Upreti, 1991, Upreti ms, Upreti & Bajpai ms. Most of the species are common except *Bacidia submedialis* (Nyl.) Zahlbr., *Heppia lutosa* (Ach.) Nyl. *Plylliscus macrosporum* A. Henssen, *Opegrapha herpetica* (Ach.) Ach. *Pertusaria pertusa* (L.) Tuck., *Endocarpon pusillum* Hedw. and *E. rosettum* (Singh & Upreti) that are rare in Uttar Pradesh. Among the families Peltulaceae, Physcieaceae and Verrucariaceae (5 spp., each) and Bacidiaceae (3 spp.) are dominant whereas *Peltula* (5 spp.*), Endocarpon* (5 spp.), *Dirinaria* (4 spp.) and *Bacidia* (3spp.) are dominant genera.

- **Bryophytes (Liverworts):** Singh (2001) in his account on diversity of Indian liverworts and their status presented a distributional account of liverworts in different phytogeographical regions including Gangetic Plain. The status of liverwort diversity in Uttar Pradesh State has also been revealed from the earlier publications (Khanna 1927, Kashyap 1929, 1932, Lindenberg and Lehman 1832, Pande 1938, Srivastava 1994, Singh 1997, Ahmad 1942, Kachroo 1954b, Udar 1976, Udar & Chandra 1956, Asthana & Srivastava 1991, Bapna & Kachroo 2000). The State comprises of 19 species belonging to 8 genera in 6 families. These species are mainly distributed in Central and Eastern parts of U.P. The basic reason is that the experts mainly concentrated their survey in the surroundings of Lucknow and its nearby areas. *Riccia* (9 spp.) is most species rich of the total 8 genera, followed by *Plagiochasma* (2 spp.), *Anthoceros (*2 spp.*), Cythodium* (2 spp.*), Notothylus* (1 sp.), *Mannia* (1 sp.*), Astrella* (1 sp.) and *Riell*a (1sp.).

- **Pteridophytes:** The pteridophytes of the Upper Gangetic Plains have been studied by Chowdhury (1973) which includes part of Uttaranchal, plains of U.P., Bihar, West Bengal. He described 72 species, mostly tropical ferns and fern allies belonging to 27 genera and 18 families. The present boundaries of U.P. are represented by 33 species belonging to 20 genera and 18 families mainly distributed in Terai region, Bundelkhand and plains of U.P.

3.2.3. Special features of plant diversity

- **Endemic species:** Of the 119 taxa of flowering plants reported endemic to earlier U.P. (including Uttaranchal), only 10 taxa are endemic to present U.P. These taxa belong to eight genera and six families (Table 3.5)

- **Plant diversity rich areas:** With regard to floristic exploration, the 70 districts, in U.P., three districts are thoroughly (>70%), 31 districts fairly (40-70%) and 36 districts under explored (<40%). On account of available information Bahraich, Gonda, Basti, Gorakhpur, Pilibhit, Kheri, Balrampur, Shravasti (all in Terai belt), Mirzapur, Allahabad, Sonebhadra, Banda, Hamirpur, Jalaun, Lalitpur and Jhansi (in Bundelkhand Vindhyas region) are plant resource rich districts. Among others, Chitrakut valley and Kalinger hilly areas are observed to be good spots for preservation and cultivation of medicinal plants. Botanical Survey of India has been surveying these districts and lot of information on their floristic accounts is available. The districts (n=36) categorized as under explored category usually do not have the rich plant diversity (excepting Etawah, Varanasi, Shahjahnpur etc.). Among other biodiversity value areas, one National Park

and twenty-three Wildlife Sanctuaries of State need mention. Of these, BSI has conducted floristic studies of Dudhwa National Park (Kheri), Samastipur (Rae Bareli), Surha Tal (Ballia) and Lake Bahusi (Farrukhabad). Efforts are being made to complete the floristic studies of remaining Wildlife Sanctuaries and survey is needed for those areas, which have not been thoroughly explored.

Table 3.5: Endemic plant species of Uttar Pradesh

Name of species	**Place of occurrence**	**Family**
Rorippa pseudoislandica Chowdhery &R.R. Rao	Hamirpur	Brassicaceae
Derris kanifillalii Shani & H.B. Naithani	Pilibhit	Fabaceae
Derris scandens (Roxb.) Benth. var. ***sharanpurensis*** (Thoth.) Thoth	Saharanpur	Fabaceae
Indigofera thotharthrii Sanj.	Bahraich	Fabaceae
Diospyros holeana Gupta & Kanjilal	Gonda	Ebenaceae
Brachystelma laevigatum Hook.f.	Gorakhpur	Asclepiadaceae
Brachystelma pauciflorum Duthie	Bahraich	Asclepiadaceae
Alectra chitrakutensis (Rau.) R. Prasad & R.D. Dixit	Banda	Scrophulariaceae
Cymbopogon flexuosus (Nees ex Steud) Wats. var. *microstachys* (Hook.f.) Bor.	Sharanpur North Oudh	Poaceae
Hemarthria hamiltoniana Steud.	Upper Gangetic Plain	Poaceae

(Source: Srivastava, 2002)

- **Ethnobotanical diversity:** Plains of U.P. are rich in tribal population. These groups mainly exist in Terai, Bundelkhand and Vindhyan ranges of the State. The tribes like Kols, Gonds, Lodhs, and Gujjars are confined to Vindhyan ranges and Tharus in Terai region. A lot of ethnobotanical information exists in the State especially on ethnomedicinal, ethnoveterinary, fibre, oil, tribal craft, socioreligious ceremonies, narcotics and drinks. This information will be useful for database on indigenous knowledge system and follow up investigations for practical applicability in food and nutrition, medicine and health care. Details of information are available as Maheshwari et al., (1981,1986) ethnobotany of Kols, Gonds, Lodhs and Gujjras of Mirzapur; Maheshwari & Singh, (1987) Kols of Banda; Saxena & Vyas (1981, 1993) tribes of Banda and other parts of Bundelkhand; Saxena & Tripathi, (1989) medicinal uses of wild trees by Bundelkhand tribes; Maheshwari et al., (1981) on ethnobotany of Tharus tribes of Kheri; Shah, (1982) on herbal folk medicine in Northern India; Dixit & Pandey (1984) on plants used as folk medicine in Jhansi and Lalitpur; Srivastava et al., (1992) traditional herbal remedies from rural folklore of Hamirpur; Sinha & Srivastava (1998), and Khanna et al., 1994, on utilization of ethnobotanical plant resources of southern U.P.

- ## Some common wild Plants used as food

1. Annona squamosa L. (Annonaceae) “Sharifa”

Fresh flower is edible and unripe fruits are roasted and eaten.

2. Bauhinia purpurea L. (Caesalpiniaceae) “Koinar”

Tender leaves are eaten as vegetable.

3. Bauhinia variegata L. (Caesalpiniaceae) "Kachnar"
Tender leaves are eaten as vegetable.

4.Cordia oblique Wild. (Boraginaceae) "Lasura"
Tender leaves are eaten as vegetable.

5. Emblica officinalis Gaertn (Euphorbiaceae) "amla"
The fruits are eaten raw or cooked.

6. Grewia tiliaefolia Vahal (Tiliaceae) "Dhaman"
Tender leaves are eaten as vegetable.

7. Madhuca latifolia (Roxb.) Macbr. (Sapotaceae) "Mahua"
Flowers are eaten raw. Local liquor is prepared from flower.

8. Marsilea minuta L. (Marsileaceae) "Catamara"
Leaves are eaten as vegetable.

9. Moringa oleifera Lamk. (Moringaceae) "Sahjan"
Pods and flowers are eaten as vegetable.

10. Nymhaea nucifera (Nymphaeaceae) "Kamal"
Tubes and seeds are eaten.

11. Phoenix dactylophora (Arecaceae) "Tarh"
Fruits sap is consumed.

12. Schleicher trijuga Willd. (Sapindaceae) "Kusum"
Fruits and nuts are edible.

- **Diversity of medicinal plants**

Major plants used as medicine by Kols is presented (Table 3.6). Besides, there are number of plants used by Tharus, Gonds, Lodhs and Gujjars for curing their ailments. However, it is estimated that nearly 300 plants in the State are of medicinal use and more than hundred are being utilized in preparing ayurvedic formulations as they contain established medicinal properties.

Table 3.6: Plants used by Kols in medicine (Srivastava, 2002)

Plant name	Family	Part(s) Used	Uses
Acacia catechu Wild.	Mimosaceae	Leaf	Juice with milk to cure blood dysentery
A. leucocephala Wild.	-do-	Root	Root juice with sugar and water to women for abortion
Aristolochia indica L.	Aristolochiaceae	Leaf	Mixed with black pepper for curing fever
Boerhavia diffusa L.	Nyctaginaceae	Root	Root paste with cow milk to women for abortion
Calotropis procera (Ait.)	Asclepiadaceae	Latex	Curing toothache and

R. Br.			scorpion sting
Casearia tomentosa Roxb.	Samydaceae	Stem bark	Juice is applied to cure ring worm
Cleome gynandra L.	Capparaceae	Leaf	Paste for curing headache
Colebrookia oppositifolia Sm.	Lamiaceae	Leaf	Past with mustard oil is applied to heal wound
Eclipta prostrata (L.) L.	Asteraceae	Leaf	Decoction of leaf in curing fever and malaria
Fumaria indica (Hassk.) Pugsley	Fumariaceae	Whole Plant	Plant paste with sugar and milk cure fever
Gymnema sylvestre (Retz.) R.Br.	Asclepiadaceae	Leaf	Leaf juice for curing gastric disorders
Lannea coromandelica (Houtt.) Merr.	Anacardiaceae	Stem bark	Bark juice is applied on cuts and injuries
Paspalum scrobiculatum L.	Poaceae	Seed	Seed with mustard oil for curing cough in children
Pterocarpus marsupium Roxb.	Fabaceae	Wood	Extraction of wood for curing digestive disorders
Selaginella bryopteris (L.) Baker	Selaginellaceae	Plant	Extract of plant cures spermatorrhoea
Xanthium strumarium L.	Asteraceae	Fruit	Paste is applied to cure eye in flammation.

3.3. Faunal Diversity Status

3.3.1. Diversity

Although large area (>70 %) of U.P. falls under agriculture and < 8% of area is represented by natural forests, the State has considerable animal diversity (Table 3.7). The diversified weather and physio-geography of the State have contributed towards this richness of wildlife. The terai forest of the State from Pilibhit, Kheri, Bahraich, Sravasti, Balrampur, Gonda to Gorakhpur are the natural home of endangered animals like Royal Bengal Tiger, Asiatic Elephant, Leopard, Swamp Deer, Black Buck and Barking Deer and thousands of Chital and Sambar. The arid and semi arid parts of the State are also rich in animals particularly Chinkara, Hog Deer, Leopard, Wolf, Jackal and Hyena. It is the only State in the Country other than Assam, where one horned Rhino is found in its natural habitats. Apart from these major reptiles, the State includes Crocodile, Gharial, Soft Shelled Turtle, Monitor lizard, Cobra, Python, Viper, Krait, Rat snake and Water snake.

Table 3.7. Richness of some animal species in Uttar Pradesh

Animal	**No.**
Lion	240
Tiger	191
Wild elephant	31
Rhinoceros	19
Chinkara	1500
Swamp partridges	2500
Barasingha	2000

(Source: Burphal, 2001)

According to the latest census conducted in May 2001 the population of Tigers, Leopards and Elephants has increased. The Tiger population has increased from 242 in 1999 to 284 in 2001; the Leopard population has increased form 94 in 1999 to 143. This is mainly due to the improved habitat conditions and the reduced mortality. Out of 2060 species of avi-fauna seen in the country, more than 500 birds are present in different parts of the State. It is the only State where the highest population of Hispid hares, Bengal Florican and Swamp Partridge, is seen in terai forests. The major reason for the Avi-fauna diversity in the State can be attributed to diversity of habitats and also to the presence of fish rich large water bodies and jheels in different parts of the State.

The State is important winter home for many migratory birds like Pintail, Common Teal, Gareaney Teal, Pochard, Gadwall, Brahmini duck, Shoveller, Wigeon, Coots, Mallard, Pelican, Crested Pochard, Bar headed goose, Greylag goose. Important local/ resident birds include Comb Duck, Whistling Teal, Spot Bill, Sarus Crane, Painted Stork, Open Bill Stork, White Necked Stork, Black Necked Stork, Spoon Bill, White Ibis, Bronze Winged Jacana, Pheasent Tailed Jacana, Purple Moorhen, Water Hen, Grebe, Cormornt, Darter, Egret, Plover, Purple Heron, Grey Heron, Pond Heron, Lapwing, Kingfisher, Night Jar, Vulture, Kite, Partridge, Hawk eagle, King Crow, Munia, Golden Oriole, Peacock, Grey Horn Bill, Barbet, Drongo, Hoopoe, Finch, Hawk Cuckoo Brain feverbird, etc.

3.3.2. Status of fauna

Recently the status assessment studies (CAMP workshops) have revalued that the various faunal elements in the State fall under different categories of threats. Brief information is as follows:

Fishes

Table 3.8: Status of fresh water Fishes in Uttar Pradesh

S.No.	Generic name	Specific name
	Category-A Critically endangered (CR)	
	Aspidoparia	*Jaya*
	Erethistoides	*montana pipri*
	Glyptothorax	*Alaknandi*
	Gylptothorax	*Garhwali*
	Glyptothorax	*Dakpathari*
	Laguvia	*Kanpuri*
	Pangasius	*Pangasius*
	Periophthalmus	*Weberi*
	Category-B- Endangered (EN)	
	Eutorpiichthys	*Vacha*
	Glyptothorax	*Saisii*
	Johnius	*Gangeticus*
	Labeo	*Dero*
	Labeo	*Dyocheilus*
	Nemacheilus	*Doonensis*
	Notopterus	*Chitala*
	Ompok	*Bimaculatus*
	Pinniwalago	*Kanpurensis*
	Sisor	*Rabdophorus*
	Tor	*mosal*
	Tor	*Pituitora*
	Category-C- Vulnerable (VU)	

Ailia	*Coila*
Anabas	*Testuadineus*
Bagarius	*Bagarius*
Barilius	*Vagra*
Botia	*Histrionica*
Catla	*Catla*
Cirrhinus	*Reba*
Claris	*Batrachus*
Clupisoma	*Garua*
Danio	*Devario*
Garra	*gotyla Gotyla*
Glyptothorax	*Indicus*
Herpetopneustus	*Fossilis*
Gonialosa	*Manmina*
Hilsa (Tenualso)	*Ilisha*
Lepidocephalus	*Caudofurcatus*
Nangra	*Nangra*
Puntius	*Conchchornius*
Puntius	*sarana sarana*
Rhinomugil	*Corsula*
Schizothoraichthys	*Progastus*
Schizothorax	*Richardsonii*
Nangra	*Viridescens*
Pseudoechenis	*Sulctus*
Raimus	*Bola*

Category-D- Low risk (near threatened) (Lr, nt)

Amblyceps	*Mangois*
Barillius	*Barna*
Barilius	*Bendelisis*
Cirrhinus	*Mrigala*
Colisa	*Fasciatus*
Glyptothorax	*Pecinoptenis*
Labeo	*Angra*
Labeo	*Bata*
Labeo	*Boga*
Labeo	*Calbasu*
Labeo	*Gonius*
Labeo	*Pangusia*
Labeo	*Rohita*
Macrognathus	*Aral*
Mystus	*Cavasius*
Nandus	*Nandus*
Nemacheilus	*Botia*
Nemacheilus	*Corica*
Nemacheilus	*Rubicula*
Nemacheilus	*Batia*
Osteobrama	*Cotio*
Puntius	*Vittatus*
Rita	*Rita*
Salmostoma	*Bacailu*

Schizothorax	*Kumaonensis*
Silonia	*Silondia*
Wallago	*Attu*
Xenetodon	*Cacila*
Category-E- Low Risk (least concern) LR (PC)	
Ambipharyngodon	*Mola*
Chela	*Laubuca*
Esomus	*Dandricus*
Gudusi	*Chapra*
Notopterus	*Notopterus*
Paarlucosoma	*Daniconius*
Puntius	*Sophore*
Semiloptes	*Gongota*

- **Reptiles**

Table 3.9: Status of reptiles of Uttar Pradesh (Source: CAMP Workshop, 1997)

Species	Status	Family	Comments
Crocodylus palustris	Vulnerable	Crocodalidae	
Gavialis gangeticus	Endangered	Gavialidae	
Hardella thuriii thuriii	Vulnerable	Gataguridae	
Geoclemys hamiltoni	Vulnerable	Bataguridae	
Kachuga dhongoka	Vulnerable	Bataguridae	
Kachuga tentaria circumdata	Vulnerable	Bataguridae	Endemic to N. India
Kachuga kachuga	Vulnerable	Bataguridae	
Kachuga smithii pallipedes	Lower risk least concern	Bataguridae	
Kachuga smithii smithii	Lower risk least concern	Bataguridae	
Kachuga tecta	Lower risk near threatened	Bataguridae	
Kachuga tentoria flaviventer	Vulnerable	Bataguridae	Endemic to N. India
Melanochelys trijuga indopeninsularis	Lower risk near threatened	Bataguridae	
Morenia petersi	Vulnerable	Bataguridge	
Indotestutdo elongata	Lower risk near threatened	Testudinidae	Probably no more found in U.P.
Aspideretes gangeticus	Vulnerable	Trionychidae	
Aspideretes hurum	Lower risk near threatened	Trionychidae	
Chitra indica	Lower risk near threatened	Trionychidae	
Lissemys punctata Andersoni	Lower risk near threatened	Trionychidae	
Hemidactylus flaviviridis	Lower risk least concern	Geckonidae	
Hemidactylus brooki	Lower risk least concern	Geckonidae	
Hemidactylus frenatus	Lower risk least concern	Geckonidae	
Hemidactylus leshenlauti	Lower risk least concern	Geckonidae	
Hemidactylus treidus	Lower risk least concern	Geckonidae	

Calotes v. versicolor	Lower risk least concern	Agamidae
Argyrogena fasciolatus	Lower risk near threatened	Colubridae
Atretium schistosum	Lower risk near threatened	Colubridae
Ramphotyphlops brminus	Lower risk near threatened	Typhlopidae
Python m. molurus	Lower risk near threatened	Boidae
Python m. bivittatus	Lower risk near threatened	Boidae
Eryx johnii persicus	Lower risk near threatened	Biodae
Eryx conicus	Vulneerable	Biodae
Ahetulla nasutus	Lower risk least concern	Colubridae
Amphtesma platyceps	Vulnerable	Colubridae
Amphiesma stolata	Lower risk near threatened	Colubridae
Boiga trigonata	Data deficient	Colubridae
Chyrospelia ornata	Data deficient	Colubridae
Dendralephis pictus	Data Deficient	Colubridge
Liopeltis rappi	Vulnerable	Colubridae
Lycodon fasciatus	Vulnerable	Colubridae
Lycodon s. stristus	Lower risk near threatened	Colubridae
Lycodon jara	Lower risk near threatened	Colubridae
Macrophistodon p. nlumbicolor	Lower risk near threatened	Colubridae
Psammophis leithi	Lower risk near threatened	Colubridae
Ptyas m. mucosus	Lower risk near threatened	Colubridae
Sybniophis collaris	Lower risk near threatened	Colubridae
Sybniophis sagittarius	Lower risk near threatened	Colubridae
Xenochropis p. piscator	Lower risk near threatened	Colubridae
Naja naja	Lower risk near threatened	Elapidae
Ophiophagus hannah	Lower risk near threatened	Elapidae
Bungraus caeruleus	Lower risk near threatened	Elpidae
Bungarus faxciatus	Lower risk near threatened	Elpidae
Bungarus sindarus walli	Data deficient	Elapidae
Viperar ruselli	Lower risk near threatened	Viperidae

- **Mammals**

Table 3.10: Threatened mammals of Uttar Pradesh (Source: CAMPS Workshop, 1997 and IUCN, 2000)

S.No.	Species	Common name	Family	IUCN
	Mammals Endemic to India			
1	*Alticola albicauda* (True)	Voles	Muridae	DD
2	*Anathana ellioti* (Waterhouse)	Tree Shrew	Tupaiidae	LRnt
3	*Cervus duvaucelli*	Swamp deer	Cervidae	CR
4	*Eptesicus nilssoni* (Keyserling and Blasius)	Eptesicus Bat	Vespertilionidae	DD
5	*Funambulus tristriatus* (Waterhouse)	3-striped palm squirrel	Scicuridae	LRnt
6	*Herpestes fuscus* Waterhouse	Mangoose	Herpestidae	VU
7	*Macaca radiata* (E. Geoffroy)	Rhesusmacaque	Cercopithecidae	LRlc
8	*Alticola roylei* (Gray)	Royle, s Vole	Muridae	DD
9	*Antilope cervicapra* (Linnaeus)	Black Buck	Bovdae	LRlc

10	*Axis axis* (Erxleben)	Chital	Cervidae	LRlc
11	*Axis porcinus* (Zimmermann)	Hog deer	Cervidae	LRnt
12	*Bos grunniens* Linnaeus	Yak	Bovidae	CR
13	*Boselaphus tragocamelus* (pallas)	Nilgai	Bovidae	LRlc
14	*Canis aureus* Linnaeus	Jackal	Canidae	LRlc
15	*Canis lupus palipus* Sykes	Wolf	Canidae	LTnt
16	*Capra ibex* Linnaeus	Ibex	Bovidae	VU
17	*Caracal caracal* (Schreber)	Caracal	Felidae	LRnt
18	*Cervus devauceli* G. Guvier	Swamp deerBarasingha	Cerviae	EN
19	*Cervus unicolor* kerr	Sambhar	Cervidae	LRlc
20	*Cuon alpinus adjustes* (Pallas)	Wild dog	Canidae	CR
21	*Cynopterus sphinx* Vahl	Furit Bat	Pteropodi	LRlc
22	*Delphinus delphis* Linnaeus	Common	Delphinid	LRnt
23	*Elephas maximus* Linnaeus	Elephant	Elephant Elephantidae	VU
24	*Felis chaus* Schreber	Jungle Cat	Felidae	LRnt
25	*Funambulus palmarum* (Linnaeus)	3-striped squirrel	Sciuridae	LRlc
26	*Funambulus pennantii* Wroughton	5-striped squirrel	Sciuridae	LRlc
27	*Golunda ellioti* Gray	Indian bush rat	Muridae	LRlc
28	*Hepestes edwardsii* (E. Geoffroy Saint-Hilliare)	Common Mangoose	Erinaceidae	LRlc
29	*Herpestes smithii* Gray	Ruddy Mangoose	Herpestidae	LRlc
30	*Hesperoptenus tickeli* (Blyth)	Tickell's Bat	Vespertilionidae	DD
31	*Hipposiderous armiger* (Hodgson)	Great Himalayan leaf nosed bat	Hipposideridae	LRnt
32	*Hyaena hyaena* (Linnaeus)	Hyaena	Hyaenidae	LRnt
33	*Hystrix* Kerr	Indian Porcupine	Hystricidae	LRlc
34	*Kerivoula picta* Pallas	Pinted Bat	Vespertilionidae	LRnt
35	*Lepus nigricollis* F Cuvier	Black naped Hare	Leporidae	Lrle
36	*Macaca multta* (zimmermann)	Rhesus macaque	Cercopithecidae	LRlc
37	*Manis crassicaudata* Gray	Indian Pangolin	Manidae	LRnt
38	*Marmota bobak*	Himalayan	Sciuridae	En
39	*Martes flavigula* (Boddaert)	Himalayan yellow throated Marten	Mustelidae	LRlc
40	*Mellivora capensis* Schreber	Ratel or Honey Badger	Mustelidae	LRnt
41	*Melursus ursinus* (Shaw)	Sloth bear	Ursidae	VU
42	*Millardia meltada* Gray	Metad or Soft furred field Rat	Muridae	LRlc
43	*Moschola meminna* (Erxleben)	Mouse deer	Tragulidae	Lrnt.
44	*Moschus chrysogaster* (Hodgson)	Musk deer	Moschidae	CR
45	*Muntiacus muntijak*	Barking deer	Cervidsae	LRlc

	(Zimmermann)			
46	*Mus booduga* (Gray)	Field Mouse	Muridae	LRlc
47	*Mustela altaica* (pallas)	Pale Weasel	Mustelidae	DD
48	*Mustela sibirica* (Pallas)	Himalayan Weasel	Mustelidae	LRnt
49	*Nemorhaedus goral* (Hardwicke)	Goral	Caprinae	VU
50	*Nesokia indica* (Gray and Hardwicke)	Short tailed Bandicoot	Murdae	LRlc
51	*Nyctalus noctula* (Schreber)	Noctule bat	Vespertilionidae	DD
55	*Ovis ammon* (Linnaeus	Nayan or great Tibetan Sheep	Bovidae	CR
53	*Paguma larvata* (Hamilton-Smith)	Himalayan Palm Civet	Viverridae	LRlc
54	*Panthera pardus* (Linnaeus)	Leopard	Felidae	VU
55	*Panthera tigris* (linnaeus)	Tiger	Felidae	EN
56	*Paradoxurus hermaphroditus* (Pallas)	Common Palm Civet	Viverridae	LRlc
57	*Platanista gangetica* (Roxburghi)	Gangetic Dolphin	Platanistidae	CR
58	*Plecotus auritus* Linnaeus	Long earedbat	Vespertilionidae	DD
59	*Rattus norvegicus* (Berkenhout)	Brown rat	Muridae	LRlc
60	*Rattus rattus* (Linnaeus)	Common house rat	Muridae	LRlc
61	*Rousettus leschenaulti* (Desmarest)	Fulvous fruit bat	Pteropodidae	LRlc
62	*Suncus montanus* (kelaart)	Mountain Shrew	Soricidae	VU
63	*Sus scrofa* Linnaeus	Wild boar	Suidae	LRlc
64	*Tatera indica* (Hardwicke)	Indian Gerbille	Murdae	LRlc
65	*Tetracerus quadricornis* (Blainville)	Four horned	Bovidae	LRnt
66	*Tupaia belangeri* (Wagner)	Tree Shrew	Tupaiidae	LRlc
67	*Ursus thibetanus* G. (Baron) Cuvier	Himalayan Black bear	Ursidae	LRlc
68	*Vandeleuria oleracea* (Bennett)	Long tailed tree mouse	Muridae	LRlc
69	*Viverricula indica* (Desmarest)	Small Indian Civet	Viverridae	LRnt

Table 3.11. Summary of status of Mammals in Uttar Pradesh

Status	**Number**	**Percentage**
Critical	7	9.3
Endangered	4	5.3
Vulnerable	7	9.3
Lower risk (least concern)	30	40
Lower risk (near threatened)	20	26.6
Data deficient	7	9.3

- **Birds**

Table 3.12. Status of Threatened Birds of Uttar Pradesh: India Red Data Book Candidate Threatened Species (Source: Birdlife International Year)

S.No.	Species	English Name
1	*Pelecanus crispus*	Dalmatian Pelican
2	*Aythay baeri*	Baer, s Pochard
3	*Haliaeetus leucoryphus*	Pallas's Sea-eagale
4	*Aquila clanga*	Greater spotted eagale
5	*Francolinus gularis*	Swamp Francolin
6	*Ophrysia superciliosa*	Himalayan Quail
7	*Tragopan melanocephalus*	Western Tragopan
8	*Catreus wallichi*	Cheer Pheasant
9	*Grus antigone*	Sarus Crane
10	*Houbaropsis bengalensis*	Bengal Florican
11	*Rynchops albicollis*	Indian Skimmer
12	*Chaetorinis Striatus*	Bristled Grass-warbler
13	*Ploceus Megarhynchus*	Yellow Weaver

3.4. Conservation Status of Wild Biodiversity

3.4.1. Ex-Situ Conservation

Ex-situ conservation of flora and fauna refers to their conservation outside the natural habitats. The *Ex-situ* conservation of biodiversity in Uttar Pradesh is largely institutional through the establishment of zoological Gardens, Botanical Gardens, arboreta etc. The Uttar Pradesh Forest Department is (UPFD) committed to conserve and rejuvenate the populations of the endangered and threatened species of fauna through *ex-situ* conservation by way of establishing institutions such as zoos, parks and conservation breeding centers. For the conservation of plant diversity, arboretum, bambusetum, populatum, herbal gardens etc. have been established at various places. Currently the State has one Botanical and three Zoological gardens, which are primarily responsible for conservation and multiplication of rare and endangered flora and fauna of the State. The Government of India has also initiated establishment of National Botanical Garden at NOIDA in U.P. Among success stories, conservation of Gangetic Gharial, crocodiles and turtles is worth mentioning. Collection and preservation of plant genetic resources is being done through continuous the efforts of National Bureau of Plant Genetic Resources, New Delhi with its branches located in the plains of U.P. One of the three national gene banks set up by the Government of India for Conservation of Medicinal and Aromatic plants is located at Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow.

There have been several efforts of establishing mini zoos/ deer parks in U.P. However, due to different reasons most of these *ex-situ* conservation sites are non-functional or poorly operational (Table 3.13)

Table 3.13: Status of mini zoos and deer parks in Uttar Pradesh

S.No	Name of *ex-situ* site	Position with respect to animals
1	Van chetna kendra, Vrindavan Mathura	Closed. Data deficient
2	Van chetna Kendra, Narora Bulandshahar	Only domestic animals are kept
3	Laxman Pahari Mrig Vihar (Deer Park)	Samber 7: Spotted Deer 1; Nilgai:1
4	Mini zoo & Breeding farm Meerut Cantt.	PvtTrader/Not a Zoo
5	Mrig Evam Pakshi Vihar Jhansi	Never took off
6	Amaltas Mirgdav Kalpl Oral	Never took off
7	Van Chetna Kendra, Jalaun Orai, Jalaun	Never took off
8	Nawab Tank Mrig Vihar Banda	Sambar 1; Chinkara 1 Proposed to be closed

9	Van Chetna kendra, Nagal Saharanpur	Never took off
10	Van Chetna Kendra Agra	The Zoo authorities have stated that all the wild animals have been released in near forest block
11	Katemiaghat Gharial Rehabilitation Center Bahraich	The Zoo authorities have stated that all the Animals have been released in the wild
12	Van Manoranjan Kendra Rampur	Animals shifted to Lucknow and Nainital Zoo
13	Nehru Van Chetna Kendra Etah	Animals were released in Sur Sarovar sanctuary, Agra & National Chambal Sanctuary
14	Van Chetna kendra, Mulkandpur Aligarh	Animals may have been shifted to Kanpur Zoo. Black buck 1; Grey partridge 4; Black partridge-1
15	India park, Bijnor	Refused recognition in 1996 (Blackbuck 7: Swamp Deer-3; Gharial 3)
16	Cheetal Park, Khatoll Muzaffarnagar	Chief Wildlife Warden wrote that all the spotted deers were released in nearby forest Block
17	Chetna Kendra, Ridhani Range Meerut	No animals, closed
18	Van Chetna Kendra Ghaziabad	Refused Recognition, having Few Chetals
19	Mrig Vihar Van Chetna kendra Jhansi	Spotted Deer2: Black buck 1: Nilgai 1: Chinkara2-Refused recognition
20	Shukratal Chital Park Muzaffamagar	No animals (zoo is closed on ground)
21	Deer Park, Hindalco Industries Ltd. Sonbhadra	Spotted Dear 10
22	Indira manoranjan Van (Deer Park), MehewaKheri	Spotted Deer 21; Black buck4; Swamp Deer 1; Hog Deer 4
23	Ban Devi Recreation Park Manu	Chital 1; Nilgai 6; Sambar1; Hog Deer1
24	Vinod Van Mini Zoo, Ramgarh Gorakhpur	Python 2; Barking deer 6; Spotted Deer 18; Nilgai 31; Parakeet 3
25	Deer Park- Kukarail Lucknow	Otter Smooth India 4
26	Wyndhum Fall Mini Zoo Mirzapur	Sambar4; Chital 1; Nilgai 1; Chausingha 1; Chinkara 1; Gharial 1
27	Deer Park	Never took off
28	Deer Park, Air Force Memaura	Never took off
29	Deer Park Allahabad	Never took off
30	Mini Zoo in Electra Vidyapeeth Meerut	Never took off
31	Triveni Environment Park Allahabad	Never took off
32	Deer Park Bareilly	Spotted Deer5
33	Aranaya Bhavan Bulandshahar	Black buck4; Sambar 1; Common Lagur2; Spotted Deer2; Baya1; Parakeet1; Grey Partridge2
34	Nawabaganj Deer park Unnao	Data Deficient-Spotted Deers
35	Gharial Rehabilitation Center Lucknow	Gharial 459; Mugger 42; Salt Water Crocodile; Turtle 3443; Otter 4
36	Van Chetna Kendra, Kumarganj Faizabad	Porcupine 3; Ratel 1; Fos 2; Nilgai 1; Chittal 9; Magger 2
37	Cheetal Grand Motels Pvt. Ltd.	Only Domestic Animals
38	Smath Deer park Varanasi	Gharial 3; Mugger 3; Partridge 8; Rosy Pelican 44; Sambar 7; Spotted Deer 60; Nilgai 1; Tortoise 10
39	Bharat Mini Zoo, Chilkana Saharanpur	Touring (Animals of this zoo have been surrendered to Kanpur zoo & Lucknow zoo. Not operational
40	New pardesi Touring Zoo Hardoi	Touring (Animals of this zoo have been surrendered to Kanpur zoo & Lucknow zoo. Not operational
41	Bajrang Touring Zoo Varanasi	Touring (Animals of this zoo have been

		surrendered to Kanpur zoo & Lucknow zoo. Not operational
42	Pardeshi Chirya Ghar Hardoi	Touring (Animals of this zoo have been surrendered to Kanpur zoo & Lucknow zoo. Not operational
43	Bina kamal Golden Zoo Bulandshahar	Touring (Animals of this zoo have been surrendered to Kanpur zoo & Lucknow zoo. Not operational
44	Azad Chirya Ghar (Touring) Varanasi	Touring (Animals of this zoo have been surrendered to Kanpur zoo & Lucknow zoo. Not operational
45	Bharatiya Touring Zoo Sitapur	Touring (Animals of this zoo have been surrendered to Kanpur zoo & Lucknow zoo. Not operational
46	Van Prani Udyan Bareilly	Black Buck 10; Swamp Deer 1; Hog Deer 4; Spotted Deer 35

(Source: TERI Report, 2000)

3.4.2. *In-situ* conservation

Establishment of protected Areas (PAs) is major *in-situ* initiative for maintaining the biodiversity values of a biogeographic zone or political area. In the State, 24 PAs (1 national park, 23 Wildlife Sanctuaries) cover approximately 5710 km^2 (nearly 2.4% of the total area). This coverage is considerably low. List (location and area) of PAs in U.P. is included in Fig. 8 and Table 3.14

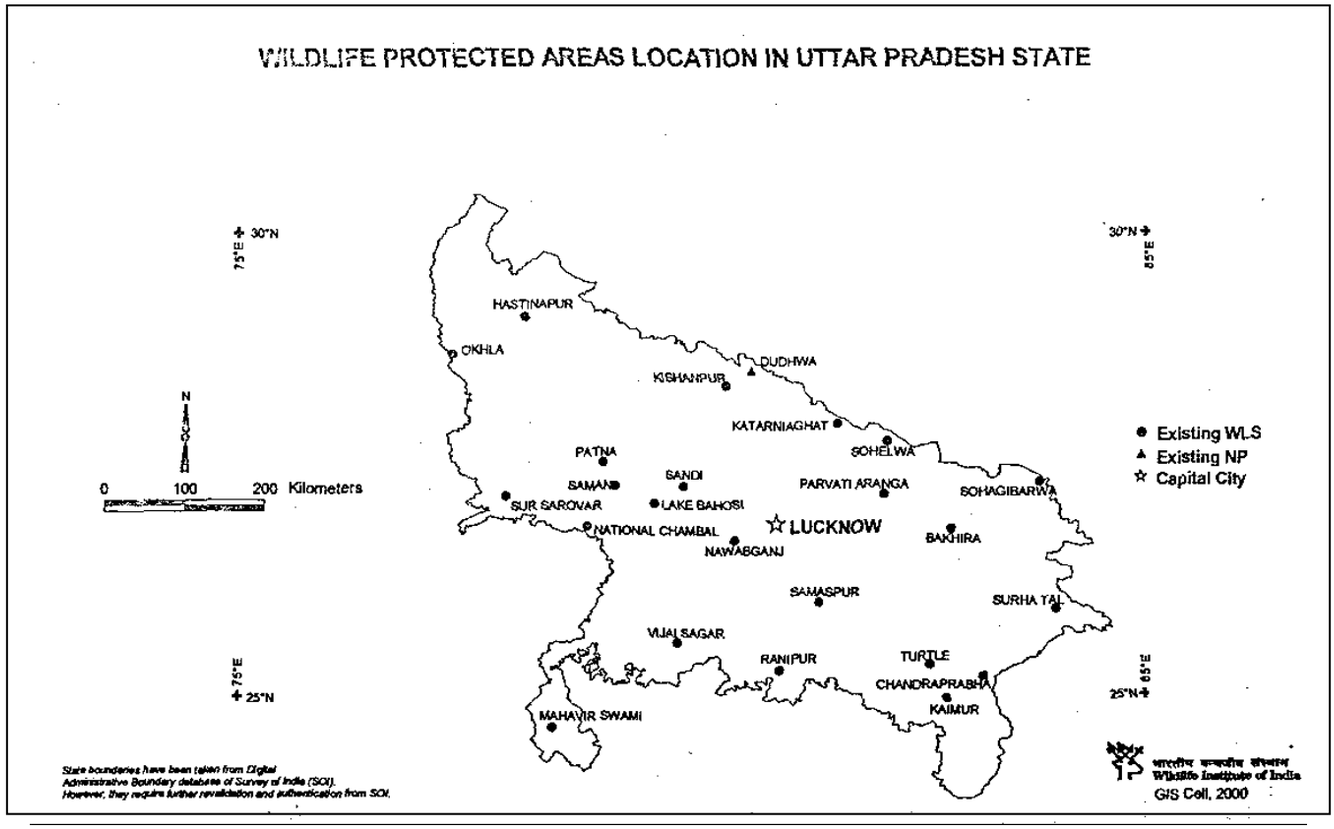


Fig. 8

Table 3.14: Protected areas in Uttar Pradesh

Name of parks	Date of establishment	Area (Km^2)	Status *	District
1. National Park				
Dudhwa	15-5-77	490	VHV	Lakhimpur Kheri
2.Animal sanctuaries				
Chambal	20-01-79	635	VHV	Etawah, Agra
Katarniya gaht	31-07-76	400	HV	Behraich
Ranipur	24-01-77	230	VHV	Banda
Mahavir swami	25-03-77	5	HV	Lalitpur
Chandra prabha	25-05-57	78	HV	Varanasi
Kisanpur	07-10-72	227	HV	Lakhimpur
Kaimur	10-08-82	501	VHV	Muzzafarnagar Merrut
Hastinapur	30-07-86	2073	-	Moradabad, Ghaziabad
Sohagibarva	29-06-87	428	-	Maharajganj
Sohailua	14-11-86	452	-	Gonda/Behraich
Kachhua	21-12-89	7	-	Varansi
Total		5036		
3.Bird Sanctuaries				
Bakhera		29	-	Basti
Okhla	08-05-90	4	-	Ghaziabad
Saman		5	-	Mainpuri
Parwati Aranga	23-05-90	11	-	Gonda
Vijay Sagar	26-06-90	3	-	Hamirpur
Surhataal	27-03-91	34	-	Balia
Sur-Sarovar	27-03-91	4	-	Agra
Patana	22-09-90	1	-	Etah
Nawabganj	07-08-84	2	-	Unnao
Samarpur	10-08-87	8	HV	Raibareilly
Lakh Bahoshi	21-03-88	80	-	Farrukhabad
Sonnandi	08-05-90	3	-	Hardoi
Total		**184**		

(* Status based on Mehta (2000): VHV- very high value; HV- High value)

The PA network in the State increased with the creation of many new Sanctuaries particularly in the 1980s. Attempts were made to cover representative areas. However, total representativeness of biodiversity elements has not been covered. Also, many of the declared PAs remained neglected from management point of view. Towards covering the States biodiversity representativeness in PA network the proposals (new establishment/extensions) of WII, DehraDun need special attention. This include upgradation of 50 km^2 of Chambal National Sanctuary as National Park in Semi arid zone; further extension Kaimur Wild life Sanctuary (150.25 km^2) in Deecan Peninsula zone, and creation of west dry land Sanctuary (10 km^2) in Gangitic plain zone (WII, 2000). In addition, the recommendations of various other agencies programmes e.g. Biodiversity Conservation Prioritization project, WWF; Important Bird Area Programmes, BNHS, etc. need consideration for implementation.

Among existing PAs of the State, few PAs have been listed under high priority (e.g. Nawab ganja, Mahavir Swami; High pressure and low management / legal status; Katarniyaghat; high pressure and high management / legal Status; Cahndraprabha; low pressure and low management / legal status; and very high priority (e.g. Kisanpur; high pressure and low management / legal status; Ranipur, Chamba; high pressure and high management / legal status; Kaimur, Dudhwa; low pressure and high management / legal status) protected areas in the country (Mehta 2000).

3.5. State of agricultural ecosystems and domesticated plant/animal species and varieties

Uttar Pradesh, being the largest producer of food grains in India (producing about 22% of the total food grain) has special and important role to play for India's food security. Nearly 7o% of land area of the State is under cultivation. Some of the districts (i.e. Fatehpur, Allahabad, Pratapgarh and Rai Breilly) have even >90% land under crops. 23 districts mostly lying in Eastern U.P., Central U.P. and Western U.P. fall in the range of 80-90%; 9 districts however fall under category of 70-80% area under agriculture. In 1997-98 contribution of U.P. was 41.8 million tons in the National food grain production of 194.1 million tons. By the end of year 2007 food grain production in the State is expected to be at the level of 70.2 million tons in the total projected National food grains production of 300 million tons. This scenario indicates that the State will continue to intensify its agricultural practices. However, considering the related affects of agricultural expansion on wild diversity following actions need to be undertaken:

3.5.1.Crop diversity status

- **Traditional crops**
- Wheat is the first ranking crop of U.P. claiming nearly 32.1% (average 1979-82: 78.05 lakh ha.) of the total cropped area. Of the total, 13 districts put more than 35 per cent of their total cropped area under wheat (Hardoi 39.9%, Mathura 38.9% Shahjahanpur 37.9%, Gorakhpur 37.6%, Bulandshahar 37.3%, Mainpuri 37.1%, Moradabad 36.6%, Unnao 36.5%, Ghaziabad 36.1%, Lucknow 35.7%, Pilibhit 35.4%, Budaun 35.4%, and Deoria 35.4%) and another 26 district lie in the range of 30-35%. Thus more than 30% of the total cropped area is put under wheat in 39 districts. The trends in area, production and yield of wheat in Uttar Pradesh (undivided) are presented (Table 3.15).

Table 3.15. Area, production and yield of wheat in Uttar Pradesh (Source: Planning Altus and Agricultural Statistics 1995)

Year	Area (lakh ha)	Production (lakh Metric tons)	Average yield (quintals/ha)
1950-51	33.15	27.21	8.21
1960-61	39.38	39.44	10.01
1970-71	59.07	76.89	13.02
1980-81	81.11	133.84	16.50
1984-85	83.89	156.75	18.89
1992-93	89.09	193.34	22.23
1993-94	90.30	208.23	23.08

- Paddy is the most important Kharif crop and occupies 21.6% (average 1979-82; 52.45 lakh ha) of the total cropped area of U.P., but in Eastern U.P. (excepting three districts of Allahabad, Pratapgarh and Sultanpur) it claims more than 30% of the total cropped area with Gorakhpur

(41.2%) at the top. Eleven districts (3 districts in Eastern U.P. and 8 district in Terai region and central U.P.) are includes in the category of 20-30% paddies where as 9 districts (Meerut, Ghaziabad, Bulandshahar, Aligarh, Mathura, Agra in western U.P. and Jalaun, Hamirpur and Jhansi in the Bundelkhand region) have the lowest (less than 5%) area under paddy which is quite understandable in view of their semi-arid conditions and preference for wheat/ gram cultivation. The remaining districts of Western U.P., Bundelkhand and Central U.P. fall in the range of 5-20% paddy cropped area.

The trends in area, production and yield of paddy in Uttar Pradesh (undivided) are present in Table 3.16.

Table 3.16. Area Production and yield of Paddy in Uttar Pradesh (Source: Planning Altas of Uttar Pradesh, 1987 and Agricultural Statististis, 1995)

Year	Area (lakh ha)	Production (lakh Metrictons)	Average yield
1950-51	38.52	19.98	5.19
1960-61	41.84	31.50	7.53
1970-71	44.17	36.05	8.16
1980-81	62.91	55.66	10.53
1984-85	55.06	71.57	13.00
1992-93	54.77	97.09	17.73
1993-94	53.68	102.10	19.02

- Maize is the third ranking cereal crop in U.P., claiming 4.9% of the total cropped area (12.00 lakh ha.) with the maximum of 20% in Bulandshahar followed by Farrukhabad (19.6)% and Bahraich (16.9%) and the minimum of zero % in Banda and Hamirpur districts. Four districts (Ghaziabad, Etah, Mainpuri Jaunpur and Gonda) claim more than 10% average; 10 districts lie in the range of less than 5%. The following table 3.17 gives the trends in area, Production and yield of maize in U.P.

Table 3.17. Area, Production and Yield of Maize in Uttar Pradesh (Source: Planning Altas of Uttar Pradesh, 1987 and Agricultural Statistics, 1995)

Year	Area (lakh ha)	Production (lakh metric tons)	Average yield (quintals/ ha)
1950-51	8.33	6.51	7.81
1960-61	10.54	6.25	5.93
1970-71	15.08	17.98	11.93
1980-81	12.23	8.93	7.31
1984-85	11.73	17.79	15.17
1992-93	10.83	16.60	15.33
1993-94	11.01	13.41	12.18

- In U.P. Gram is the most important Pulse and claims 9.07% of the total cropped area with the maximum of 35.74% in Banda followed by Hamirpur (35.37%), Jalaun (28.76%) and Jhansi (27.43%) Gram has preponderance in the Bundelkhand region whereas its share in the total cropped area is very low (less then 5%) in the Upper Ganga-Jamuna Doab, three districts of Rohilkhand plain and three districts of Eastern U.P. 9 district lie in the range of 10-30% whereas 22 districts lie in the range of 5-10% only. Gram shows a declining trend in both area and production and its average yield per ha (Table 3.19)

Table 3.18: Area, Production and Yield of Gram in Uttar Pradesh

Year	Area (lakh ha)	Production (lakh metrictons)	Average yield (Quintal/ ha)
1950-51	24.39	14.53	5.96
1960-61	25.52	18.31	7.17
1970-71	20.77	15.43	7.93
1980-81	15.54	12.88	8.61
1982-83	15.06	13.95	9.26
1083-84	13.58	11.86	8.73
1984-85	13.74	12.72	9.26
1992-93	10.65	9.51	8.93
1993-94	10.13	9.31	9.19

- Barley claims 3.1% coverage of the total cropped area in U.P. Its importance as a cereal crop has suffered a serious set back in U.P. as shown in the following table 3.20. Mathura district claims the maximum average (9.1%) followed by Aligarh (8.2%). 5 districts (Fatehpur, Agra, Unnao, Mirzapur, and Allahabad) all in the category of 6-8%; 14 districts lie in the range of 4-6% and the remaining districts are grouped together in the range of 0.1-4.0%. Most of the districts in the Upper Ganga-Jamuna Doab, the Rohilkhand plain, the Avadh plain and the Bundelkhand are noted for its conspicuous insignificance.

Table 3.19: Area, Production and Yield of Barley in Uttar Pradesh

Year	Area (lakh ha)	Production (lakh metrictons)	Average yield (Quintal/ ha)
1950-51	19.47	17.12	8.80
1960-61	18.46	16.87	9.14
1970-71	13.23	14.30	10.81
1980-81	7.79	10.32	13.25
1984-85	9.46	9.49	10.02
1992-93	8.38	10.47	12.49
1993-94	8.18	9.22	11.32

- Bajra, an early maturing kharif cereal crop, claims an area of 4.1% average (1979-81) of the total cropped area of Uttar Pradesh with a maximum of 27.5% in Agra followed by Etah (18.8%), Mathura (17.4%), Budaun (17.4%0, Aligarh (16.9%), Etawah (13.8%) and Mainpuri (12.3%) which form a compact Bajra region of the state. In Eastern U.P. Allahabad alone claims 9.2% of the total cropped area under bajra. 27 districts, mostly lying in eastern U.P., Bundelkhand, the Avadh plain, the Rohilkhand plain and the Upper Ganga Jamuna-Doab account for less than 3% of their total cropped area under bajra. It is noteworthy that Bajara cultivation has not been adversely affected (1950-51, total area 10.44 quintal/ha. 1980-81, total area –9.9 lakh ha production 7.33 lakh metric tons and average yield 7.37 quintal/ha) in the State.
- Jowar is less important as Kharif crop as it claims barely 2.8% of the total cropped area of U.P. Bundelkhand is predominantly a Jowar dominated region (Lalitpur 22.1%, Jhansi 18.6%, Hamirpur 17.6% and Jalaun 7.6%). Three other districts (Fatehpur 9.4%, Rampur 6.0% and Rae Bareilly 5.8%) lie in the range of 5-10%. The remaining districts of the Ganga plain (including Mirzapur) account for less than 5% of the total cropped area under jowar. The trends in total area, production and average yield for jowar show a down ward tendency (1950-51, area 9.47 lakh ha. production 6.46 lakh/metric tons and average yield- 6.86 quintals/ha; 1980-8; area 6.77 lakh ha production-4.05 lakh metric tons and average yield 6.00 quintals/ha.

- Arhar (tur or pigeon pea) is an important kharif pulse claiming an area of 3.03% in the total cropped area of the state with the maximum of 8.64% in Pratapgarh followed by Jhansi (6.52%), Rae Barli (6.52%), Hamirpur (6.28%) and Banda (6.20%). It is an important crop of Eastern U.P. (excluding the Saryupar plain) the Bundelkhand region (excepting Lalitpur) and the lower Ganga-Jamuna Doab and Basti and Lalitpur account for less than 2% area under arhar. In terms of area there has been a decline in arhar cultivation (1950-51:6.47 lakh ha; 1980-81; 7.56 lakh metric tons) and average yield (1950-51; 6.34 quintals/ha; 1980-81; 14.48 quintals/ha. there is percentile improvement. Some districts like Etah, Barielly, Moradabad, Shahjahanpur, Etawah Kanpur, Allahabad, Unnao and Sultanpur in particular show a negative trend in area but a positive trend in production.

- **Cash Crops**

- Sugarcane is the most important cash crop of U.P. claiming nearly 6.0% of the total cropped area with the maximum of 32.2% in Muzaffarnagar followed by Meerut (29.6%), Bijnor (26.9%), Kheri (14.3%), Deoria (10.8%), Ghaziabad (15.8%), Saharanpur (19.2%), Moradabad (18.9%). The crop receives least importance (less than 5%) in the Bundelkhand, the lower Ganga-Jamuna Doab. Muzaffarnagar, Meerut, Ghaziabad, Bunlandshahar, Bijnor, Moradabad, Kheri, Pilibhit and Deoria exhibit upward trends in the cultivation of sugarcane. In some of the districts of the Suryupar plain and Eastern U.P. the yield trends have been static or down ward. Uttar Pradesh remains the most important Sugarcane growing state claiming nearly 54 % of the national production, but during 1950-51/1980-81 it has shown a relatively low compound rate of growth (1.8% in area; 1.4% in production and 0.50 % in average yield) as compared to the all India averages of 3.158% (area) 2.009% (production) and 1.152% (average yield). In fact the growth rate in sugar cane productivity in U.P. is the lowest in India. The following table shows the growth trends in sugarcane cultivation:

Table 3.20: Area, Production and Yield of Sugarcane in Uttar Pradesh

Year	Area (lakh ha)	Production (lakh metrictons)	Average yield (Quintal/ha)
1950-51	10.13	294.98	291.04
1960-61	13.28	545.15	410.27
1970-71	13.45	546.72	406.42
1980-81	13.63	642.04	470.90
1984-85	15.43	708.88	459.36
1992-93	18.57	1029.29	554.13
1993-94	17.61	1040.82	591.12

- Potato is widely grown vegetable crop in U.P.However; it claims only 1.1% of the total cropped area. Farrukhabad district (9.2%) is the leading potato producer in the state followed by Lucknow (3.1%) and Mainpuri (3.0%). 20 districts lie in the range of 1-3% and the reaming districts claim less than 1.0% of their cropped area under potato. Potato has recorded significant up ward trends in area, production and yield in the State (Table 3.22)

Table 3.21: Area, Production and Yield of Potato in Uttar Pradesh

Year	Area (lakh ha.)	Production (lakh metrictons)	Average yield (Quintal/ha)
1950-51	0.82	6.40	78.08
1960-61	1.13	7.99	70.37
1970-71	1.61	14.85	92.00
1980-81	2.65	41.64	156.66
1984-84	3.21	54.49	170.00
1992-93	3.85	56.62	147.08
1993-94	3.78	73.23	193.58

- Groundnut is the most important oilseed crop and it claims nearly1% of total cropped area in U.P. Budaun district (8.0%) followed by Hardoi (5.1%), Sitapur (3.8%), Barielly (3.5%), Unnao (3.2%) and Lucknow (3.1%) lead in groundnut production. Other important producers are Moradabad, Bijnor, Saharanpur, Kheri, Bahraich, Rae Bareli and Bara Banki. The reaming district put < 1% of the total cropped area under groundnut cultivation. Its area, production and yield fluctuate due to vagaries of the Monsoon (1950-51: area- 0.89 lakh ha; production-1.01 lakh metric tons; 1980-81; area 1.90 lakh and production- 1.3 lakh metric tons).
- Mustard seeds are the most important Rabi oilseed crop and claim nearly 1.82% of the total cropped area of the state. The middle Ganga-Yamuna doab is the most imps. Mustard seed area. Agra district (13.87), followed by Etawah (9.52%), Kanpur (9.03%), Mainuri (4.33), Mathura (3.73%), Farrukhabad (3.70%) are leading Mustard producers districts of U.P. In the northern Terai region (Kheri, Pilibhit, Gonda and Bahraich) mustard seeds cultivation claims 2.7% of the total cropped area. Other important Mustard seeds producing district are Hardoi, Fatehpur, Unnao, Jalaun, Shahjahanpur, Etah and Budaun. In the reaming districts the mustard seed crops claim less than 1% of the total cropped area. The cultivation of mustard and rape seeds has shown an upward trends as indicated in the following table:

Table 3.23. Area, Production and yield of Mustard and Rapeseeds in Uttar Pradesh

Year	Area (lakh ha.)	Production(lakh metrictons)	Average yield (Quintal/ha)
1950-51	1.18	0.43	3.64
1960-61	1.25	0.61	4.85
1970-71	2.12	1.26	5.96
1980-81	4.07	2.20	5.40
1984-85	5.17	3.95	7.64
1992-93	7.49	8.91	7.39
1993-94	7.67	11.24	9.80

Some of the important trends of agricultural practices in U.P. exhibit the following:

(i) Food grains have shown positive trends in area, production and yield as indicated in the following table 3.25:

Table 3.24. Area, Production and yield of Food grains in Uttar Pradesh

Year	Area (lakh ha)	Production (lakh metrictons)	Average yield (Quintal/ha)
1950-51	17.89	117.74	6.89
1960-61	183.43	144.85	7.90
1970-71	194.58	194.67	10.00
1980-81	204.64	249.46	12.19
1984-85	205.47	326.23	-
1992-93	203.97	387.72	-
1993-94	202.84	397.25	-

(ii) Cereals have shown positive trends in area, production and yield during 1950-51/1980-81, as indicated in the following table 3.26.

Table 3.25: Area, Production and yield of Cereals in Uttar Pradesh

Year	Area (lakh ha)	Production (lakh metrictons)	Average yield (Quintal/ha)
1950-51	43.45	30.23	6.96
1960-61	45.47	38.23	8.41
1970-71	37.24	30.69	8.24
1980-81	28.55	25.26	8.84
1984-85	28.83	27.05	-
1992-93	29.21	25.23	-
1993-94	28.75	25.15	-

(iii) In spite of the fact that Pulses are the main source of protein to the predominately vegetarian diet and in livestock feeding, they have not received due attention in research and development programs for augmenting their production in the State.

(iv) The total production under crops like rice, wheat, maize shows an increasing trend.

Table 3.26: Production of food grains (thousands tones)

Food grains	1994-95	1995-96	1996-97
Rice	10365	10362	11773
Jowar	394	418	362
Bajara	863	1061	1017
Maize	1441	1498	1551
Ragi	191	186	185
Wheat	22560	21816	24332
Barley	781	699	669
TotalCereales	36729	36178	40029
Gram	948	698	895
Total Pulses	2479	2189	2664
Total food grains	39207	38367	42693

(Source: Bulletin on Food Statistics 1996-97)

(v) Considering the index of cropping intensity for the State, which was 115 in 1950-51 rose to 128.09 in 1961-62, 134.11 in 1971-72, 142.69 in 1980-81, 251.78 in 1998-99 (excluding

Uttaranchal), an increasing efficiency of land use is apparent in the State. This can be attributed to better means of irrigation and improved technology. The minimum index of cropping intensity (104.42) was recorded for Hamirpur district. The regional variations in cropping intensity reflect the impact of physical and cultural factors involved in agricultural land use management. The highest class of cropping intensity (160-180) in 4 districts (Meerut, Ghaziabad, Bulandshahar and Aligarh) due to there location in Ganga-Jamuna Doab. The second highest class of cropping intensity (140-160) has extensive coverage in western U.P. & Eastern U.P.The third class of cropping intensity (120-140) is mainly concentrated in Central U.P. with extension in eastern U.P. (Allahabad, Pratapgarh and Mirzapur), Western U.P. (Agra, Etawh Bijnor and Budaun) and Bundelkhand (Lalitpur and Banda). The lowest class of cropping intensity is found in three districts (Hamirpur, Jalaun and Jhansi) of the Bundelkhand region whose average cropping intensity is only 112.98: These variations in cropping intensity are mostly attributed to availability of irrigation facilities in the upper Ganga-Jamuna Doab where the irrigation intensity is the highest, so also the cropping intensity which has been given further fill up by use of improved technology and level of common civilization. As we move towards the lower Ganga Jamuna Doab or the trans Yamuna region of Bundelkhand, the cropping intensity is lower and the irrigation intensity is also lower. The Bundelkhand region has the lowest cropping intensity as it is a rain deficit area with poor irrigation facilities, but in the district of Lalitpur and Banda where more irrigation facilities are now available the cropping intensity is higher. In Eastern U.P. the cropping intensity is favoured by higher rainfall, better irrigation facilities and higher pressure of population on its subsistence agriculture. As there is hardly any scope for extension in net cultivated area, the greater intensity of cropping is the alternative strategy for increasing agricultural productivity and land use efficiency by tapping irrigation potential and scientific land management practices in different region of the state.

CHAPTER --4

Statement of the Problems Related to Biodiversity

Uttar Pradesh, one amongst largest States of India, has diverse range of wildlife habitats. The habitats range from natural forest and semi natural thorn scrub to alluvial grasslands, diverse agricultural ecosystems to fragile wetlands. In spite of these features, the biodiversity in the State faces various problems. A few major problems in the State are as follows:

(i) Just a little over 7% of land area in the State is under forest cover. This in itself is indicative that the State lacks natural wildlife habitats. Moreover intensification of agricultural practices, increasing demand for fuel wood, development of vast network of roads and railways, etc. in the State further contributes towards the destruction of existing forest habitats. This consequently affects the overall biodiversity status.

(ii) On account of depletion and fragmentation of natural habitats various floral and faunal species in the State have been listed under threatened category. These species, presently do not find desired conservation inputs from State/Central Government.

(iii) The State faces heavy livestock pressure (density 283 animal per km^2) on land and biological resources. However, the productivity level is low due to poor quality (non descript type) animals. At the same time due to improper management and breeding attention the indigenous animal germplasm is depleting fast.

(iv) On account of increasing demand for grain production, crops like wheat, rice and maize have received more attention. Whereas, some traditional crops like pulses, Barely, Jowar, etc. showed decline. Likewise, more focus on high yielding varieties has caused depletion of traditional varieties.

(v) The conservation initiatives, especially PA coverage (< 2%) is far less than the desired norms. Also, due to unresolved issues of settlements of rights and lack of proper plans for most PAs, cause great impediment in achieving the desired goals.

(vi) Since most of the Biodiversity rich forests also contain the mineral wealth and also the best sites for water impoundment, mining and developments projects in such areas have often led to destruction of habitats. Poaching and illegal trade of wildlife products too have adversely affected biological diversity in the State.

(vii) Destructive developments on biodiversity rich lands such as industries, canals and urban growth, are also among the major factors of loss of biodiversity.

4.1. Statement of threats to Biodiversity – general facts

As elsewhere, the biodiversity of U.P. (i.e. forests, grasslands, weltlands ecosystems, face many pressures. One of the major causes for the loss of biological diversity in U.P. has been the depletion of vegetative cover in order to expand in agriculture. Since most of the biodiversity rich forests also contain the maximum mineral wealth and also the best sites for water-impoundment, mining and development projects in such areas have often led to destruction of habitats. Poaching and illegal trade of wildlife products too have adversely affected biological diversity. The whole world has witnessed two important phenomenon due to increase in human population and also of consumer demands, changes in economic and social relations, trade patterns, centralization of power, and so on in the 20^{th} century. Firstly, scientific advancement that gave social and economic benefits has posed a threat to the existence and survival of human and animal population. Secondly, forest ecosystems which are responsible for the sustainable development, sustainable economy, sustainable society and sustainable use are worst hit by the pace of industrial development. They are disappareing rapidly and no one is really sure about the rate of extinction and the degree of threat.

In general, major causes of Biodiversity loss (applicable to any region) are attributed to two major categories –

1. Root causes
2. Proximate causes

- ***Root causes of Biodiversity loss:***

These mainly include:

- Development pressure
- Market failure
- Intervention failure

- **Developmental pressure**: Any path of economic development will sustain itself only when the stock of capital assets remain constant, or richness over time. These capital assets may be in the form of machines, roads, factories, human capital, forests, wildlife, soil quality, etc. But, the population growth has two counteracting effects on the environment and development. Firstly, it brings in prospects for development by rising GNP per capita. At the same time, it impedes development by reducing environmental quality leading to biotic impoverishment. Intensification of agriculture has also led to genetic simplification as stability and diversity are traded for uniformity and productivity.
- **Market failure:** The "market" in biodiversity is skewed and does not indicate the real value of the Biodiversity or it's by products. Biological products form the common property or open access resource, are normally zero prized commodities. For instances, fuel wood grasses, seeds, gum, etc. and are exploited by the stakeholders with unintended destruction. Since the markets do not consider the options and existence values, the higher reflected market price becomes an incentive for habitat destruction.
- **Intervention failure**: Lack of political will is an important hindrance for the conservation of Biodiversity. Intervention by the Government in the economy through subsidies, price controls, physical out put targets, exchange control, etc. leads to

inefficiency. Environmental qualities are affected by excessive utilization of fertilizers and pesticides leading to increasing levels of pollutants in the environment. In addition to this, shortsighted gains, personality clashes, political agendas and lack of coordination on the part of various wings of the Government combine to cause degradation of habitats and loss of Biodiversity.

- **Progressive alienation of citizens including local communities from their local:** Villagers no longer have the stake in conserving that may have earlier had, because forests and wet lands have been taken away from them into centralized , and these systems can not deliver the goods either. Urban citizens are so cut off from nature that they don't care or are helpless to do anything. Bureaucratic structures to manage natural resources, are one of the major problems. Also inequities in power and control amongst various sections of society, including between women and men. There is lack of clarity and insecurity in tenure.

- ***Proximate causes of biodiversity loss***

  Every species has its importance in its ecosystem as wild plant or animal and it can provide new genetic material for improvement. Economically important plants were over-exploited to meet the demand of growing population through out the globe and resulted in drastic decline in the size of their populations. Some species of important plants have already become extinct and there are many species facing danger of extinction. Many factors both natural and man-made have been responsible for limiting the distribution of creation of species and causing them to become rare or even extinct. Causal factors of threat may be natural or man made. In general following are the major causes of biodiversity losses in Uttar Pradesh.

  Development Pressure
  - Construction
  - Forest based industries
  - Hydel/irrigation projects
  - Mining
  - Pollution
  - Resource extraction
  - Road & transport

  Encroachment
  - Agriculture
  - Expansion of forest villages
  - Fishery
  - Grazing/increased domestic animals
  - Habitat depletion/change
  - Horticulture
  - Monoculture forestry
  - New settlements
  - Siltation of river beds/wetlands
  - Teak cultivation

  Exploitation
  - Collection made by scientific/educational institutions
  - Exploitation by local authorities as revenue resources
  - Firewood, fodder and MFP collection

- Food gathering
- Food hunting
- Poaching/illegal hunting
- Smuggling of timber/forest produce across international border
- Unregulated collection of medicinal plants and orchids
- Unregulated trade/market forces

Human Induced Disasters

- Floods
- Wildlife depredation
- Epidemic
- Intentional forest fires

Management of Natural Resources

- Change in people's life style
- Conflicting/increasing demands
- Dilution of traditional values
- Erosion of indigenous knowledge
- Generation gap
- Human harassment
- Ignorance/lack of awareness
- Inadequate trained human resources
- Inappropriate landuse
- Lack of effective management
- Tourism development/impact

Political and policy issues

- Change in use/tenure/legal status
- Civil unrest/political movement
- Insurgency/armed conflict
- Intervention failure
- Lack of clear policy implementation
- Lack of interdepartmental coordination
- Lack of intervention
- People's/political pressure
- Reduction in size of PAs

- ***Threats to Ecosystems***

Humans have emerged as main causative factor for the degradation of ecosystems. The general categories of threats induced by human to ecosystems are presented (Table 4.1)

The main causes of loss of forest ecosystem in U.P. (as elsewhere) are: commercial clear felling and selective clear felling, conversion for agriculture, settlements, roads; inundation for development projects like multipurpose river valley projects; shifting cultivation, conversion to monoculture, grazing, mining, fire wood collection, introduction of exotics, fire and pollution. Commercial pressures, they come under pressure from grazing, pollution development projects, and conversion for agriculture, trees and introduction and spread of exotics.

The lakes, marshes, river systems and other wetlands are mainly threatened by pollution from untreated sewage, industrial pollutants and toxic effluents, agriculture runoffs containing residues of pesticides and chemical fertilizers and excessive siltation from

degraded catchments. Excessive withdrawal of water from the water bodies for industry, irrigation or domestic use, dredging and reclamation of water bodies excessive fishing, building of dams, jetties and canals are other factors adversely affecting the wetlands.

Table 4.1. Primary Human –Induced Pressures on Ecosystems

Ecosystems	Pressures	Causes
Agro-ecosystems	• Conversion of farmland to urban and industrial uses • Water pollution from nutrient run off and siltation • Water scarcity from irrigation • Degradation of soil from erosion, shifting cultivation or nutrient depletion • Changing weather patterns	• Population growth • Increasing demand for food and industrial goods • Urbanization • Government policies subsidizing agricultural inputs (water, research, transports) and irrigation • Poverty and insecure tenure • Climate change
River ecosystems	• Over exploitation of fisheries • Conversion into wetland habitats • Water pollution from agricultural and industrial sources • Fragmentation or destruction of natural tidal barriers • Invasion of nonnative species	• Population growth • Increasing demand for food and coastal tourism • Urbanization and recreational development, • Government fishing subsidies • Inadequate information about ecosystem conditions, especially for fisheries • Poverty and insecure tenure • Uncoordinated coastal land-use policies • Climate change
Forest ecosystems	• Conversion or fragmentation resulting from agricultural or urban. • Deforestation resulting in loss of biodiversity, release of stored carbon. air and water pollution • Acid rain from industrial pollution • Invasion of non-native species • Overexertion of water for agricultural, urban and industrial uses	• Population growth • Increasing demand for timber, pulp, and other fiber • Government subsidies for timber extraction and logging roads • Inadequate valuation of cost of industrial air pollution • Poverty and insecure tenure
Fresh water ecosystems	• Over extraction of water for agricultural, urban, and industrial uses • Over exploitation of inland fisheries • Building dams for irrigation, hydropower, and flood control • Water pollution from agricultural, urban and industrial uses • Invasion of non-native species	• Population growth • Wide spread water scarcity and naturally uneven distribution of water resources • Government subsidies of water uses • Inadequate valuation of costs of water pollution • Poverty and insecure tenure • Growing demand for hydropower
Grassland	• Conversion or fragmentation owing to	• Population growth

ecosystems	agricultural or urban uses • Induced grassland fires resulting in loss of biodiversity, release of stored carbon, and air pollution • Soil degradation and water pollution from livestock, herds • Over exploitation of game animals	• Increasing demand for agricultural products, especially meat • Inadequate information about ecosystem conditions • Poverty and insecure tenure • Accessibility and ease of conversion of grasslands

4.2. Threats to Biodiversity – some specific feature

4.2.1. Pesticides, eutrophication or dranage of wetlands

Excessive use of pesticides in agricultural and horticultural crops is among the major problems. Also, eutrophication and draning of wetlands are causing loss of biodiversity of wetlands in most parts of the Uttar Pradesh.

4.2.2. Major weeds of Uttar Pradesh

Proliferation of weeds in the State is among major causes of biodiversity loss. About 97 species of weeds have been identified in the State. A few of these need special mention – see Box.

Box (based on Dr. D.K. Pandey, Weed Research Institute (ICAR), Jabalpur

- **Wasteland weeds**

1. ***Parthenium hysterophorus* L. (Family Asteraceae, English name- Congress grass, ragweed parthenium)**
   Annual, seed propagated, herbaceous plant occurring throughout, more during summer and rainy seasons. Erect highly branched herb, 1-2.4 m tall. Leaf highly dissected, segments narrow, appears like that of carrot, that is why often called as carrot weed. Heads small, off white, button shaped. Plant and their parts contain phenolics and sesquiterpene lactones. While some of the phenolics are phytotoxic, the terpenoids-sesquiterpene lactones are toxic to plants, animals and human being. The species threatens agriculture, animal and human health, natural biodiversity and the environment. It can be managed to varying degrees by Mexican beetle (an insect feeding on it), *Cassia tora* (species replacing it during rainy season) or by broad leaf herbicides like 2,4-D at 1-2 kg a.i. ha.-1. Presently there in no obvious use of this species.

2. ***Lantana camara* L. (Family Verbenaceae, English name- Lantana)**
   A woody scrub, perennial plant. Roughly hairy shrub, profusely branched, rambling. Stem quadrangular. Leaves 2.5-7.5 cm, short stalked, ovate, serrate. Flowers about 8 mm long, bright red or yellow, crowded on head. Fruit a drupe, blackish purple containing two stony seeds. More predominant during rainy season, flowering throughout warm season, propagation by seeds and rooted slips. Plant and its parts contain a dozen phenolic, many phytotoxic, and among other constituents, several pentacyclic triterpenoids. The terpenoids make the species toxic to animals that graze on it. Often causing hepatotoxicity and death when grazed during scarcity of green forage. Species variously used including as ornamental plant, soil binder, soil cover, and source of fire wood. Fruits eaten by birds. Glyphosate at 2-4 kg a.i. ha-1 may manage the weed.

3. ***Ageratum conyzoides*** **L. (Family Asteraceae, English name- Goat weed, Hindi name- Neel phul)**
Annual, erect, highly branched, softly hairy herb, 30-90 cm long. Leaves opposite, stalked, ovate, heads numerous, dense rounded corymbs, flowers pale blue, minutely barbed scales, united in a toothed cup like ring. Propagation by seeds. Predominant in wastelands, along roadside, and in cultivated lands. Seeds are disseminated by water and wind. The species is used as an animal feed. The species can be managed by pre-emergence application of simazine, atrazine, diuron, oxadiazon, oxyfluorfen. Post-emergence management can be achieved by spraying 2,4-D.

4. ***Argemone mexicana*** **L. (Family Papaveraceae, English name- Mexican priklepoppy)**
A prickly annual herb with alternate showy yellow flower. Stem is 50-90 cm tall, pithy with scattered prickles and smooth to slightly pubescent. Leaves are bluish-green, sessile somewhat clasping stem, 10-20 cm long and pinnately lobed with an irregularly serrate and sharply spiny margin. Fruit spiny, seeds globular, reticulate and black brown with a prominent hilum. Predominant along roadsides, wastelands and cultivated areas. The plant is toxic to animal as well as human beings. Cattle avoid grazing this plant. Plant exudes yellow sap when cut. This weed can be managed by applying broadleaf herbicides like 2, 4-D at seedling stage and paraquat post emergent.

5. ***Cassia tora*** **L. (Family Caesalpiniaceae, Hindi name- Chakaura).** 3-5 leaflets, flowers yellow, seeds black, predominant in vacant sites, pastures, wastelands and along roadsides as well as well croplands. Used as a medicinal plant and leafy vegetable. Seeds have glycosides that act as laxatives and are used to treat skin diseases. Seeds rich in protein and substitute for coffee. Broadleaf herbicides can manage the weed.

6. ***Xanthium strumarium*** **L. (Family Asteraceae, English name- Cocklebur)** Annual, erect and highly branched, coarse herb. Leaves cordate, lobed and toothed. The species is seed propagated. Occurs profusely in wastelands, roadsides, and in crop fields. Broadleaf herbicides can manage the weed.

7. ***Eichhornia crassipes*** **Mart Solmns. (Family Pontederiaceae, English name- Water hyacinth** A floating fresh water aquatic weeds. Perennial or occasionally annual. Used locally as fodder, manure, a source of methane and alcohol, for purifying water and cultivated for decoration. The weed can be managed by releasing beetle *Neochatina bruchi* or more reliably by using herbicides like 2, 4-D.

8. ***Pistia stratiotes*** **L. (Family Araceae, English name- Water lettuce)**A floating aquatic weed. Plant stoloniferous, free-floating, rosettes with numerous roots. Perennial or annual. Widespread in tanks, lagoons and rice fields. Usually occurs in fresh water, but may be found in brackish or even salt water. Used as a medicinal plant as antiseptic, antidysenteric, insecticide and cure for asthma. Used also as feed for duck and pigs.

9. ***Spirodela polyrhiza*** **L. Schleid. (Family Lemnaceae)** A floating aquatic weed. Plants perennial. Usually found in eutrophic condition, mostly in lakes and large tanks. Plant consists of ovate to orbicular fronds 1-1.5 time as long as wide, 1.5-10 mm long, 1.5-8mm wide usually rounded at the tip but sometimes pointed. Roots

7-21, rarely more. Plants often cover entire surface of water. Aquatic herbicide may manage the weed.

10. ***Lemna minor* L. (Family Lemmaceae, English name- Duck weed)**. A floating aquatic weed. Occurs in a wide range of aquatic habitats. Fronds floating, flattened, not more than 1 mm thick, 1-8mm long, 0.6-5 mm wide 1.3-2 times as long as wide. Plants often cover entire surface of water. Aquatic herbicides may manage the weed.

11. ***Hydrilla verticillata* L. f. Royle (Family Hydrocharitaceae)** Perennial or annual submerged aquatic weed. Predominant in still or slowly moving water. Often very abundant and dominant over large areas. Stem elongate, branched regularly but at distant intervals, horizontal and stoloniferous below, and spreading above. Roots branched. Readily eaten by grass carp, thus biological control feasible. Management through chemical control with aquatic herbicides is effective.

12. ***Ceratophyllum demersum* L. (Family Ceratophyllacea)** Perennial or annual submerged aquatic weed. Widespread in eutrophic water. Shoot tips often with shortened internode giving it a bottle brush appearance. Leaves usually bright green or love green, robust, rigid, brittle, feeling hard in hand, the majority I or 2 times forked. Readily eaten by grass carp, thus biological control feasible. Management through chemical control with aquatic herbicides is effective.

13. ***Najas graminea* R. D. (Family Najadaceae)** Perennial or annual submerged aquatic weed. Often dominant in standing fresh or brackish water. Plants slender or robust appearing feather-like above because of closely packed leaves. Readily eaten by grass carp, thus biological control feasible. Management through chemical control with aquatic herbicides is effective. The plants are used as a feed for ducks.

14. ***Chara* sp. (Family Characeae, English name- Musk grass)** A submerged aquatic algal weed growing attached by rhizoid to muddy or sandy bottom of small pools, lakes and slowly flowing streams. The plant body is slender and flexuous, Individual plants attaining lengths of 20-30cm or more. Plant appears like horsetail. The weed can be controlled by algicides.

15. ***Azolla pinnata* L. (Family Azolaceae)** A free floating annual fern symbiotically hosting the nitrogen-fixing algae Anabaena azollae in its frond cavities. Often used as a source of nitrogen for rice. The species forms thick mat quickly on open water bodies. Plants are 1-2.5 cm in diameter, with triangular or polygonal shape. The species is predominant in lakes, marshes, ponds, paddy fields, ditches and rivers. The weed can be managed by using aquatic herbicides.

16. Crop weeds

a. Rainy season/Kharif

1. ***Echinochloa crusgalli* Breav. Family Poaceae, English name-barnyard grass)** Annual seed propagated and vegetatively propagated, a major grass weed in rice and other crops during rainy season. Plants ranges from 30-120 cm with thick, coarse, mostly erect, smooth and branching at the base. The plant has sessile leaf blades attached to smooth sheath, which enriches the stem in the absence of ligules. Leaves are rolled in flattened but-shoot. Sheath is pale green, flattened, keeled and split, with bay line margins. Leaf blades about 10-30cm long and 5-20

cm wide. Pre-emergence herbicides like alachlor, chloramben, atrazine, simazine, diuron, linuron, metalachlor, bethiocarb, etc. are effective against this weed.

2. ***Trianthema mongyna*** **L. (Family Aizoaceae, English name (carpet grass, and Hindi name-Patharchata)** Occurs in wastelands, roadsides, lawns, gardens, upland cultivated crops including in paddy fields. Plant extracts has analgesic, antibacterial and anti-inflammatory effects and is used to treat fever, inflammatory diseases, respiratory infections and pain. The weed can be managed using pre- and post- emergence herbicide, pendimethalin and atrazine, respectively.

3. ***Cyperus rotundus*** **(Family Cyperaceae, English name-nutgrasss)** Persistent perennial sedge, occurs almost in all crops all over the world. Aromatic sedge with glabrous culms and underground rhizomes. Culms 16-32 cm high, 3 angled at the top, holding 3 leaves, umbels compound, dark purple colored. Propagation through seeds and tubers. Herbicides like atrazine, perfluidone and glyphosate are effective in its management.

- **Winter season/Rabi**

1. ***Phalaris minor*** **Retz. (Family Poaceae, English name-Small canary grass, Hindi name-genhusa)** Annual seed propagated species, one of the most predominant trouble some weeds. Plant is morphologically similar to wheat. Plant is tufted erect grass, stem 25-75 cm in height, leaves 25-40 cm long, glabrous, panicle oblong, and seeds lens shaped. The species is fed to cattle. The species can be managed by post emergence application of methabenzthiazuron, metoxuron and isoproturon. Pre-emergence application of methabenzthiazuron, pendemethalin and terbutryn are also effective.

2. ***Chenopodium album*** **L. (Family Chenopodiaceae, English name lambsquarter, Hindi-bathua)** An annual, erect, herbaceous, seed propagated weed attaining 1-1.5 m height. Most widely distributed broad leaf weed. Leaves are irregularly lobed, pointed, and somewhat silvery below. Flowers in clusters in branched spikes, minute, dull white, seeds minute. Tender plants and leaves are used as vegetable. Plants are often used as feed. The weed can be managed by 2,4-D and parquet applied on foliage and by soil applied herbicides like triazines and ureas.

3. ***Vicia sativa*** **L. (Family Fabaceae, English name –common vetch, Hindi name-akra)** Annual, seed propagated, trailing herb, leaflets 8-12, flowers violet. Propagation by seeds. Broadleaf herbicides like 2,4-D can manage it.

4. ***Chicorium intybus*** **L. (Family Brassicaceae)** Annual seed propagated herb appearing as a serious weed in winter crops. Broadleaf herbicides can manage it.

5. ***Anagallis arvensis*** **L. (Family Primulaceae, English name-blur pimpernel, Hindi name-jonkmari)** An annual, erect, seed propagated, procumbent, ascending or erect, glabrous herb. Stem quadrangular, weak, gland dotted. Leaves opposite, sessile, broadly ovate, entire, Flowers blue and solitary in leaf axis. Capsules small and globose. The weed is sensitive to foliage applied herbicides such as 2,4-D,

diclofop, bentazon, etc. as well as soil applied herbicides like triazines, ureas and sulfonyl ureas.

6. ***Alternanthera sessilis* (L.) DC. (Family Amarnathaceae)** A creeping perennial or annual herb, stem weakly erect or lower stems prostrate with adventitious roots at nodes. Primarily a weed of rice. Broadleaf herbicides can manage it.

7. ***Cynodon dactylon* (L.) Pers. (Family Poaceae, English name-bermuda grass, stargrass, Hindi name-doob)** Perennial, creeping grass, rooting at nodes with short erect branches, spikes digitately clustered. Used as pasture and lawn grass. It is susceptible to shade and competition. It propagates vegetatively by rhizomes and root slips, more than by seeds. Post emergence application of glyphosate is effective in its management. Pre-emergence application of diuron, pre-or post-emergence application of bromacil, and post emergence application of fluazifop-P, clethodim, sulfometuron plus 2,4-D amine are effective in its management.

CHAPTER—5

Major Actors and Their Roles in Biodiversity Conservation

While considering the major actors and their role in biodiversity conservation in the State, following broad categories can be recognized:

5.1. Governmental Sector

5.1.1. Department of Forest (Uttar Pradesh Forest Department – UPFD) constitutes the most important sector, which is largely responsible for maintenance of existing wild biodiversity of the State. Total forest area of U.P. is about 7.05% of its total geographical area. The forest area under the control of Forest Department is 40,830km^2 (Table 5.1). The Department has, however, played a mixed role. Department has however, played mixed role by involving in forestation, extension and other activities.

Table 5.1. Details of forest area under Forest Department by legal status (Uttar Pradesh Forest Statistics in brief 1998)

Reserved forest (Km^2)	36,613.11
Protected forest (Km^2)	1,588.03
Unclassified and vested forest (Km^2)	2628.95
Total (Km^2)	**40,830.09**

Table 5.2. Forest areas by ownership in Uttar Pradesh

Ownership	**Area (km^2)**	**% w.r.t. total**
ForestDepartment	40,830.09	79.3
Civil	5,184.54	10.0
Soyam	1,859.28	3.6
Panchayat	3,337.81	6.5
Municipality, Cantonment, private and others	291.13	0.6
Total	**51,502.85**	**100.00**

5.1.2. Wildlife Wing: This is an important wing of Forest Department which plays an important role in protecting the wild fauna in the State by establishing Zoos, Sanctuaries, Deer Parks, etc. Major success has been achieved in breeding programmes. Reptile Breeding Centre at Kukrail Forest in Lucknow is on of the notable examples.

5.1.3. Department of Agriculture: Considering the major role of agriculture sector in the State, this is also the most important Department. However, while the Department has achieved a goal of improving grain production through diversification of agriculture, the department has played rather passive or indeed negative role on the issue of agriculture biodiversity. Maintenance of indigenous crop varieties has not been taken care off, which is leading to the loss of traditional land races. Also, diversification of agriculture has not been a success story in the State.

Department of Animal Husbandry; Department of Fisheries; Department of Horticulture; Department of Industry; Department of Science and Technology; Department of Environment; Botanical Survey of India; and Zoological Survey of India are some other Government Departments in the State.

5.2. Academic Institutions and R & D Bodies

These institutions have contributed significantly towards various R & D issues of the State biodiversity. Notable among these are: Agra University; Aligarh Muslim University; Allahabad Agricultural Institute; Allahabad University; Banaras Hindu University; Birbal Sahni Institute of Palaeobotany; Birla Institute of Scientific Research; Central Building Research Institute; Central Drug Research Institute; Central Institute for Research on Goals; Central Institute of Medicinal & Aromatic Plants; Central Jalma Institute for Leprosy; Central Water Commission; Center for Indian Middle Atmosphere Programme; Ch. Charan Singh University; Chandra Shekhar Azad University of Agriculture & Technology; Dayalbagh Educational Institute; Directorate of Pulses Research; Forest Research Institute; Geological Survey of India, Lucknow, Gorakhpur University; Government Central Textile Institute; Indian Grassland & Fodder Research Institute; Indian Institute of Sugarcane Research; Indian Veterinary Research Institute; Industrial Toxicology Research Center; Institute of Engineering & Technology; Institute of Paper Technology; J.K. Institute of Applied Physics & Technology; Kamala Nehru Institute of Physics & Social Sciences; Lucknow University; Motilal Nehru Medical College; Narendra Deva University of Agriculture & Technology; National Botanical Research Institute; National Bureau of Fish Genetic Resources; National Cooperative Development Corporation; National Institute of Hydrology; National Research Center for Agroforestry; National Research Laboratory For Conversation of Cultural Property; National Thermal Power Corporation Limited (R&D) Center; Non-Conventional Energy Development Agency; Oil & Natural Gas Commission; R.B.S. College of Agriculture; Remote Sensing Application Center; Rohilkhand University; Sanjay Gandhi P.G. Institute of Medical Sciences; Shri Shahuji Mahraj Kanpur University; Sugarcane Research Station; U.P. Council of Science & Technology; U.P. Irrigation Research Institute; U.P. State Observatory; U.P. Council of Science & Technology; Viklang Kendra Rural Research Society; and Wildlife Institute of India.

5.3. Citizen's Groups and NGOs

These are one among major actors in biodiversity related field. Based on the extent of coverage, they can be divided into two groups.

(a) **International:** UNICEF, UNESCO, IUCN, , WWF International, Oxfam, Action Aid, etc.

(b) **National:** At present more than 70 NGOs are working in different places of U.P. Various citizens groups and NGO, in U. P. with their work areas are listed below:

Akhil Bhartiya Ekta Parishad, Lucknow	Rural areas of Sitapur, Basti, Rai Bareli, Sultanpur, Faizabad, Lucknow and Meerut districts
Akhil Bhartiya Gramin Vikas Sansthan, Aligarh	Sokhana village of Aligarh district
Aliganj Mahila Bal Kalyan Samiti, Lucknow	National
Academy of Environmental Science (AES), Meerut	Meerut, Farrukhabad and Kanpur Districts of Uttar Pradesh
Action for Food Production (Afro-Aligarh Project), Aligarh	Balrampur, Gonda, Sravasti and Bahraich Districts
Bharat Sarvodaya Samaj,	Shahjahanpur, Farrukhabad, Manipuri, Etawah, Etah,

Lucknow	Faizabad and Agra Districts
Bhartiya Mahila Vikas Sansthan, Moradabad	Hasanpur Tehsil of Moradabad District; Chandpur; Tehsil of Bijnor District
Arthik Anusandhan Kendra, Allahabad	Allahabad and Mirzapur Districts
Awoke Sansthan, Ghazipur	Bhanverkole Blocks of Ghazipur District
Baba Shri Nath Shiksha Sansththan, Sultanpur	14 districts of Uttar Pradesh, Sultanpur District
Ballia Environmental Society (BES), Ballia	Ballia District
Balrampur Environmental Action Group (BEAG), Balrampur	Balrampur
Center for Rural Education and Development Action (CREDA)-Mirzapur	Mirzapur and Allahabad Districts
Deokalia Jan Kalyan Samiti, Barabanki	Bahraich, Barabanki, Faizabad, Sitapur and Lucknow Districts
Dr. Salim Ali Memorial Nature Club (SAMNC), Hamirpur	Uttar Pradesh
Gonda Environment Population and Wildlife Awareness Association (GEPWAA), Gonda	Gonda District
Gram Kalyan Samiti, Barabanki	Eastern Uttar Pradesh
Gramin Lok Vikas Sansthan, Domariaganj Basti	200 villages of Domariaganj, Radauli and Mithwal Block of Basti District
Gramin Sewa Sansthan, Aligarh	Villages of Aligarh District
Gramin Vikas Samiti Bhinga, Bahraich	Bahraich District
Gramya Vikas Sansthan-Lucknow	Lucknow Districts
Harit Kranti Seva Sansthan, Bijnore	Bijnore District
Indian Institute for Development Studies and Research, Allahabad	Uttar Pradesh
Indian Society of Environment, Kanpur	Kanpur city and surroundings
International Environment Protection and Development Center, Rae Bareli	Rae Bareli district
International Society for Environmental Protection, Gorakhpur	Khorabar Block, Gorakhpur
International Society for Tropical Ecology (ISTE), Varanasi	Uttar Pradesh, National

Jan Kalayan Parisad, Gorakhpur	Kotha Village in Kaunram Block of Gorakhpur District
Janpad Vikas Evam Samaj Kalyan Samiti, Mau	Mau district
Jeevan Dhara Marg Darsak Society, Deoria	Deoria District
Kailash Chandra Seva Ashram, Allahabad	Thulama village, Allahabad District
Kendriya Nehru Smarak Parishad, Lucknow	Barabanki, Hardoi, Unnao, Kanpur, Lucknow, Sitapur and Gonda Districts
Kendriya Vikas Vigyan Parishad- Lucknow	Lakhimpur, Kheri, Bareilly, Saharanpur, Aligarh and Bulandshahar Districts
Kisan Ashram, Agra	Barauli Ahir and Shamshabad Blocks of Agra District
Kisan Bharat Seva Sansthan, Agra	Chadauli
National Environmental Conservation Association-Varanasi	National
National Forum for Environmental Studies and Conservation (NESCO), Allahabad	Allahabad city and adjoining rural areas
Nav Jeevan Seva Sansthan, Sultanpur	Uttar Pradesh
Navodaya Vikas Sansthan, Ghaziabad	Ghaziabad District
Neeraj Gramodyog Sansthan, Aligarh	Chandaus block, Aligarh district
Nehru Seva Ashram, Shahjanpur	Kant and Dadrol development blocks
Nehru Yuva Kendra Sangathan, Agra Road Etah	Etah, Agra
Nehru Yuva Kendra Sangathan, Meerut	Meerut
Labour Organization of Rural Poor, Ghazipur	Ghazipur, Azamgarh, Ballia, Jaunpur and Varanasi Districts
Mahila Evam Bal Vikas Sansthan, Bijnore	Bijnore district
Mahila Udyammita Vikas Kalyan Evam Shiksha Sansthan, Rae Bareli	Rae Bareli, Lucknow, Pratapgarh; Barabanki, Bahraich, Faizabad, Sultanpur, Unnao, Fatehpur, Farrukhabad, Allahabad, Kanpur and Varanasi
Manav Kalyan Pratishthan, Fatehpur	Uttar Pradesh
Myana Gramodyog Sewa Sansthan, Bulandshahar	Jewar and Arnia Blocks, Khurja Tehsil Bulandshahar District
Pipalsana Gramoudyog Vikas Samiti Pipalsana, Moradabad	Pipalsana Village, Moradabad District
Rajeev Gandhi Institute of Waste-Lands and Rural Development, Sultanpur	Sultanpur, Raebareli, Barabanki, Faizabad, Varanasi, Lucknow
Randhol Vriksharopan Samiti, Muzaffarnagar	Muzaffarnagar District

Saghan Kshetra Vikas Samiti, Varanasi	Uttar Pradesh
Gorakh Environmental Action Group	Gorakhpur
Sarva Deshik Seva Samaj, Lucknow	Ghazipur District
Shanti Ashram, Lucknow	Saharanpur, Bulandshahar, Aligarh, Lucknow and Sitapur
Sharda Environmental Conservation Center, Jaunpur	Eastern Uttar Pradesh
Shohratgarh Environmental Society, Siddarthnagar	Siddarthnagar district in the Terai region
Shri Bankey Bihari Sanskrit Sansthan, Mathura	Mathura, Aligarh, Agra and Bharatpur
Smt. Bhu Devi Mahila Evam Vikas Evam Shikshsan Sansthan, Agra	Shamshabad block of Fatehabad Tehsil, Agra District
Society for Conservation of Nature and Scientific Development, Lucknow	Uttar Pradesh
Society for Environmental Pollution Control, Lucknow	Lucknow city
Society of Professionals for Rural Enrichment Environment and Technology, Ghaziabad	National
Swachchha Ganga Mahila Samiti, Varanasi	Kanpur, Allahabad, Varanasi, and Ghazipur
Swargiya Dr. Sher Singh Verma Seva Sadan, Sadarpur, Hardoi	Hardoi district
The Academy of Environmental Biology, Lucknow	National
Urmila Gramodyog Sewa Samiti, Gonda	Tulsipur Tehsil, Gonda District
Uttar Pradesh Vigyan Lekhak Avam Samvaddata Samiti-Lucknow	Lucknow, Barabanki, Agra, Meerut, Gonda, Gorakhpur, Lakhimpur and Unnao districts, Uttar Pradesh
Academy of Environmental Sciences, Meerut	Meerut, Farrukhabad and Kanpur districts

5.4. Others: Among others local community groups (for example**:** Nehru Yuvak Kendra, Mahila Mangal Dal, Mahila Vikas Samiti, etc.), various industrial and corporate sectors are main actors which play significant role in maintaining the biodiversity of the State. The traditional role of communities in conservation of forests, wetlands, species and ecosystems, agrobiodiversity, biodiversity based enterprises, etc. is most important in the State. These activities need to be properly assessed and reviewed.

CHAPTER—6

ON GOING BIODIVERSITY RELATED INITIATIVES

Most of the initiatives taken by various departments/institutions have already been included in different chapters. Here we intend to focus on the initiatives on Policy and Legal measures of biodiversity in the State; ex situ & in situ conservation measures and initiatives by R&D institutions and NGOs.

6.1 Policy and legal measures

Legal aspects of biodiversity conservation in Uttar Pradesh are detailed in the report **Biodiversity Conservation: Legal Aspects:** prepared by Pia Sethi (Tata Energy Research Institute, New Delhi). Main features of the document are summarized as follows (*full document available on request*)

6.1.1 Background

This report seeks to evaluate the legal regime that affects biodiversity management especially in the State of (undivided) Uttar Pradesh. This sets the premise to evaluate the state specific laws on bio-diversity. It is important to note that there still does not exist a law on biodiversity at the national or state level. Thus the report delves into the various components of biodiversity and its related legislation. Lastly, this appraisal of legal aspects of biodiversity in such a manner forms an integral part of the larger study that is being conducted under the Biodiversity Planner Project in the state of Uttar Pradesh under the aegis of the World Bank.

6.1.2. Introduction

Besides India's international obligation to preserve biological diversity, there is a need to regulate and check the uncontrolled exploitation of the rich resources with which the country is blessed, while at the same time not losing sight of the demands of the growing population and those of equity as mandated by our Constitution. The concern over the rapid erosion of biological diversity necessitates the study of the causative factors that impact the biodiversity. As an essential pre-condition of this exercise, it is important to examine whether there is a need to reform the legal framework in the areas of in-situ protection, ex-situ protection, exchange of genetic material, biotechnology, identification and monitoring of species in India. This requires a critical evaluation into how the biological resource is managed looking at the legal framework that regulates the use, conservation and regeneration of bio-diversity. And this would surely incorporate a detailed analysis of the national laws and policies including the International Conventions to which India is a party.

6.1.3 Legal Framework on Biodiversity

The legal framework may be developed from three different perspectives of national, state and international laws. With the broad understanding that these laws would have implications on each other, let us now look at the three different focus areas of our study i.e. National Laws, State Laws and International Covenants on biodiversity.

6.1.3 (a) National laws

The national laws on biodiversity may be broadly categorized into three heads:

- Laws on protection of biodiversity

- Laws on use of biological resources
- Laws on enhancement of bio diversity

(I) Laws on protection of biodiversity.

The laws that protect biodiversity may include within its fold both in-situ and ex-situ conservation. Ex-situ conservation has not yet been covered under the legal regime directly. The primary legislation that enables in-situ conservation is the Wildlife Protection Act, 1972.

- ***Wildlife Protection Act, 1972***

Before understanding the mandate of the WLPA for in-situ conservation it is important to understand how historically wildlife conservation has been viewed. The earliest codified law on wildlife protection traces back to the third century B.C when King Ashoka made a law in the matter of preservation of wild life and environment where he prohibited the killing of certain species of animals such as parrot, ruddy, geese, rhinoceros etc. Subsequent to this, there were sporadic efforts for wild life preservation such as `Elephant Preservation Act, 1873', the Wild Birds Protection Act, 1887. It was for the first time that the `Wild Birds and Animals Protection Act, 1912' prohibited the killing of wild animals and birds and the disobedience of this mandate entailed penal offence. The efforts prior to 1972 clearly establish that the focus on conservation of biodiversity was limited to species. It is for the first time that a network of protected areas was established under the Wildlife Protection Act, 1972. (WLPA)

- ***Forest Conservation Act, 1980***

The Forest Conservation Act of 1980 (FCA) represents the other significant attempt by the Central Government to slow deforestation caused by the conversion of forestlands to non-forest purposes (Table 6.1). Under this Act, no State Government can authorise such conversion without securing Central Government's approval. It is pertinent to mention that FCA as modified up to 1988 does not itself ban any non-forest activity or the de-reservation of forestland. This is further highlighted in the next Section on JFM in laws relating to 'Enhancement of Biodiversity'.

Table– 6.1: Essential provisions under FCA and WLPA

Name of the Act	Objective	Essential Provisions	Applicability	Remarks
Forest Conservation Act, 1980	To check further deforestation and conserve forests	-Restricts use of forest for non-forest purpose -Restricts de-reservation of reserve forests - Regulates diversion of forestland by way of lease to private industries and individuals. - Restricts clear felling of trees - Constitution of Advisory Committee for grant of approval for any of the activities above.	Whole of India except the State of Jammu and Kashmir	The State of Jammu and Kashmir has its own Forest Conservation Act, 1990 on the lines of the FCA 80

Wildlife Protection Act, 1972	To protect wild animals, birds and plants including their habitat	-To form a uniform legislation for the protection of wildlife. -to regulate and control trade in wildlife and products thereof. - To establish a network of protected areas in the form of national parks and sanctuaries. - Right of private citizen to prosecute a wildlife offender	Whole of India except the State of Jammu and Kashmir	The State of Jammu and Kashmir has its own Wildlife Act, 1987 on the lines of the unamended Wildlife Act of 1972.

- ***The Biological Diversity Bill 2000***

Apart from the above it is pertinent to note that the Biodiversity Bill, 2000 is still to come into force. This will further have implication on the biodiversity conservation. Essential provisions of the proposed Bill are included in Table 6. 2.

Table 6. 2: Essential provisions of the Biological Diversity Bill 2000

Name of the Act	**Objective**	Essential Provisions	**Applicability**	**Remarks**
The Biological Diversity Bill 2000	Conservation of Biological Diversity, sustainable use of its components and equitable sharing of the benefits of biological resources	-Provides for establishment of National Biodiversity Authority. - Makes use and regulation of biological diversity subject to the approval of National Biodiversity Authority. - Provides for establishment of State Biodiversity Board - Requires the Central Government to develop National Strategies, plans, programmes for the objectives of the Act. - Requires the Central Govt. to notify threatened species and the State Govt. to notify biodiversity heritage sites.	The proposed Act extends to the whole of India.	The present Bill awaits the approval of the Parliament for coming into force as the Biological Diversity Act 2000.

		- Mandates every local body to constitute Biodiversity Management Committee. - Provides for establishment of Local Biodiversity Funds.		

- ***Biosphere Reserves***

Another significant attempt to widen the scope of conservation strategies is the creation of Biosphere Reserves (BRs) under the aegis of UNESCO. At present there are seven BRs including Nanda Devi in Uttar Pradesh, although none of them is officially registered with UNESCO.

(ii) Laws on use of biological resources

- ***Indian Forest Act, 1927:***

The Indian Forest Act of 1927 (IFA) and its progeny in the various states provide the overarching framework for forest management in India. For the basic objectives, its extension and main provisions see Table 6.3.

Table 6.3: Essential Provisions of IFA

Name of the Act	Objective	Essential Provisions	Applicability	Remarks
Indian Forest Act, 1927	To consolidate laws relating to forests, transit of forest produce and duty leviable on timber and forest produce	- Establishes three classes of forests namely Reserve Forest, Protected Forest and Village Forest - Has elaborate procedure for constituting the above categories with a detailed process of settlement of rights through the FSO - Ch.V deals with control over forests not being the property of the Government - Chapter VI deals with duty on timber and other forest produce - Ch. VII deals with timber and forest produce in transit. - The object of Ch. VIII is to regulate the rights of the owners in drift and stranded timber.	In the states as follows: Ajmer-Merwara (Now merged with Rajasthan), Berar (Partially), Bombay, Delhi, Dadra and Nagar Haveli, Goa, Daman and Diu, Orissa, Gujarat, Madhya Pradesh, Manipur, Tripura and Vindhya Pradesh (Vindhya Pradesh is now a part of Madhya Pradesh), Minicoy, Laccadive and Admindivi Islands, New Provinces and Merged States, Pondicherry, Punjab, Haryana and Chandigarh	Several States have its own Forest Act such as Andhra Pradesh, Karnataka etc. Others have adapted the IFA. However the basic principle remains that the spirit of the National law reflects in them.

		- The power to reserve specific tree species in protected forests	Himachal Pradesh,	

- ***Working Plans and Micro-Plans***

The management of forests is primarily guided by Working Plans. For this purpose one-year time was granted to the various States for preparation of Working Plans. This becomes pertinent in case of JFM areas too where any felling for accruing benefits to the communities necessarily has to be in accordance with the Working Plans.

(iii) Laws on enhancement of bio diversity

Although there are no statutes that may be directly said to be enacted for the purpose of enhancement of forests the attempts at Social Forestry and presently popular Joint Forest Management Circular may be attributed to this class of quasi-laws, which helps in regenerating and enhancing forests under administrative fiat.

- ***Joint Forest Management***

Table 6.4: Main Elements of Circular on JFM

Main elements of Circular on JFM*:*

- JFM should be implemented under an "arrangement" between the village community (i. e. the beneficiaries), NGO's and the State Forest Departments. The selected area should be managed in accordance with a working scheme "prepared in consultation with the beneficiaries." The working scheme is to cover such matters as steps for inducements of natural regeneration, seeding, soil conservation methods, fire protection, maintenance of boundaries, weeding, tending, thinning etc.
- Beneficiaries should essentially be village communities and not commercial or other interests. They may be entitled to usufructs like grasses, lops of branches, and other minor forest produce, as prescribed by the State. Subject to successful protection the user group is also entitled to a portion of the proceeds from the sale of mature trees. They may also plant fruit trees to fit into the over all scheme of afforestation and grow indigenous medicinal plants as per the requirements of the beneficiaries.
- Access and usufruct rights are limited to people who organise they as groups such as co-operatives or village forest committee and in no case shall access or tree pattas (leases) be given to individuals.

- Neither the beneficiaries nor any NGO may acquire ownership or lease rights over the land in question. No grazing or agriculture is allowed on the selected area.
- The selected site should be free from any existing claims or rights, privileges, or concessions. Thus a site burdened with existing claims is not favourable for JFM. In the alternative, for a given site any one who has a claim to forest produce should be given the opportunity to join the beneficiary group.
- The work of the beneficiaries is to be closely supervised by the forest department. If the work has been done in an unsatisfactory manner "the usufractory benefits should be withdrawn without paying compensation to any one for any work that might have been done prior to it."

- ***Panchayat Act and the 73rd Amendment***

The potential impacts of other legislations relating to Panchayat, tribal welfare, become extremely crucial in case of conservation of biodiversity especially in its role vis-à-vis JFM and wetlands and pasture land management. Legally speaking, the Panchayat obviously stands on a higher footing as it derives its sanctity from the Constitution and thus any law contrary to that is liable to be struck down. The Panchayats are empowered to legislate on matters specified in the Eleventh Schedule. The items that relate to biodiversity include land improvement, soil conservation, watershed development, social forestry, farm forestry, minor forest produce, fuel fodder etc. The Panchayat Act regulates the right to minor forest produce, management of water bodies etc. The JFM agreements need to be looked afresh in this light. Either the JFM agreements or the respective Panchayat Act of the state need to be amended suitably to address this issue. Some of the glaring legal problems that the State has to confront in its endeavor to evolve a more efficient and effective wildlife administration, include:

(i) Procedural Delays
(ii) Lack of trained legal manpower
(iii) Minimal Professional Agencies backup
(iv) No special Courts
(v) Un-represented / minimally represented cases
(vi) Forest and Wild Life Cases receives least priority
(vii) Confiscation and Seizures: Escaping Liabilities
(viii) Demarcation of forest areas
(ix) Regulation of trade in Medicinal Plants

The rapid depletion of medicinal plants is another major concern for the biodiversity planners. It is important to bear in mind that there is no Central Legislation that directly deals with medicinal plants. However, an examination of the national legislation on forest and wildlife for their implications on regulation of medicinal plants is useful. The WLPA as enacted in 1972 did not contain any provision on specified plants. But the 1991 amendment to the WLPA enlarged the title of the Act as well as the definition of "wildlife" to include plants and land vegetation that forms part of the habitat.

In the entire process beginning from cultivation of medicinal plants to their ultimate sale in domestic and international markets a number of problems can be seen and, briefly, these include:

- Non-availability of sufficient data/studies on the various types of plants their location, their nature and use.

- Ad-hoc process of their collection compounded by a very unorganized market.
- The all pervasive middlemen and traders and, by them, continuous exploitation of the collectors of these plants.
- The increasing trend of involving people with no experience/knowledge of the forest produce including the medicinal plants.
- The certificates of cultivation and NOCs being 'managed' at the local level through unscrupulous means.
- Inadequate provisions relating to the medicinal plants under the Wildlife Protection Act, falling short of the spirit and mandate of the CITES. (See above).
- The botanical names of medicinal plants and other NTFPs are not mentioned under several Acts and rules leading to confusion about the identity of the plants. Apart from administrative lapses, this directly contributes to problems like plants of higher economic value being transported in the name of other species with lesser commercial value.
- Insufficient policing and monitoring by the FDs resulting in very few seizures.
- Difficulties and delays in procurement of Government permits encourage 'smoother' illegal extraction.

6.1.4 Other National Laws that affect biodiversity.

(a) Constitution of India 1950

India has taken a bold step of including environmental protection and rights in its national constitution. Under the Directive Principle of State Policy, Article 48-A of the Constitution, enjoins that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country, and Article 51-A (g) which proclaims it to be the fundamental duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures.

(*b) The Environment Protection Act, 1986*

The Environment Protection Act, 1986 was the response to a widely felt need for a general legislation for environment protection. Under the Act, the Central Government is vested with power to take all such measures, as it deems necessary or expedient for the purpose of protecting and improving the quality of environment and preventing, controlling and abating environmental pollution.

Although the above features do find mention partially[2] in the laws relating to PAs under the WLPA these are yet to find mention in areas that are rich in biodiversity and are outside the protected areas network.

6.1.5 State Legal framework on biodiversity for Uttar Pradesh

The state laws may be studied under three broad categories.

6.1.5(a) Laws relating to biodiversity and its use
6.1.5(b) Laws relating to protection of biodiversity
6.1.5(c) Laws relating to people and biodiversity

6.1.5 (a) Laws relating to biodiversity and its use

There are numerous laws that primarily seek to use biodiversity (mainly forests) rather than conserve it. The Indian Forest Act as applicable to Uttar Pradesh and the rules made thereunder is the most significant statute that governs the use and management of forests in U.P.

[2] Category II, IV and IX relating to national parks, sanctuaries and biosphere reserves are such examples.

- ***Indian Forest Act, 1927 (as applicable to Uttar Pradesh)***

Under this Act the state government has been empowered to reserve forest which may constitute any forest land or waste land but excludes the land being comprised in any holding or in any village abadi. Further, the state government also has the power to declare reserve forest over the forest produce on which the government has proprietary rights. The procedure by which the reserve forest is constituted is similar to that under the Central Act. However there are minor variations in the amended state Act, which include the provision for appeal from the order passed by the Forest Settlement Officer. Further, certain forest land or waste land which were earlier recognized as reserve forest or dealt with as reserve forest in any working plan or declared by ruler of such states that were merged, are deemed to be reserve forest. The formation of village forest under the amended Act not only may be constituted out of reserve forest but also out of protected forest or any forest, which belongs to government forest. It is pertinent to mention that the scope of forming the village forests has been broadened under this section (section 28) by including all the categories of forests under the said Act.

A unique feature in the amended forest Act of U.P. is the control of certain forest by the "claimants". A 'claimant'[3] to any land is a person who has entitlement to land or any interest therein executed by lease or license prior to the commencement of the U.P. Zamindari Abolition and Land Reforms Act, 1950 any provision of any enactment, including the said Act. Interestingly, Chapter V-A also defines "forest" and "forest lands" [4]. This is unique to the amended Forest Act of U.P. The definition of forest includes plantation and may further include pastureland as well as cultivable or non-cultivable land. The definition of forestland is rather broad and includes land intended to be utilized as forest. What is perhaps unique is the fact that there is an attempt to define forest and forestland. It is however unclear whether these definitions are restricted to the Chapter alone or may be construed for the whole Act. Normally, a definition within a chapter is restricted to that chapter unless otherwise stated. Further, the state government has the power to regulate or prohibit breaking or clearing land for cultivation or any other purpose in the claimant(s) land. The state government also has the power to take over the management of any particular forestland in the name of public interest (section 38-H) and also subsequently release the forest or forestland from its management (section 38-L). Another unique feature of this Act is the summary eviction of persons from any land in respect of which the offence has been committed.

Section –3 of the Indian Forest Act in its application in the State of Uttar Pradesh provides that the state government may constitute any forest land and waste land *or any other lands excluding the land comprised in any holding or grove or in any village abadi* and over which government has proprietary rights, as 'reserved forest' in the state.[5] Section 5 of the Indian Forest

---

[3] Chapter V – A, Indian Forest Act as applicable to Uttar Pradesh.

[4]Section 38-A (b) 'Forest' means a tract of land covered with trees, shrubs, bushes or woody vegetation whether of natural growth or planted by human agency, and existing or such a tract of land on which without human effort, or such tract of land on which such growth is likely to have an effect on the supply of timber, fuel, forest produce, or grazing facilities, or on climate, steam-flow, protection of land from erosion, or other such matters, and shall include-

(i) land covered with stumps of trees of a forest;
(ii) land which is part of a forest or lies within it or was part of a forest or was lying within a forest on the first day of July, 1952;
(iii) such pasture land, water-logged or cultivable or non-cultivable land, lying within, or adjacent to, a forest, as may be declared to be a forest by the State Government.]

38-A (c) 'Forest land' means a land covered by a forest or intended to be utilized as a forest.

[5] The expression 'holding' has the same meaning as under the U.P. Tendency Act, 1939 and the expression 'Village Abadi' has the same meaning as assigned under the U.P. Village Abadi Act, 1947.

Act as amended by the state of U.P. prohibits (i) acquisition of any right, (ii) fresh clearing for cultivation or any other purpose, (iii) felling, girdling, burning, etc. of trees and (iv) removing any forest and trees, in or over the land comprised in the notification issued under Section 4 except in accordance with such rules as may be made by the State Government. Thus, it has been held by the Allahabad High Court that the Gaon Sabha cannot permit a person to cut and remove trees from the plots in question unless a rule is made by the State Government authorizing the Gram Sabha to do so[6].

It is significant to note here that the control of reserve forestland, civil and soyam land, and Van Panchayat land is vested with the U.P. Forest Department, Revenue Department and Van Panchayats respectively. There is a need to streamline different regulations and approaches to forest management under various categories of land vested with different authorities. A fundamental pre-requisite of a proper land use policy is the classification of land into different categories based on the use to which such land can be put and the specific socio-economic priorities of the State. The vesting of the various categories of land, as mentioned above, has to be accordingly done with the said well-defined and specific objectives of land use within the State. It is only pursuant to such a policy perspective, that laws concerning irrigation, mining, agriculture, industries and urban zoning have to strictly restrict the various activities to specified land areas [7]. A nexus between inefficient land use and forest management can be seen in the over-use, and abuse of the provision that enables the State Government to denotify reserve forests and protected areas under the Indian Forest Act and the Wildlife Protection Act. The laying down of railway lines and irrigation canal or an ammunition dump within and along the corridor of Rajaji National Park is a mute testimony of this fact. Similarly, persistent violation of the Forest Conservation Act is also ultimately a manifestation of ineffective land use regulations. For example, the illegal mining and limestone quarrying in the ecologically sensitive Doon Valley has primarily been a result of the failure of the Mussorie- Dehradun Development Authority to come up with well thought out land use policy for the region.[8] These experiences are clear pointers to the fact that a comprehensive land use planning and management policy is fundamental to conservation and regeneration of forest areas in the State.

Several rules have been enacted under the above Act. These ranges from rules regarding protected forests, transit of timber and other forest produce, collection and disposal of drift and stranded wood and timber to regulation and establishment of saw mills and grazing rules. The above said rules primarily regulate the use of the forest and focuses on production forestry.

- ***The U.P. Transit of Timber & Other Forest Produce Rules, 1978***

This Rule regulates the transit of timber and other forest produce within the state of U.P. by means of passes. An official of the forest department or any person duly authorized under the above said rules may issue a transit pass (TP) for the movement of forest produce to any rule and in accordance with any conditions that may be imposed. However, any forest produce that is removed for *bonafide* consumption in exercise of a privilege granted by the state or through a right recognized under this Act does not require a transit pass. Similarly no T.P. is required for a contracting agency, which is managed by the forest department as such movement is regulated by the contractual agreement deed between the contractor and forest department. Further, the state government may exempt certain forest produce from the operation of these rules (Rule 3) It is pertinent to mention that the exemption of TP to contractors as well as to such forest produce not covered under the rules have resulted in several illicit timber and forest produce being transported

[6] See Layakat Ali Khan v. State of U.P. 1990 F.L.T. 215 (All.)

[7] See in that context Biodiversity, Wildlife and Protected Area Management in India: A People Centered Approach by Nandan Nelivigi, Journal of the I.L.I., April-June 1995.

[8] This is clearly borne out of the facts of the ongoing case in the Supreme Court titled Supreme Court Monitoring Committee V. Mussorie-Dehradun Development Authority in (1997) Supreme Court Cases 605 and subsequent orders.

[9]. Unclear guidelines and non-uniform transit rules in other state have resulted in immense loss of biodiversity to the state. It is interesting to note that the language of the TP needs to be in Hindi or Urdu. Such mandatory use of language could potentially be a problem in other states where the prescribed language is not spoken or written and this might affect consignments that originate from U.P. It is also provided that the forest produce may only be transported during daylight. (Rule 19). As regards forest produce imported into the State of Uttar Pradesh such import shall be regulated by the rules framed by the Central Government as prescribed in section 41-A of the Indian Forest Act, 1927[10]. Rule 26 clearly prohibits the conversion of timber within the precincts of reserved, protected or unclassed forests under the forest department. It specifically prohibits the establishment of sawpit within sixteen kilometers of the limits of the forest mentioned above. It is also provided that no machinery or plant shall be erected without the previous sanction, in writing, of a forest officer who is not of a lower rank than a Divisional Forest Officer. These rules however, do not apply to ordinary operations of domestic carpentry or other similar work done on a small scale. A similar transit pass is also required for transit or timber and other forest produce by water. (Rule 26). Under Section 45 of The Indian Forest Act, 1927 certain kinds of timber, which includes drift, and standard timber are deemed to be the property of the Government and may be collected in such areas as directed by the State Government.

These rules shall repeal all the other rules that correspond to the above said rules with regard to the provisions there under. This includes *The Rules Regulating the Collection and disposal of drift and stranded wood and Timber, 1963*[11].

The State of Uttar Pradesh has a special provision; under Chapter-VIII-A of the amended Indian Forest Act as applicable in U.P. that regulates the manufacture of preparation of articles based on forest produce. The state government has been empowered to make rules for establishment and regulation by licenses of saw mills and also other units/factories that are engaged in the manufacture or preparation of Katha (from Khair tree), resin, turpentine etc.

- ***The U.P. Establishment & Regulation of Saw Mills Rules, 1978***

Enacted under the above said section 51-A provides that no person would establish or operate any sawmill or machinery for converting or cutting timber and wood without a license from the concerned Divisional Forest Officer (Rule 3). It has been clarified by the Allahabad High Court that these Rules in no way interfere with the freedom of trade or business as contemplated under Article 19(1) of thew Constitution. [12]Details of application, conditions of grant of licenses, the validity, renewal revocation etc. are provided under the above said rules.

- ***U.P. Protected Forest Rules, 1960***

In areas that are declared as protected forest the *U.P. Protected Forest Rules, 1960* is applicable where no person is allowed to cut, saw any tree or forest produce in protected forests. Further, the clearing and breaking of land for cultivation for creating any temporary or permanent structure, cutting of grass pasturing of cattle or burning of any fire near such protected forests is prohibited

---

[9] In respect of resin and resin products, the provisions of the Uttar Pradesh Resin and Other Forest Produce (Regulation of Trade) Act, 1976 and the rules framed thereunder, shall apply.

[10] Section 41-A provides that the Central Government may make rules to prescribe the route by which alone timber or other forest-produce may be imported, exported or moved into or from [2][the territories to which this Act extends] across any customs frontier as defined by the Central Government.

[11] *The Rules Regulating the Collection and disposal of drift and stranded wood and Timber, 1963* specifically prohibits that the collection of wood and timber unless specially authorized in writing by the Forest Officer to whom the control of the river is vested. It is pertinent to mention that for the purposes of timber transit operation and collection of disposal of driftwood the control of rivers is vested with the Divisional Forest Officers.[11]. There are penal provisions for violations of above said rules.

[12] Shri Baleshwar Singh and ors vs State of U.P and ors 1991 All. L.J. 529

unless the Forest Officer permits to do so. Further, there are rules that regulate the regulation and collection of drift and stranded wood.

In exercise of Section 29 of the IFA, the government of U.P. has declared the strips of government forest or wasteland whether under tree growth or not as protected forest. In such protected forest Chapter-IV (provisions relating to PF) and section-68 (power to compound offences would be applicable).

- ***The Rules Regulating the Grazing of Cattle in the Land Management Circle, Uttar Pradesh 1954***

The State of U.P. has also formulated rules regulating the grazing of cattle in the reserved forest of the land management circle and to other forests or lands that Conservator of Forest, Land Management Circle, Uttar Pradesh may direct[13]. Under the said Grazing rules areas that are open to grazing have been earmarked. Further, grazing is prohibited in certain blocks in accordance with the working plans of the said area. The rules also provide for grant of permit for grass cutting and the conditions on felling or lopping of any tree. The concerned DFO is required to publish at his office the area open to grazing in each block, according to the schemes of grazing regulation for the time being in force.

- ***U.P. Panchayati Forest Rules, 1972***

The U.P. Panchayati Forest Rules 1972 has been enacted under section 28 of the IFA and is applicable primarily in the hill areas of U.P[14] including Nainital, Almora, Pithoragarh, Garhwal, Chamoli, Uttar Kashi and Tehri districts and Chakrata tehsil of Dehra Dun district to such other areas as the State Government may from time to time notify. The Panchayati Forest under these rules has the same meaning as assigned to the village forest under the IFA. A Forest Panchayat constituted under the above said rules manages such Panchayati Forest. The State Government may also appoint a special officer to organize and supervise the working of the Panchayati Forest constituted under these rules who in turn is under the control of the Commissioner under whose territorial jurisdiction the Panchayati Forests lie. The Panchayati Forest is constituted after an application is made by at least one third of the adult residents in the village to constitute such Panchayat. The Forest Panchayat so constituted has its own administrative structure and its officials are primarily decided by the Deputy Commissioner. When the Forest Panchayat is duly constituted an agreement in writing is made between such Forest Panchayat and the Deputy Commissioner wherein the management and working of the area under the Panchayati Forest is in accordance with a draft-working plan. In such Panchayati Forest every villager has equal rights (Rule 11). Every Forest Panchayat is required to prevent damage to trees, ensure that no encroachment takes place, to utilize the produce of Panchayati Forest to the best advantage of the village community and to protect the forest from illicit felling. Further, the Forest Panchayat is required to carry out the directions or execute the orders of the Deputy Commissioner regarding maintenance, improvement and exploitation of forest (Rule 18). The Forest Panchayat has been given the power of a Forest Officer and thus it can compound offences, institute and defend suits and also regulate the sale and exploitation of forest produce. However, the latter requires the approval of the DFO and is made for the *bonafide* domestic use of right holders (Rule 19). The Forest Panchayat has also been vested with the power to lease certain amount of land for commercial purposes, regulate grazing and also sell tree to right holders. However, any such sale should not violate the provisions of the working plan (Rule 19). The Forest Department is required to prepare working plans for all Panchayati Forest in consultation with the Forest Panchayat. The working of the Forest Panchayat is to be inspected by the Commissioner and

[13] For details of this notification on Grazing Rules of Forest Blocks See Forest Department Notification No. 23/XIV dated October 13, 1954.

[14] This would now comprise areas mostly in the newly formed Uttaranchal State

inspection reports is required to be submitted to the Conservator of Forest who in turn reports to Chief Conservator of Forest. The Deputy Commissioner is also vested with the power to suspend, supersede or dissolve any Forest Panchayat (Rule 43). Another interesting feature in the above said rules is the provision for Joint Forest Panchayat where two or more Forest Panchayat may combined by means of a written instrument for the purpose of transacting any business in which they are jointly interested. The above rules also saves the Panchayati Forest/Forest Panchayat duly constituted under the Kumaon Panchayat Forest Rules existing framed under the Scheduled District Act, 1874, Tehri-Garhwal Rajya Prant Panchayat forest Vidhan No.1, 1938.

- ***The Uttar Pradesh Forest Corporation Act, 1974***

The Act provides of the establishment of a corporation for better preservation, supervision and development of forest including better exploitation of forest produce within the State. The Corporation of the Chairman and five other members appointed by the Government besides at most three other non-official members having experience in preservation and development of forest[15]. The Act empowers the Corporation to undertake removal and disposal of trees and exploitation of forest resources entrusted to it by the State Government. The Corporation is also required to prepare projects and under take research programs in forestry within the State. Notably, the Corporation can also incur expenditure and grant loans and advances to any person performing the functions of the Corporation under this Act[16].
Every local body is mandated by the Act to extend full support to the Corporation furnishing all the requisite information including examination of records, maps, plans and other documents relevant to the local area[17].

- ***Laws on Forest Produce***

The State of Uttar Pradesh has earmarked two major forest products and has enacted laws to create a monopoly in the trade of purchase and distribution of "Tendu Patta" and "Resin". This has been done in the interest of public good. Without going into the merits of the above-mentioned public good let us briefly see the essential features of the above-mentioned laws on forest produce.

- ***The Uttar Pradesh Tendu Patta (Vyapar Viniyaman) Adhiniyam, 1972***

The above act restricts the sale, purchase and transport of Tendu leaves to the state government or an authorized officer of the state government or an agent in respect of the unit in which the leaves have grown. The Act also defines the grower of Tendu leaves and includes the state government in respect of the RF and the PF, the Gaon Sabha and tenure holder on whose land such leaves are grown. The State Government is empowered to fix the price of the Tendu leaves and also register growers and manufacturers of bides and exporter of Tendu leaves. The rules under the above Act prescribes the manner in which agents are appointed, the manner in which Tendu leaves would be collected, the authority who would issue transport permit, etc.

- ***The Uttar Pradesh Resin and Other Forest Produce (Regulation of Trade) Act, 1976***

It was observed that the tapping and sale of Resin in the reserved, civil Panchayati and soyam forest was done by the Forest Department while the tapping and sale of Resin in the forests under local bodies, cantonments and nap lands was being done by the owners. Due to excessive demand Resin was being black-marketed and thus resulting in revenue loses to the State. This necessitated

[15] For the Establishment, Composition and other aspects of the membership of thew Corporation See Section 3-13. of the Act.
[16] See Section 14-15.
[17] See Section 27

the enactment of the above Act. The regulation of Resin was done in a similar manner in which Tendu leaves are regulated. Detailed penal provisions have been provided for offences by persons or companies. The rules under this Act provide for the application for issue of permit, tapping of trees, registration of tappers etc. and the officers authorized to implement the Act.

- ***Regulation of Medicinal Plants in U.P with special reference to Cooperative trading in Medicinal Plants***

Some of the recent initiatives of the Central Government have been briefly mentioned in the section on medicinal plants above. The Union Ministry has sought to administer the Van Vanaspati Yojana under the JFM Programme. Besides they have to be managed by registered societies headed by Divisional Forest Officers. In the context of the State of U.P there is a need to examine closely the aspect of management of medicinal plants and herbs under registered societies.

It is imperative to understand the objectives of the Societies Registration Act especially in the context of the aims and objectives of any initiative of regulation and conservation of medicinal plants. The preamble to the Societies Act clearly states that it is an Act for improving the legal condition of Societies for the promotion of literature, science, or the fine arts or for the diffusion of useful knowledge as well as charitable purposes. This seems to be fundamentally at variance with the objective of a resource management activity, which has an incentive-based approach to conservation and sustainable use of the natural resources of a local area. Having noted this general incompatibility of purpose, it has to be said that The Societies Registration Act, 1860 as applicable to the State of U.P makes any possible registration of village associations under the Act very much legally valid and permissible in view of the generally worded purposes under the Act. For example, the Act makes clear that Society established for the promotion of Panchayat, Industry and Rural Development may be registered under the Act.[18]

It is also important to note that the Societies Act generally details various aspects of the internal administration of the Society and its obligations and dealings with the Registrar of the Societies.[19] The provisions limited to the aspects of management of Society and restrictive conditions on property and their transfers are not conducive for an incentive based Associations engaged in resource management and their use.

As opposed to the aforesaid, the registration under Co-operative Societies Act seems to be more appropriate. The Co-operative Societies are primarily associations seeking to be self reliant enterprises based on thrift, self help and mutual aid and owned, managed and controlled by their members for their economic and social betterment.

The Act also provides for registration of Co-operative Farming Societies.[20] Such Societies are empowered to raise loans on the mortgage of land held by it. Besides, there are concessions and facilities provided to Co-operative farming Societies in marketing of forest produce among other things.

A careful examination of the Cooperatives technique is essential because of the fact that in most of the States including the State of U.P collection and procurement of some of the NTFP is being undertaken through the cooperatives. Bhesaj Sangh comprising of village level cooperative societies in the erstwhile Uttarakhand region of the state of UP, is responsible for regulation of collection and sale of medicinal plants besides the forest department. Since 1986, the State Government authorized Kumaun Mandal Vikas Nigam (KMVN), Nainital, also for the collection

[18] See Section 20 of the Act.

[19] It may be noted that the property rights, movable or immovable, of a society is vested with the Governing body of the Society under Section 5 of the Societies Registration Act. It is not lawful for the governing body or any of the members of the Society to transfer any immovable property belonging to the Society without the previous approval of the Court

[20] See Chapter IX of the Act for the relevant provisions in this regard.

and sale of medicinal plants besides the Bhesaj Sangh.[21] This ended Bhesaj Sangh's monopoly in the Kumaun region though it continues to operate exclusively in the Garhwal region.[22]

The Bhesaj Sangh/KMVN was basically created to save the collectors from the exploitation of the middlemen and traders and to ensure attractive prices to the collectors by the cooperatives. A look at how the Sangh operates is instructive. The Bhesaj Sangh appoints agents for organizing collection and sale of medicinal plants. The agent deposits a certain amount as 'security money' and engages the locals for collection. After completion of the collection process the Sangh inspects the harvested material and issues the 'transit pass', which is also counter signed by the concerned DFO. However, some recent reports have highlighted that the Bhesaj Sangh has no check on what is collected and also the fact that money paid to the gatherers by the cooperative is much lower than the rate offered by the private traders.[23] The system of auctioning the rights for NTFPs and medicinal plants with very little control over the cooperative/Agents is liable to result in unsustainable harvesting practices. These are pointers to the fact that functional autonomy of the cooperatives has to go hand in hand with their responsibilities and accountability particularly towards the forest department.

- ***The United Provinces Fisheries Act, 1948***

The United Provinces Fisheries Act, 1948 is amongst the earliest laws on the use and regulation of aquatic biodiversity. In view of the extensive canal system and the existence of large number of wetland including ponds and *jheels* especially in the eastern of U.P. a need was felt to develop the fish industry and provide legal backing to plan the development of such industries on sound scientific lines under expert advise. The Fisheries Act provides for the prohibition and licensing of fishing in selected waters. It is interesting to note that the definition of fish is a broad one under the Act and includes a wide gamut of aquatic biodiversity including "turtles, dolphins aquatic plants of fisheries, whale and fish in all states in its life history". For the purposes of regulating fishing, the rules made under this Act provides for selected waters where there is prohibition for fishing. However, this excludes 'private waters' [24]and 'religious waters'[25]. The authority constituted under this Act has been vested with power of arrest without warrant, compound certain offences as well as prohibit the sale of fish in such area as may be specified.

- ***The U.P. Fisheries (Development and Control) Rules, 1954***

These Rules specifically provide that no person would destroy or attempt to destroy fish as defined under the Fisheries Act by any explosive substance or by poisoning or pollution of water by trade effluent. (Rule 2) It further, prohibits any person to catch, destroy or sale fish during the breeding season in prohibited areas.

6.1.5(b) Laws relating to protection of biodiversity

The United Provinces, which include the Present State of Uttar Pradesh, was the first State to enact to law to establish National Parks for the preservation of wild animal life and other object of scientific interest.

---

[21] As per NotificationNo. 542/28-1.86(6)/83 dtd.17.3.86.

[22] See Jain, Ashok K; 2000. Regulation of Collection, Transit and Trade of Medicinal Plants and Other Non-Timber Forest Produce in India-A Compendium.TRAFFIC –India/WWF-India, New Delhi.

[23] For example a detailed critical comment on the cooperative is available in *Down To Earth*, January 31,2001, Centre of Science and Environment.

[24] Private waters are exclusive property of any person or religious body or institution where such persons or institution has exclusive right of fishery.

[25] Religious water means water belonging to a religious body or institutions and which have never been fished before on account of any restrictions on religious grounds.

- ***The United Provinces National Parks Act, 1935***[26]

The above Act established the first National Park of India[27] for the propagation and preservation of wild animal life. The Act also provided for the constitution of other national parks. The authorities constituted under this Act were vested with the powers of arrest without warrant, search and seizure and could impose penalties. Although, the above-mentioned Act now stands repealed in light of The Wildlife Protection Act, 1972, its significance cannot be gainsaid.

- ***The Uttar Pradesh Wildlife Protection Rules, 1974***

The Wildlife Protection Rules of U.P. in exercise of the power under Section 64 of WLPA constitutes the State Wildlife Advisory Board and also prescribes the manner in which license or hunting etc. may be given. It is pertinent to note that the 1991 amendment in the WLPA prohibits hunting altogether and thus the provisions relating to game hunting in the above said rules would be infructous and against the vires of 1991 amendment Act of WLPA the rules also prescribes the form of the proclamation notification, form of claim, entry fees etc. The rules also provide for the form of declaration of animal article the manner in which certificate of ownership may be granted and the process of taxidermy may be carried out. It is strongly recommended that the above-mentioned Wildlife Protection Rules needs to be urgently amended in accordance with the 1991 amendment of WLPA. This will help in clarifying the doubts that may persist regarding game hunting, trade and commerce in scheduled animals and other restriction imposed by the amended Act in the State of U.P.

- ***U.P. Private Forests Act, 1948***

The U.P. Private Forests Act, was enacted immediately after independence to check the denudation of tree growth in 'private forests'[28] due to extensive over felling as a consequence of high prices of fuel. The preamble to the Act provides that this Act was enacted for the conservation of private forests and groves and for the afforestation of wastelands in the State of Uttar Pradesh. The laudable objectives of the above Act include conservation of forest for providing fuel and fodder resources, prevention of erosion, the interest of future generations and also develop Private Forests as national assets. It is provided in the Act that the owner of such Private Forests has the option to manage such forest in accordance with a working plan approved by a Forest Officer and in case the owner fails or refuses to manage the forest in accordance with the working plan the management of forest would be done by the Forest Officer in lieu of profits for such management .The above Act also provides for plantation of trees on wasteland. Although, the U.P. Private Forests Act, aims at conserving private forest which is not the property of the government and the government has no proprietary rights over the forest produce, the control over such forest almost vests all powers with the state to manage such forest by means of approved working plans as well as restriction on rights to cut, collect or remove timber even for domestic or agricultural needs. The Act further, provides that in the public interest any private area or forest whether notified or not may be vested in the state government after following a due procedure (Section 16 to 25). The extinguishments of right of a right holder are determined after consideration of the fact that the grant of those rights would affect the preservation of the forest (Section 24). The U.P. Private Forests Act is quite unique as compared to other forest-related

[26] Established under section 81 of the Government of India Act, 1919.

[27] Hailey's National Park, now known as The Corbett National Park.

[28] Private Forests exclude (a) any land which is vested in the [Government]
(b) any land in respect of which notifications and orders issued under the Indian Forests Act, 1927, is in force.
(c) any land where the Kumaun Forest Pinhead Rules apply

laws as it defines the right holder as well as wasteland and working plan.[29] It is further provided that this Act may be applicable to groves and grove-lands as defined under the U.P. Tenancy Act, 1939

- ***The U.P Protection of Trees in Rural and Hill Areas Act, 1976.***

The Act provides for the regulation of felling of trees and replanting of trees in rural and hill areas of the State of Uttar Pradesh. However it is made clear that the Act does not apply to the trees situated in Reserve and Protected Forests and in forests or forest land in respect of which a notification by the State Government under the Indian Forest Act, 1927. Further, the Act does not apply to trees situated in Urban Areas which means an area included within the limits of a Nagar Mahapalika, Municipal Board, Notified Area Committee, Town Area Committee, Cantonment Board or of a Development Authority. On the other hand, the Act applies to Hill areas, which includes the Districts of Almora Pithoragarh, Garhwal, Chamoli, Tehri, Garhwal, Uttar Kashi, and Hill Pattiis of Nainital areas of Chakrata Tehsil and Mussorie Municipal Board of Dehradun all of which now fall in the newly crated State of Uttaranchal[30]. Under the Act every person is prohibited from felling any tree standing on any land whether included in a holding or not except on grant of permission, following an enquiry, by the competent authority appointed by the State Government under the Act.[31] Besides, every person permitted to fell, cut or remove or dispose of any tree is bound by the Act to plant and tend two trees in place of every tree so cut or removed. Besides imprisonment of any person felling or removing any tree in contravention of the Act is also provided and the forest officers / police officers (not below the rank of Forest Ranger and Sub-Inspector respectively) have been given powers to arrest offenders without warrant. In addition, such Forest Officers/ Police Officers have been empowered to seize- on their reasonable beliefs- the wood and wood products of the trees that have been felled, removed or cut in contravention of the Act[32].

- ***The U.P. Private Forest Rules, 1950***

The U.P. Private Forest Rules, 1950 enacted under the U.P. Private Forest Act, prescribes a manner in which notified area of private forest may be managed. It also seeks to regulate the quantity of timber of forest produce that may be permitted to be taken by right holders. For the purposes of these rules the conservator of forest may declare the notified area or forest or any part thereof as "plantation" or "regeneration area" or "fodder reserves". In such areas as described above all the rights of the landlord and the right holder is suspended for the period of closure.[33] The rules further prescribe the manner in which vested forests would be managed.

- ***The Uttar Pradesh Bhoomi Evam Jal Sanrakshan Adhiniyam, 1963***

As early as 1954 the state of Uttar Pradesh realized the importance of soil conservation research[34] in order to conserve and improve the resources of the state. However, a more comprehensive Act to consolidate the laws relating to conservation and improvement of soil and water resources was enacted only in 1963. The amended Act not only provided for soil but also for water

[29] "Right-holder" means a person, who has by custom a right of cutting or collecting in, and removing from, a forest timber, fuel and other forest produce for his domestic and agricultural purposes and of pasturing his cattle in a forest.
"wasteland" means any land which the [State Government] may, by notification, declare to be a wasteland for the purposes of this Act
"working plan" means a written scheme for the management and treatment of a forest

[30] The Extent of the applicability of this Act to the State is made clear by combined reading of Section 2-3 of the Act.
[31] See Sections 3-5 of the Act. For the procedure to obtain permission to fell or remove trees See Section 6 of the Act.
[32] See Section 10-15 of the Act.
[33] The period of closure cannot exceed twenty years at a time.
[34] The Uttar Pradesh Soil Conservation Act, 1954

conservation. For the purposes of this Act the administrative machinery constituted includes a Bhoomi Evam Jal Sanrakshan Board, the Zila Samiti and also the Bhoomi Sanrakshan Adhikari. On a resolution passed by The Zila Samiti, the Bhoomi Sanrakshan Adhikari is required to prepare a detailed soil and water conservation plan. (Section – 9) The said plan is required to be approved by the Zila Samiti. In case the authorities (e.g. Collector) are satisfied that for the purposes of executing the plan it is necessary that temporary possession of any land should be taken he may direct the Bhoomi Sanrakshan Adhikari to take temporary possession of such land for a period, which should not exceed five years. The Act further prohibits any person to do any act on any land, which is prejudicial to the interest of soil and water conservation.

6.1.5(c) Laws relating to people and biodiversity

One of the most significant aspect of the relationship between biodiversity and the role of people in its conservation or use is the right of access and use to such communities who are living within an around the biodiversity hot spots within the state. The right to access and use is limited to those rights, which are recorded and find mention in the government records.

- ***Nature of Rights***

Rights[35] may be exercised in different categories of statutorily notified areas of forests and other ecological areas of biodiversity importance. These may be broadly classified into

(i) Rights under the reserved forest
(ii) Rights under the Panchayati forests
(iii) Rights in protected areas

(i) In case of rights and concessions, which may be exercised in reserved forests, it is limited to the actual bonafide agricultural and domestic requirement of the right holder.[36] The right to fish has been excluded in such settlement of rights. For the purposes of settlement of rights the reserved forests may be classified into Class I and II forests.

(ii) In Panchayati Forests from Class I or Class II forests as mentioned above, the Deputy Commissioner, at the time of forming Forest Panchayat, may allow concessions in Panchayati Forest even to those persons who have no recorded rights.

(iii) The rights in protected areas i.e. national parks and sanctuaries are extremely limited. While no rights may continue to exists in national parks (Section 19 to 26-A of WLPA) rights may be allowed to continue in a sanctuary by the Collector with the prior consultation of the Chief Wildlife Warden of the state (Section 24 (2) (c) of WLPA).

It is worth mentioning here that in developing a perspective on forest based rights the need of sustaining livelihood of the forest dependent people should be distinguished from the requirements of commercial exploitation of forest resources for private profits. This is best exemplified by the Rules for the exercise of rights in Kalagarh Reserve which states that "all the forest rights recorded with the sole exception of right to fodder grass for sale, are for agriculture and domestic requirements of the holder and not for the purposes of trade, nor shall forest produce obtained as of right be sold or transferred by the right holder".[37]

[35] Rights need to be distinguished from concessions and privileges. While rights are legally enforceable privileges and concessions are not legally enforceable.
[36] See for example rights in schedule –A reserved forests in Kumaun vide United Provinces Gazette, June 19, 1915
[37] For this and other rules in this context See Notification No. 955/XIV dated Nov.6, 1925 and its subsequent amendments.

- ***Rights under International Law***

In the context of India the settlement of rights within PAs and Reserved Forest Areas do not find mention in its process, the international covenants. The basis for settlement of right is primarily government records. Although, the Constitution of India[38] is obligated to abide by International Instruments that they sign (for example ILO Convention 169) it is still to be reflected in National Legislation especially in the context of the biodiversity related laws.

The Convention on Biological Diversity however speaks about the customary practices and use of biological resources and indigenous and local communities. Article 8(j) of the Convention lays down that each contracting party shall, " subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity". Further the Convention seeks to promote their wider application and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations, and practices. Besides, for each contracting party to the Convention it is mandatory to protect and encourage customary use of biological resources in accordance with traditional, cultural practices that are compatible with the conservation or sustainable use requirement (Article 10 (c)). Public education and awareness is also provided for by the Article 13 of the Convention. However, critics argue that the Convention fails to come up with an unambiguous guarantee of the rights of the local people.

- ***Joint Forest Management in U.P and other Legal Concerns***

The Uttar Pradesh government is one of the first States[39] to provide a legal basis to the JFM scheme. The provision of the village forest (Section 28 of the Indian Forest Act as applicable in Uttar Pradesh) has been used to give a surer legal footing to the JFM program. The first set of rules was enacted in 1997[40], which is now being replaced by the Uttar Pradesh Village Forest Joint Management Rules 2001.

(i) Main elements of the 1997 Rules

- These rules for JFM in the state of U.P. provide for three tiered JFM committees for conservation and protection of forests. These include the committees at the village level, range level and divisional level. The scope of the Rules excludes the Panchayati Forest.
- The management of village forest would be jointly done by village forest committee and nominated officers of the Forest Departments.[41] The rules also provide for a Panchayati forest to be governed under the JFM rules if the forest Panchayat so decides.
- The village committee is required to prepare Microplans, annual implementation plans, prevent destruction of trees, ensure that no encroachment takes place and further ensure the preservation of wildlife among other things.
- The power vested with the village committee is that offer forest officer.
- The funds are required to be arranged by the village committee from government and non-government organization including contribution from village community. However, the control over the same is in the hands of the DFO who releases fund in accordance with the order of the government.
- The benefits accruing from sale of forest produce, fees and permits etc. are fifty percent subject to a maximum of Rs. fifty thousand a year. After deducting the cost of investment.

[38] Article 51 of the Constitution of India states " The State shall endeavor to …foster respect for international law and treaty obligations in the dealing of organized peoples with one another…"
[39] The State of Jammu and Kashmir was the first to formulize the JFM scheme under its Forest Act.
[40] The Uttar Pradesh village forest Joint Management Rules, 1997.
[41] Village forest committee means a committee constituted under sub-section (6) of section 29 of the United Provinces Panchayati Raj Act, 1947 for the purpose of these Rules;

The above said rules are soon going to be replace by the Uttar Pradesh Village forests Joint Management Rules 2001. This is supposedly a more improve version of the earlier rules. Although the rules are not yet finally notified it is pertinent to place here the major features, which are 'an improvement' over the earlier rules.

(ii) Main feature of 2001 Rules

- The rules for the first time defines a forest user group which means a village community or a group of persons who residence of a village or a hamlet.
- The rules also define a right holder and further constitutes a state level steering committee.
- The village forest is required to be managed by a Joint forest Management committee and on behalf of the forest user group and nominated officers of the forest department.
- The rules also delineate the active involvement of Gram Sabha Vis-à-vis the JFM committee.

It may be noted here that the recently enacted The Panchayats (Extension to the Scheduled Areas) Act, 1996 has vested with the Gram Sabha wide ranging powers to approve development plans, to identify the beneficiaries and to certify utilization of funds for the plans or project. Further, the Gram Sabha or the Panchayats at the appropriate level has to be consulted before acquisition of land for the developing project in Scheduled Areas. Even though in the state of undivided Uttar Pradesh there are no Scheduled Areas the logic of the Panchayat Extension Act cannot be escaped and will have to be necessarily applied in state in due course of time.

Apart from the above some of the cases that need urgent attention and follow up for its implications for the State of UP are listed in Annexure H.

Following legal Instruments relevant to Biological Diversity are operational in Uttar Pradesh:

- ***Agricultural and Processed Food Products Export Development Authority Act, 1985/1986***

- Promotion and regulation of export of agricultural products specified in schedules
- Includes medicinal plants

- ***Agricultural produce (Grading and Marketing) Act, 1937***

- Fixing grade designations to indicate quality of any specified agricultural produce (3a, b)
- Prohibition or restriction on trade in wrongly marked /graded produce (3g)
- Extension of such provisions to any other article (Incl. Non-agricultural articles) [6]

- ***Customs Act, 1962***

- Regulation of import export specifically for:
- (a) The protection of human, animal or plant life or health [11(i)]
- (b) The conservation of exhaustible natural resources (11 (m)]
- Regulation of transportation and storage of notified items [11(j, k, l, m)]

- ***Destructive insects and pests Act, 1914***

- Prohibition or regulation of import of any 'articles' which may cause infection to any plant [3{1}]
- Prohibition or regulation or movement, between States within India, of articles likely to cause infection to any plant [4A]

Note: articles include insects and plants

- ***Environment (Protection) Act, 1986***

- General measures to protect environment [3{I}]
- Restriction of industrial and other processes/activities in specified areas [3(2)(v)]. Prevention and control of hazardous substances including their manufacture, use release and movement [3(2), 7,8]

- ***Fisheries Act, 1897***

- Prohibition on use of explosives for fishing [4(1)]
- Prohibition on use of poisons for fishing [5]
- Regulation and prohibition on fishing in private waters with consent of owners/right holders [6(2) & (3)
- Prohibitions of all fishing in specified waters for maximum 2 years [6(4)]

- ***Forest Act, 1927***

- Setting and managing reserved forests [Chapter II)
- Setting up and managing village forests [Chapter III]
- Setting up and managing protected forests [Chapter IV]
- Protection on non-government forests and lands [Chapter V)
- Control of movement of forest produce [Chapter VII]
- Control of grazing/trespass by cattle in forest land [Chapter X]

- ***Forest Conservation Act, 1980***

- Prohibiting or regulating non forest use of forest lands [2]

- ***Import and Export (Control) Act, 1947***

- Prohibition or restriction on imports and exports of specified items (3)
- Marine Products Export Development Authority, 1972 Regulations on transportation of specified items [4e]
- Establishment of an Authority for developing and controlling marine - Developing and regulating off-shore and deep-sea fishing, taking measures for Conservation, fixing standards for export, regulating exports [9(2a,c, f)]. Prohibition/restriction on export of marine products [20(1)].

- ***National Dairy Development Board Act, 1987***

- Establishment of a Board which promotes dairy development and other agriculture based industries [4, 16(1 a)]
- Financing and facilitating animal husbandry, agriculture high yielding cattle (including import of semen), import export of milch animals and bulls and general enhancement of cattle wealth [16(1)]

- ***National Oilseeds and vegetable Oils Development Board, 1983***

- As in Rubber Act, etc. special focus on providing farmers, especially seeds, and certified deeds of high quality and for improved methods of cultivation

- ***Prevention of Cruelty to Animals Act, 1960***

- Restriction on cruel treatment of animals, including use, transportation and trade [Chapter III, and Rules under Section 38]
- Restrictions on use of animals for purposes of experimentation and performances [Chapter IV & V]

- ***Rubber (Production and Marketing) Act, 1947***

- Establishment of Indian Rubber Board with function of developing/encouraging improved rubber cultivation and marketing, advising or import/export [B (1) & (2)]
- Restrictions on right of rubber planters-license required to plant or replant where to plant, etc [17]

- ***Seeds Act, 1966***

- Regulation on quality of seeds of notified food crops, cotton and fodder to be sold for agricultural purposes [5,6]
- Restriction on export/import of notified seeds [12]
- Exemption to persons selling/delivering on own premises, seeds grown by them [24]

- ***Spices Board Act, 1986***

- As in Rubber Act, etc. for cardamom; for other species, restricted to export-import development and regulation

- ***Tea Act, 1935***

- As in Rubber Act, etc. includes restrictions on export of tea seeds [17]
- Applicable to one species, *camellia sinensis*, presumably to all the varieties

- ***Territorial Waters, Continental Shelf, Exclusive Economic Zone and other Maritine Zones Act, 1976***

- Establishment of sovereign rights over waters and seabed within the continental shelf and exclusive economic zone (200 nautical miles from nearest appropriate point on Indian territory) [3(1), 5(1), 6(2), 7(4)]
- Sovereign right to explore, exploit conserve and manage resources of continental shelf and EEZ [6(3), 7(4)]
- Notification of any area within this zone for purpose of protection of resources and conservation of marine environment [6(5), 7(6)]

- ***Tobacco Board Act, 1975***

- As in Tea Act

- ***Wildlife (Protection) Act, 1972 and Wildlife (Protection) Amendment Act, 1991***

- Restriction or prohibition on hunting of animals [Chapter IV]

- ***Setting up of zoo authority, control of zoos and captive breeding***

- Control of trade and commerce in wild animals, animal articles and trophies [Chapter v and Chapter VA]

6.2. Programmes and schemes related to biodiversity:

Following programmes and schemes are operational at various degrees in U.P.; National environment awareness campaign (NEAC); Eco clubs in schools; Environments Awareness programme; Paryavarn vahini scheme; Children's science congress; Science popularization programmes; Workshops on conservations

6.3 Conservation initiatives

6.3.1 Ex-situ conservation: Under this initiatives following specific example need to mention

- ***Kanpur zoo***

The Kanpur Zoological Park, situated in the sylvan surroundings of Allen Forests, was established in 1974. The total area of the Zoo is 76.56 ha with the built-up area of a 3.75 per cent of the total area. The zoo contains over 891animals belonging to 134 species (mammals-57, Birds-71 and Reptiles-6). The zoo also houses 33 endangered species. The Zoo is visited by 4.83 lakh visitors annually and has been a very important captive breeding center in the last 25 years.

- ***Prince of Wales Zoo, Lucknow***

The Lucknow zoo (established 1921) situated in the state capital spreads over 70 acres (300 proper 59 acres) and is home for 97 species totaling about 685 individuals. Among special features, it has an Aquarium (housed in the Aish Mahal) and a Serpentarium. The zoo has annual visitors of over 10 lakh.

- ***Reptile breeding center, Kukrail***

Kukrail breeding center (started 1975) located in Lucknow, is a major reptile-breeding center of the state. Kukrail has long history of breeding and release of Gharial in the wild. However, since late nineties the center is facing sever resource crunch which is impeding on the captive breeding activities. Between March and May 2000, more than 200 Gharials from the center were released into Girva River flowing across the Katarnaighat wildlife sanctuary. Also, about 3,500 turtles were released in Gomti River flowing across Lucknow city in February 2000. Apart from conservations breeding, Kukrail is one of the 'picnic spots' of the Lucknow city providing recreation value through display of animals such as Gharial, Mugger, turtles, Chousingha, Swamp deer and Smooth Indian otters. Currently the center houses 4 male smooth Indian Otters, one male Chousingha and one male and two female Swamp deer.

- ***Reptile breeding center, Katarniaghat***

The crocodile-breeding center in Katarniaghat Wildlife Sanctuary has the past history of successfully breeding endangered Gharials and Mugger. The breeding activity has stopped since 1992. Currently the center harbours 27 Gharials of varied age classes and one mugger crocodile. Center release 20 Gharials and one mugger crocodile in the Girva River were retained for public display. In total 27 breeding pools exist in the center. Currently 3-4 pools are in working condition and rest either needs repair or renovation. The major problems faced by the local officials are inadequate funds for maintenance and animal feed alongwith lesser field staff.

- ***Turtle breeding center, Sarnath, Varanasi***

Supported by Ganga Action plan (GAP) programme, the wildlife preservation organization of the UPFD had initiated a fresh-water turtle rehabilitation project in the Ganges since 1989-87 with the major objectives of rehabilitation of depleted population and to clean up the dead-organic matters in the Ganges aquatic system. A total of about 55,690 eggs were collected from the National Chambal sanctuary from 1987 through 1993 for hatching and rearing at the Saranath (Varanasi) and Kukrail (Lucknow) turtle breeding facilities before releasing into the Ganges turtle sanctuary. A total of 28,820 captive hatched and reared Ganges soft-shelled turtle (*Aspideretes gangeticus*) have been released within the 7 km long Ganges turtle sanctuary between January 1990 to May 1995. The minimum age at which the turtles were released was 5 months and the maximum was around 6 years, with the largest bulk (24,037) of the turtles released when they were around 2 years of age (Choudhury et al. 1996).

Gharial rehabilitations: a success story

The gharial hatched at the Kukrail and Katerniaghat rehabilitation centers prior to 1994 were, mostly released in the wild. The eggs hatched between 1994 and 1998 are still being reared in captivity . So far 4,331 gharial were successfully reared in captivity and 3,495 of them have been released into the river systems of UP, while another 184 individuals were transferred to zoos and other animal collections.

The release of captive bred gharials started in 1979 and is happening more or less on an annual basis. About 70% of the releases were done in five PA's of the State, which are under active wildlife management. The remaining 30% were released into rivers outside PA's. (Singh et al. 1999).

- ***National Bureau of Fish Genetic Resource***

The NBFGR, located in Lucknow is devoted to the conservation and sustainable utilization of Fish diversity in the country in general and state in particular. Out of nearly 20,000 documented fish species of the world, 2200 fish species have been reported from India from cold fresh waters of upper stretches of Indus, the Ganges and the Brahmaputra. Twenty-seven species are considered to be rare/endangered/vulnerable. The mandate of the NBFGR includes.

Cataloguing genotypes

- Conservation and maintenance of fish germplasm in collaboration with other centers
- Conservation of endangered species
- Monitoring the introduction of exotic fish species in Indian waters.

- ***Conservation of Plants***

Many research organizations in the state are committed to ex-situ plant diversity conservation. The major institutes working towards this objective include National Botanical Research Institute, Lucknow, Central Institute for medicinal and Aromatic Plants, National Bureau of Plant Genetic Resources**.** The state has adequate facilities for conservation of threatened and endangered plants. Some of the facilities/ activities devoted to conservation of rare and threatened plants in the state are;

- Medicinal plant herbarium at CIMAP with collection of over 100 rare and threatened medicinal plants
- Field experimentation on use of over 200 medicinal plants at Banthra research station of NBRI
- Four Arboretums, two Bambusetum and one Populatum
- About 31 species of trees numbering over 100 are designated as protected trees
- More than one fifth number of Preservation plots of the country are scattered over hills and plains of UP

(i) Botanical Garden, National Botanical Research Institute, Lucknow

This center has contributed in the areas such as plant biotechnology, floriculture, tree biology, plant wealth utilization, plant taxonomy and biodiversity. The major contribution of NBRI towards *ex-situ* conservation of plants includes:

- Sequencing of chloroplast genome of *Populus deltoids*

- About 80 species of fuel wood plants (superior fuel value) that can be grown in waste lands.
- Identification of promising (*Acacia nilotica, Dalbergia sisoo, Terminalia arjuna* and *Prosopis juliflora)* timber and fuel wood species for the rehabilitation of sodic water lands.
- Monographic studies on pyrenocarpous lichens of Indian subcontinent were completed.
- The Botanic garden (NBRI) is repository of germplasm collection of diversified plant groups with special reference to be endangered, ornamental and economic plant species. The four national facilities of the institute, which contribute, to the ex-situ conservation of plants are Banthra Research station, Economic Botany information service, Botanic Garden and the Herbarium. The Botanical garden is maintaining exchange relations with nearly 300 leading Botanical Gardens/arboreta of the world with particular reference to isoclimatic regions.

- ***Conservation of medicinal plants***

The UPFD in mid eighties initiated medicinal plants research units by way of raising nurseries. However, the activity is stopped since early nineties, as there was no financial allocation in subsequent five-year plans.

- ***Genebank of medicinal and aromatic plants***

CIMAP, Lucknow has developed a genebank for medicinal and aromatic plants. The following plant species were collected recently from various parts of the country for addition to the gene bank. *Achillea millaefolium, Aconitum heterophyllum, Angelica glauca, Asparagus curillus, Bergenia ciliata, Ajuga bracteosa, Dactylorrhiza hatagirea, Origanum vulgare, Thymus serpyllum, Valeriana wallichii, Phytolacca acinosa, Lycopodium clavatum, Eleocarpus ganitrus, Chlorophytum arundinaceum, Abelmoschus moschatus, Adansonia digitata, Bacopa monnieri, Cyperus rotundus, Catharanthus roseus, Luffa cylindrica, Moringa oleifera, Nyctanthes arbor-tristis, Ricinus communis, Vigna unguiculata* and *Ziziphus jujuba*.

- ***DNA bank of medicinal and aromatic plants***

The DNA bank of CIMAP, Lucknow has accumulated DNA samples of 562 accessions drawn from 35 species of medicinal/aromatic importance. The species are as under:
Allium sativum L., *Artemisia annua*, *Bacopa monnieri* (L) Penn, *Callistemon lanceolatus* DC., *Cassia fistula* L., *Capsicum annuum* L., *Catharanthus roseus* Don., *Cymbopogon pendulu*s, *Cymbopogon flexuosus* stedu., *Cymbopogon citratus* stapf, *Cymbopogon martinii* (Roxb.) Wats., *Cymbopogon confertiflorus*, *Cymbopogon nardus* Rendle., *Cymbopogon winterianus* Jowitt., *Cymbopogon caesius* Stapf., *Cymbopogon microstatiil Cymbopogon spp.*, *Mentha arvensis* L., *Mentha spicata* L, *Mentha spicata* L var. *viridis*, Nentha X piperita L, Mentha X piperita L ev. Citrata, Mentha X gracilis Sole ev, *cardicaca*, *Mentha gentilis* L. *Mentha longifolia* L. *Mentha rubia* L, *Ocimum kilimandscharicum* Guerke, *Ocimum gratissmum* L, *Ocimum sanctum* L, *Pelargonium graveolens* L. Herit, *Taxus wallichiana* L. (North east), *Taxus wallichiana* L. (Himachal Pradesh) *Vetiveria zizanioides* (L.) Nash.

- ***Medicinal and Aromatic Plants Herbarium***

The medicinal plant herbarium located in CIMAP currently has more than 70 plant specimens of medicinal value collected from various phytogeological regions of India.

- ***Status of Protected Trees***

In UP, 31 species of trees numbering over 100 are designated as Protected trees for their superior morphological and genetic characteristics. These species are scattered over hills and plains of the state in various forest types.

- ***Status of preservation plots***

The representative areas set aside in various forest types for permanent protection are known as the preservation plots. The main objectives of these preservation plots are:

a. Preserve examples of existing forests as far as possible in their present form
b. Protect such forest plots from all form of injury and to permit progression towards climax form.

The preservation of both climax and seral stages are both envisaged. Currently there are 188 preservation plots. Out of 188 preservation plots, in the country, near 40 preservation plots are in U.P Bahraich has a total area of about 50 ha under preservation plots. These plots provide representative set of condition of a natural forest.

6.3.2 In-situ conservation Initiatives

- ***Protected areas***

Uttar Pradesh has currently 24 designated PAs (1NP, 23 WLS). They cover over 5710 km2 of total geographical area. The PAs contribute significantly towards maintenance of depleting biological resources of the state. However, in developed plans, inadequate infrastructural and manpower is an impediment in achieving the desired goal.

6.3.3 Research Initiatives/ Projects related to Biodiversity conservation

Various individuals / organizations have contributed towards R & D sector of biodiversity conservation in the State. The notable among these are as follows:

1. Physiological epidemiology and biochemi cal basis of *Alternaria* blight of pigeon pea (*Cajanus cajan* (L.) Millsp.Varanasi-CSIR-EXTRM
2. Development of pigeonpea and chickpea genotypes resistant to biotic stresses through biotechnological means, DBT-CRP, Dr. A.N. Asthana, Kanpur
3. Molecular characterization of the red rot pathogen and production of somaclones in subtropical sugarcane, DBT-CRP, Dr. V.K. Madan, Lucknow
4. Biological nitrogen fixation through Rhizobium in the area responsibility of C.S. Azad university of agriculture & technology, Kanpur, DBT-CRP, Dr. L.K, Lehri, Kanpur
5. Collection, screening, physiological and genetic analysis for improvement of lentil-rhizobium combinations for saline soils of UP, DBT-CRP, Dr. R. Rai, Faizabad
6. Use of blue green algae as bio-fertilizer for rice production, DBT-CRP, Dr. L.K. Lehri
7. Development of prototypes from natural products of influencing insect behaviour development of reproduction, ICAR-APCF, Dr. A.K. Tripathi, Lucknow
8. Surveillance and management of major insect pests of cabbage and cauliflower with special reference to diamondback moth *Plantella modestella*, ICAR-APCF, Dr. S. Rai, Varanasi
9. Quantification of the change in chemical properties of chemically reclaimed alkali soils with different cropping system, ICAR-APCF, Dr. R. Singh, Faizabad

10. Nitrogen-use efficiency of coated urea materials for rice wheat system in parti-ally reclaimed salt affected soils, ICAR-APCF, Dr. R.P.S. Chauhan, Faizabad
11. Plasticulture development for water conservation for other agriculture uses, ICAR-APCF, Dr. P.M. Singh, Faizabad
12. Development of commercial off type stock using reciprocal recurrent selection, ICAR-APCF, Dr. B.P. Singh, Kanpur
13. A study on poverty alleviation programme in Bundelkhand region of central UP, ICAR-APCF, Dr. J.P. Singh, Agra
14. Studies on the biochemical basis of leaf blight resistance in wheat, UGC-MJRP, Dr. R. Sinha, Varanasi
15. Improvement of mung and urd beans through induced mutagenesis, UGC-MJRP, Dr. V.P. Singh, Varanasi
16. An in *vitro*/ *in vivo* comparison of yolk-sac function and embryo development for tetragonic screening of new drugs/compounds in laboratory animals, CSIR-ES, Dr. N. Sethi, Lucknow
17. Bioecology of poultry shaft house, Menop on gallinae linne (Phthiraptera: Amblycera), CSIR-EXTRM, Dr. A.K. Saxena
18. DNA damages and repair induced by X-irradiation in male gem cells, DAE-BRNS, Dr. M.J. Raman, Varanasi
19. Genetic engineering of microorganism for biodegradation of chlorinated pesticides, Dr. A. Kumar
20. Conservation of phytodiversity (flowering plants) through in vitro strategies, Dr. H.C. Chaturvedi, Lucknow
21. Degradation of organic pollutants by ligniases of *Phanerochaete chrysosperium*, DOEN-R&D, Dr. D.S.K. Yadav. Gorakhpur
22. Influence of enhanced Uv-B irradiation and tropospheric ozone on plants, DST-SERC, Dr. M. Agrawal, Varanasi
23. Reduction of chromium toxicity by genetic manipulation of bacteria from leather tannery effluents, DST-SERC, Dr. A. Tripathi, Varanasi
24. Studies of heme environment and its role in catalysis by lignin peroxidase of *Phanerochaeec chrysosporium*, Dr. K.D.S. Yadav, Gorakhpur
25. The second half of the genetic code deciphering of instruction in primary sequences related to protein folding, DST-SERC, Kanpur
26. Enhanced UV-B effects on the terrestrial and aquatic plants, DST-SERC, Dr. Shyam, Radhey, Lucknow
27. Structural and biochemical studies on soluble lactose binding lectin (S-Lac-Lecting) from mammalian liver, DST-SERCYS, Dr. N. Ali., Aligarh
28. Restriction analysis of mitochondrial DN- As of wild mice of India which are closely allied to *Mus musculus*, DST-Ys, Dr. B. Chatterjee, Varanasi
29. Activities of wild and mutant strains of micro fungi on decomposition of sewage sludge, DST-Ys, Dr. R.C. Mishra, Varanasi
30. The ancestry of the house mouse in the light of genetic variation in Indian wild mice, ICMR-ADHOC, Dr. T. Sharma, Varanasi
31. Integrated management of Fusarium wilt pigeon pea, UGC-MJRP, Dr. S. Jariwala, Varanasi
32. Evaluation of integrated control of some agriculture pests, UGC-MJRP, Dr. A.M. Khan, Aligarh
33. Analysis of chromatin conformation and gene expression during agine role of histone HI, UGC-MJRP, Dr. M.M. Chaturvedi

34. Cytogentics and cytonomy of aphids (homoptera: aphididae) of Garhwal Himalaya, UGC-MJRP, Dr.. S.P. Kuri, Modinagar
35. Studies on HMG non-histone chromosomal proteins with particular emphasis on the expression of HMG2 gene during development and aging of rat, UGC-MJRP, Dr. S. Prasad, Varanasi
36. Studies, on leaf surface mycoflora of brinjal, UGC-MNRP, Shri J. Singh, Varanasi
37. Vegetative propagation in some medicinal plants of Shajahanpur, UGC-MNRP, Dr. S.C. Sharma, Shajahanpur
38. Studies on the use of induced autopolyploidy in the breeding of the Plantogoovata F., UGC-MNRP, Dr. R.K. Singh, Shikohabad
39. Effects of nicotine on the central nervous system of rats, UVC-MNRP, Dr. A.K. Sinha, Hathras

6.3.4: Initiatives of NGO'S/ Peoples organizations

More than 70 NGOs are working in U.P. About 44 NGOs are doing the work of tree plantations, afforestation, social forestry etc. Three NGOs namely International Society for Environmental protection, Gorakhpur, National Forum for environmental studies and conservation (NESCO), Allahabad, and Sharada and Environmental Conservation Centers, Jaunpur are doing the biodiversity Conservation directly. Rest of the NGOs is doing tree plantation, afforestation, Social forestry and environmental awareness programmes. In one or other way these all are related with biodiversity Conservation. Therefore directly or indirectly they are related with biodiversity conservation.

Table 6.5: Initiatives of NGOs

Name	**Activity**	
	Geographical Coverage of Activities in U .P.	**Activities Related to the Environment**
Gorakh Environmental Action Group, Gorakhpur	Gorakhpur	Agrobiodiversity and urban issues
Academy of Environmental Science (AES), Meerut	Meerut, Farrukhabad and Kanpur Districts of Uttar Pradesh,	Programmes for tree planting and nursery raising eco-development, published 6 papers on pollution of the Ganga and Kali rivers, Monitoring of 20 rivers in India; constructing improved chulhas in villages; encouraging use of solar cookers; installing hand pumps for water; participation in environmental awareness campaigns
Action for Food Production (Afro-Aligarh Project), Aligarh	Balrampur, Gonda, Sravasti and Bahraich Districts	Organizing a forestation camps in the Terai region of Gonda and Bahraich districts; organizing exhibitions highlighting environmental problems; interacting with industry to control pollution; setting up Paryavaran Kendras

		in Balrampur block; research on nutrient cycling in fuel wood tree species
Bharat Sarvodaya Samaj, Lucknow	Shahjahanpur, Farrukhabad, Mainpuri, Etawah, Etah, Faizabad and Agra Districts	Organizing Ecodevelopment camps providing relief in areas devastated by floods and drought
Bhartiya Mahila Vikas Sansthan, Moradabad	Hasanpur Tehsil of Moradabad District; Chandpur, Tehsil of Bijnor	Surveys and analytical studies of the village oil industry, the artisan industry, the village power loom, rice-milling technology, carcass utilization, and social forestry; conducting pilot projects on the handloom industry and mini cement technology; improving the efficiency of solar cookers; training in environment
Arthik Anusandhan Kendra, Allahabad	Allahabad and Mirzapur Districts	Environmental education; use of renewable energy; afforestation; land and water management
Asok Sansthan, Ghazipur	Bhanverkole Blocks of Ghazipur District	Environmental protection through education and training; social forestry; demonstration center for appropriate rural technologies such as improved chulhus, solar cookers, waste water disposal system, wind mill, water purification system, fire retardent thatching, diaphragm pump, winnowing fan, leaf cup dona making machine and paper slate
Ballia Environmental Society (BES), Ballia	Ballia, District	Environmental education and training; tree planting; encouraging use of non-conventional energy sources
Balrampur Environmental Action Group (BEAG), Balrampur		Creating environmental awareness through seminars and camps; rural afforestation programmes; nursery raising by school children; undertaking agriculture and environment research with assistance of the Indian Agricultural Research Institute, New Delhi, G.B, Pant Agricultural University, Pantnagar, and the Indian Council for Agricultural research, consultancy services, encouraging non-conventional energy use

Center for Rural Education and Development Action (CREDA)-Mirzapur	Mirzapur and Allahabad Districts	Environmental education and training, tree planting drives; study on environmental pollution in Mirzapur; helping form Citizen's Groups for tree planting and the cleaning of the Ganga ghats; providing consultancy services to other NGOs in Uttar Pradesh; encouraging use of smokeless chulhas and solar cookers
Deokalia Jan Kalyan Samiti, Barabanki	Bahraich, Barabanki, Faizabad, Sitapur and Lucknow Districts	Environmental education and training; promoting smokeless chulhas, water conservation; protecting plants and trees
Dr. Salim Ali Memorial Nature Club (SAMNC), Hamirpur	Uttar Pradesh, Madhya Pradesh, Orissa, Delhi	Creating environmental awareness among school children and local people, protecting the existing forest and wildlife in local areas; survey of flora and fauna; promoting use of renewable sources of energy
Gonda Environment Population and Wildlife Awareness Association (GEPWAA), Gonda	Gonda District	Conducting competitions on environment, population and wild life related topics; tree plantation; organizing seminars and ecodevelopment camps
Gram Kalyan Samiti, Barabanki	Eastern Uttar Pradesh	Environmental education and training; tree planting; vocational training for women
Gramin Lok Vikas Sansthan, Domariaganj Basti	200 villages of Domariaganj, Radauli and Mithwal Block of Basti District	Conducting environmental awareness camps; afforestation; water conservation; construction of smokeless chulhas; training masons in the construction and installation of biogas plants; installing and demonstrating windmills and the use of solar cookers
Gramin Sewa sansthan, Aligarh	Villages of Aligarh District	Creating environmental awareness; creating awareness about potable water; sanitation; family planning, wasteland development; tree plantation
Gramin Vikas Samiti Bhinga, Bahraich	Bahraich District	Environmental education and training water treatment; social forestry
Harit Kranti Seva Sansthan, Bijnore	Bijnore District	Environmental education; wasteland development through mixed plantations
Indian Institute for Development Studies and Research, Allahabad	Uttar Pradesh	Environmental education; Raising fruit tree plantations; social forestry; conducting an

		evaluation study of Drought. Prone Areas Programme (DPA P)
Indian Society of Environment, Kanpur	Kanpur city and surroundings	Environmental education and training for students; studies relating to wildlife and conservation of natural resources; regular survey of the river Ganga; studying the effects of domestic and industrial effluents on the flora and fauna of the ponds of Kanpur, tree plantation programmes; solid waste management technology; afforestation
International Society for Environmental Protection, Gorakhpur	Khorabar Block, Gorakhpur	Environmental education; forming ecoclubs in schools, pollution control; research on the effects of industrial effluents on aquatic life; promoting use of waste products as a source of energy; tree planting
International Society for Tropical Ecology (ISTE), Varanasi	Uttar Pradesh	Holding symposia on topics related to tropical ecology
Janpad Vikas Evam Samaj Kalyan Samiti, Mau	Mau district	Environmental education; tree planting; wasteland development programme
Jeevan Dhara Marg Darsak Society, Deoria	Deoria District	Environmental education and training; promoting smokeless chulhas; tree planting; ecoclubs; recycling of agricultural waste; rural sanitation; agroforestry
Kailash Chandra Seva Ashram, Allahabad	Thulama village, Allahabad District	Environmental education camps; tree planting
Kendriya Nehru Smarak Parishad, Lucknow	Barabanki, Hardoi, Unnao, Kanpur, Lucknow, Sitapur and Gonda Districts	Environmental education and training; rural afforestation, including pasture improvement and forest conservation; improving rural sanitation; installing biogas plants
Kisan Ashram, Agra	Barauli Ahir and Shamshabad Blocks of Agra District	Environmental education; tree planting construction of low-cost toilets for sanitation hand pumps for clean drinking water
Kisan Bharat Seva Sansthan, Agra	Chadausi district	Environmental education for school children; eco-development; tree plantation; implementing environmental sanitation programmers; encouraging energy

		conservation and use of smokeless chulhas, biogas and sanitary toilets; organic farming
National Forum for Environmental Studies and Conservation (NESCO), Allahabad	Allahabad city and adjoining rural areas	Conducting training workshops for teachers; participating in the UNEP sponsored campaign ' Clean up the World'; environmental research and surveys; providing consultancy services; promoting afforestation and preservation of biodiversity
Nav Jeevan Seva Sansthan, Sultanpur	Uttar Pradesh	Creating environmental awareness; reclamation of usar land in Mahona East and West of Sultanpur District; imparting technical knowledge about plantation on wastelands; tribal development
Labour Organization of Rural Poor, Ghazipur	Ghazipur, Azamgarh, Ballia, Jaunpur and Varanasi Districts	Promoting use of windmills for irrigation and for drinking water supply; generating electricity for the use by household and small scale industry; fabrication and installation of smokeless chulhas in rural areas
Mahila Evam Bal Vikas Sansthan, Bijnore	Bijnore district	Environmental education; promoting alternative sources of energy; tree planting
Mahila Udyammita Vikas Kalyan Evam Shiksha Sansthan, Rae Bareli	Rae Bareli, Lucknow, Pratapgarh; Barabanki, Bahraich, Faizabad, Sultanpur, Unnao, Fatehpur, Farrukhabad, Allahabad, Kanpur and Varanasi	Environmental awareness camps, plantation, promoting biogas, improved chulhas and solar energy, constructing low cost toilets and providing hand pumps, nursery raising and plantation of indigenous trees like Neem and mulberry, disaster management
Manav Kalyan Pratishthan, Fatepur	Uttar Pradesh	Conducting seminars, competitions, exhibitions and training programmes for dissemination of environmental education, carrying out environmental surveys, encouraging use of renewable energy, afforestation
Myana Gramodyog Sewa Sansthan, Bulandshahar	Jewar and Arnia Blocks, Khurja Tehsil Bulandshahar District	Environmental education; tree planting
Pipalsana Gramudyog Vikas Samiti Pipalsana,	Pipalsana Village, Moradabad District	Environmental education and training; tree planting

Moradabad		
Rajeev Gandhi Institute of Waste-Lands and rural Development, Sultanpur	Sultanpur, Raebareli, Barabanki, Faizabad, Varanasi, Lucknow	Environmental education, encouraging use of renewable resource, tree planting
Randhol Vriksharopan Samiti, Muzaffarnagar	Muzaffarnagar District	Environmental education through camps, meetings, plays and audio visual aids, nursery raising and plantation of local species of trees
Saghan Kshetra Vikas Samiti, Varanasi	Uttar Pradesh	Environmental education for school children, encouraging use of renewable sources of energy
Sarva Deshik Seva Samaj, Lucknow	Ghazipur District	Social forestry; environmental training for youth, water use and management, surveys and analytical studies on the wastewater disposal system, encouraging use of smokeless chulhas and solar appliances
Shar Environmental Conservation Center, Jaunpur	Eastern Uttar Pradesh	Biodiversity conservation, environmental education, pollution monitoring
Shri Bankey Bihari Sanskrit Sansthan, Mathura	Mathura, Aligarh, Agra and Bharatpur	Environmental education, rural development, planting
Smt. Bhu Devi Mahila Evam Vikas Shikshan Sansthan, Agra	Shamshabad block of Fatehabad Tehsil, Agra District	Improving sanitation in villages, afforestation
Society for Conservation of Nature and Scientific Development, Lucknow	Uttar Pradesh	Organizing lectures on environment related topics, ecodevelopment camps for youth, training programmes on ecology and environment, social forestry, pollution control and study of flora and fauna
Society of Professionals for Rural Enrichment Environment and Technology, Ghaziabad	National	Environmental awareness, promoting non-conventional energy.
Urmila Gramodyong Sewa Samiti, Gonda	Tulsipur Tehsil, Gonda District	Environmental education, afforestation encouraging use of alternative sources of energy
Uttar Pradesh Vigyan	Lucknow, Barabanki, Agra,	Environmental education and

Lekhak Avam Samvaddata Samiti-Lucknow	Meerut, Gonda, Gorakhpur, Lakhimpur and Unnao districts, Uttar Pradesh	training, demonstration and lectures, eco-development camps and nature study training camps, afforestation, conserving flora and fauna
Academy of Environmental Sciences, Meerut	Meerut, Farrukhabad and Kanpur districts	Programmes for tree planting and nursery raising, ecodevelopment, pollution of the Ganga and Kali rivers, monitoring of 20 rivers in India, constructing improved chulhas in villages, encouraging use of solar cookers, installing hand pumps for water, participation in environmental awareness campaigns

CHAPTER—7

GAP ANALYSIS

Considering various facts and figures about the biodiversity and its related aspects (as discussed in Chapters 1 –6) in the State Uttar Pradesh, following gap areas have been identified:

7.1. Gaps in information

7.1.1. Wild Biodiversity

- Baseline data on the floral and faunal diversity, rare, endangered, native, endemic and key stone species is not available**.** This lack of information had made prioritization of species difficult. Consequent of this conservation efforts have not been channalized.
- Documentation of indigenous knowledge of biological resources is poorly available. There is a great need to document and analyze the information on indigenous use and maintenance of biological resource.
- Identification, documentation and prioritization of high value groups of plants viz., medicinal, wild edibles, fodder, fuel and timber species, is weak.
- Lower plants particularly pteridophytes; bryophytes, algae, fungi, lichens and microbes have not been given serious consideration. Similarly lower animal groups have not received due attention of the researchers.
- There seems to be a clear-cut linking gap between the scientific knowledge available with the researchers, local knowledge system of people and information available with various implementing agencies such as the forest Department.
- District plans on the flora and fauna needs to be updated and uniformity maintained.
- Habitat monitoring of sensitive elements such as threatened, rare-endangered, native and endemic fauna and flora is lacking.
- Studies on the plant animal relationship are lacking in the State. From national perspective, one of the glaring gap is the relationship between wild and agrobiodiversity.
- Comprehensive information on biodiversity of PAs and fragile ecosystems (such as wet lands) is needed.
- Inventory of plant diversity of agroforestry systems such as agroforestry trees, wild plants, weeds, crops, horticultural species of kitchen gardens and varieties or races of traditional crops, etc. is inadequate.
- There is lack of proper dissemination mechanism of available information.
- Information and documentation of successful initiaves at conservation, sustainable use and equitable benefit sharing are lacking.
- Information and monitoring of the impacts of various human activities and of phenomenon like exotic in vasivespecies, is severely deficient.

- Most of the studies on biodiversity are short term. Long term monitoring of biodiversity has not been carried out, which is a must for the ecological modeling and conservation and management of biodiversity.
- Much more research is needed to define the responses of ecosystems when subjected to ecological stress and to explore their responses to different types and patterns of ecological stresses.
- Impact of human disturbance on the natural ecosystems has not been studied in most parts of the State.
- Fragile ecosystems such as wetlands, ponds, lakes and rivers have been poorly studied.

7.1.2. Domesticated Biodiversity

(i) Agricultural ecosystems & biodiversity

- Information on the land races, biomass and productivity (yield) of the agricultural crops is poorly available.
- Information on the rate and kind of erosion of agrobiodiversity, the specific impacts of agricultural and other policies and strategies that impact on agrobiodiversity, and links between agricultural patterns and wildlife, is very inadequate.
- Documentation of weed flora and its impact on the agricultural crops has not received due attention.
- Impact of use of organic and biofertilizers on the agricultural crops is poorly studied.
- Lack of information on crop diversification and its role in economic growth and prosperity of rural people

(ii) Livestock

- Lack of information on indigenous varieties of animals
- Poorly available (practicable) information about breeding
- Lack of veterinary information system.

7.2. Gaps in visions

- Lack of appreciation and estimation of the value of biodiversity, including its contribution of the well being of the State's citizens.
- Conversion of wetlands into agricultural land indicates the lack of appreciation of the ecological importance of those areas leading to ecosystem destruction.
- Conversion of forest land into agricultural land indicates the destruction of forest ecosystems leading to ecological imbalance in the area/region.
- Lack of representativeness in designated PA System of the State and improper/inadequate management plans for PAs
- Lack of ecosystems approach in Research and Development planning for the State

    (i) Currently State has to manage ecosystems for dominant goods or services such as timber, fish or hydropower without fully realizing the trade offs we are making. Especially, ecosystem approach is lacking in biological diversity conservation initiatives.

(ii) The education system in the State has not realized the value of environmental education, specifically awareness building and motivation initiatives on biodiversity related issues.

7.3. Gaps in policy and legal structure

- State lacks a separate over reaching policy on biodiversity with strong and well-defined laws on biodiversity conservation, use and enhancement, etc.
- Uttar Pradesh has no defined policy and methodology for valuation of biological resources and their equitable benefit sharing.
- There is no policy for human capacity building to conserve biodiversity.
- State lacks clear-cut policy/programme for targeted expansion of forest cover and protection of forests.
- The ongoing Protected Area policy in the state ignores the value of low profile animals/plants and focuses on some large high profile animals/birds. The policy lacks realization of a holistic view of conservation of biodiversity elements.
- The Protected Area management in the State often excludes people participation. Their demands from the reserve are not considered, their biodiversity related knowledge and conservation related practices not respected and built upon, nor they are involved in conservation efforts.
- The policy on agriculture in the state rarely considers the issues related to conservation of indigenous crops and livestock varieties.
- State lacks proper policies for reclamation of problematic (salt affected, ravinous, usar) and culturable wastelands to increase cultivated areas and cropping intensity.
- Well-defined policies/programmes for crop diversification and enhancing economic incentives to rural masses are lacking.
- The policies on linking various sectors such as energy, water, industry, mining transport, health, etc. with conservation and utilization of biodiversity are poorly developed.
- Implementation of all the existing laws relating to biodiversity is weak, and citizen's role in this implementation is not adequately developed.

7.4. Gaps in institutional and human capacity

- Various institutions including NGOs, community groups and self help groups involved (directly/indirectly) in addressing biodiversity related issues are working in isolation and with rigid mindsets.
- There is a lack of proper coordination among research institutions, Universities, NGOs and local communities.
- There is an imbalance in subject expertise; a few sectors are over represented while others under represented. For instance Experties on the lower group of plants are very few in comparision to higher group of plants
- Activities of most institutions lack participatory planning and resource management.
- Most Institutions, especially the research organizations, lack infrastructure compatible with global/national development.
- Application of new tools/ approaches (e.g., remote sensing and GIS) of biodiversity assessment, monitoring and conservation by most institutions is weak.

CHAPTER—8

STRATEGIES

While thinking about developing strategies to fill up gaps in biodiversity related issues of Uttar Pradesh, we need to keep in mind some of the key features of this State, which have direct or indirect bearing upon the initiatives.

(i) Uttar Pradesh has large human and livestock population, which show an ever-expanding trend.
(ii) Uttar Pradesh is agriculture-dominated State with nearly 70% of its land area under crops. Pressure for expanding agriculture land is mounting.
(iii) The State is facing a problem of increasing wasteland. The problem of salinity and alkalinity have rendered a large (11.4 lakh ha) land area as barren and uncultivated in lower Ganga-Ghaghra and lower/middle Ganga- Jumuna Doab.
(iv) Uttar Pradesh suffers from severe problem of soil erosion from agriculture lands and deeply gullied/ ravinous lands.
(v) Water logging/flooding is one major problem of Eastern Uttar Pradesh, which is responsible for large-scale devastation of agricultural land.
(vi) Actual forest cover in the State, especially in Gangetic plains is extremely low.
(vii) Uttar Pradesh has low literacy rate (27.16%, 1981). Especially the women literacy is in grave situation (14. 04%).
(viii) The political scenario of U. P. in recent decades has been quite unstable and level of social development in the State is poor (nearly 40% districts falling under low to very low development, category).

Strategy 1: **Biodiversity Information is made available**

Conservation and sustainable utilization of biodiversity can be ensured only if we have adequate information about three basic facts of the biodiversity elements: What, how much and where? In view of this, State needs a comprehensive strategy wherein adequate information on various aspects of biodiversity is generated, compiled, analyzed and made available to different stakeholders. The proposed broad elements (actions to meet these elements are included in Chapter 9) of the strategy are as follows:

- Complete documents (including information on distribution, habitat requirement, status, thereat if any, use potential, etc.) on State flora and fauna (covering both lower and higher groups) are prepared and widely disseminated.
- The available knowledge base on indigenous systems and practices of biodiversity use and maintenance (covering both wild and domesticated elements) is documented, taking steps simultaneously to protect it against theft and unfair use.
- Weed flora (alien invasion) of the State is documented, impact assessed and mitigation methods are popularized.

- Priority biodiversity elements such as threatened, rare-endangered, native, endemic and economically important species are identified and recommended for long term monitoring.
- High value biodiversity elements (e.g., special groups like Medicinal plants, wild edibles) are identified and assessed for their economic and ecological viability.
- A strong State Biodiversity Research and Information Network (link between academics, Government Departments, NGOs, Community Groups and rural people, etc.) is established for easy exchange of information.

Strategy 2: State **has a wider vision on Biodiversity conservation and utilization**

In the fast changing perceptions on biodiversity wherein holistic perspectives to address both ecological and socio-economic values of biodiversity are realized, State needs to have a wider vision towards developing plans/programmes on biodiversity and their implementation. This should not only look into the present priorities/needs of the State but also consider the future (projected) needs (say for 20 years or beyond). The proposed major elements of this strategy are:

- Programmes for long term monitoring of biodiversity (focusing on priority elements as identified under Strategy 1) are developed (considering the value of modern tools such as RS, GIS, GPS) and implemented.
- Ecosystem approach realizing the impact of harvesting goods and services and conversion of one land use to other is realized for research and development initiatives.
- Economic potential (raw or processed forms) and ecological viability of Non Timber Forest Produces (NTFPs) is analyzed and popularized.
- Indigenous races/varieties (crops and livestock) are maintained and high production with reduced impact on wild/natural diversity is achieved.
- Representative biodiversity elements are maintained under PA network and *ex-situ* initiatives to provide a back up for maintenance and promotion of threatened elements.
- Education/awareness about biodiversity (its value and linkages) is imparted among the students/teachers, rural people, community groups, Government officials and other stakeholders.

Strategy 3: **State has clear policy and legal structure for biodiversity conservation and utilization.**

Comprehensive regulatory framework to address issues related to biodiversity use and maintenance requires clear policies on diverse aspects and firm/well defined legal structure. This should ensure harmonization of different laws and policies. In this context following elements are proposed:

- An over arching policy and a set of legislation on biodiversity (having clear definition, enforcement rules, and laws for conservation, use and enhancement) is framed and enacted.
- A policy and methodology for accounting of States biological resources and equitable sharing of benefits is developed and implemented.
- A policy for human resource development (covering representation of all stake holders) for conservation of biological diversity is developed and implemented.

- Components of targeted expansion and protection of existing forests which are presently not under protection, included in State forest policy.
- Protected Area policy in the State is reframed (realizing holistic approach of conservation wherein peoples' involvement is ensured)
- Agriculture policy in the State is reviewed and components of maintaining indigenous varieties is given due consideration. Also, programmes for crop diversification are developed and implemented.
- Policies related to Livestock is reviewed and components of maintaining indigenous varieties is given due consideration.
- Clear policies for reclamation of waste land are framed and implemented.
- Policy to link biodiversity with different sectors is developed.

Strategy 4: **Capacity of Institutions/individuals related to biodiversity is enhanced.**

In view of fast changing global scenario with regard to approaches and concepts to address issues of biodiversity conservation and use, it is desired to build up or further strengthen the capacity of various institutions involved (directly). To achieve this following elements are proposed:

- Mechanisms to improve complementariness (through the net work as suggested under Strategy 1) are ensured.
- Expertise in under explored areas of biodiversity (e.g., lower plants, animals and micro organisms) is developed.
- Participatory (representation from various stake holders) planning, implementation and benefit sharing is ensured.
- Rural masses (especially the women folks) are made aware of values of biodiversity knowledge (e.g., value to the outside world including commercial and genetic values) they have and the possible ways of receiving benefits.
- Institutions are provided with desired infrastructural facilities (including the emerging advanced techniques of assessment, monitoring and enhancement) and funds.
- A State level and District level biodiversity cell (having representation from various stake holders) is established for monitoring of the biodiversity related research and development activitites and implementation of policies.

Strategy 5: **Legal Strategy for Biodiversity Conservation in U.P. is framed**

(Based on document Biodiversity Conservation and law in Uttar Pradesh – Constraints, Opportunity, Strategies; Pia Sethi pes. Comm.)

The detailed over view and analysis of the gamut of laws and rules that impact biodiversity of the State has sought to indicate the legal issues and parameters which has to be borne in mind while developing a comprehensive regulatory framework for conservation of biodiversity in the State of U.P. Based on the legal analysis some of the broad strategies that have emerged may be classified as under:

5.1. Proposed Amendments in Laws relating to biodiversity

5.1.1. Conservation laws

- WLPA or the Rules there under may provide for guidelines or defining parameters for the purposeful administration of the protected areas i.e., the national parks and sanctuaries including settlement of rights.
- It is strongly recommended that the Wildlife Protection Rules of U.P. need to be urgently amended in accordance with the 1991 amendment of WLPA. This will help in clarifying the doubts that may persist regarding game hunting, trade and commerce in scheduled animals and other restriction imposed by the amended Wildlife Act in the State of U.P.
- The criteria for diversion of forest land to other purposes need to be further developed beyond what is provided under the Forest Conservation Rules of 1981. There exists no transparent guidelines for clearances under the Act and it is important to understand that the reasons for acceptance or rejection of any proposal for clearance under this Act should be given to concerned party as a mandatory requirement under the law
- Biosphere Reserves, which are not statutorily created but are administrative categories, may be created as legally protected zones under the "closed areas" provision of the Ecologically Sensitive Areas under the Environmental Protection Act.

5.1.2. Use Laws

- There is a need to develop the definition of forests. The lack of any such definition has wide implications at the field level.
- The principles or criteria need to be developed which could qualify any land or area to be a forest. These principles should be based on sound ecological and scientific bases. However, the term forest needs to be distinguished from the definition of 'forestland'.
- There is an urgent need to bring 'forest villages' - as distinguished from 'village forests' under the IFA -under a legal definition either under the Indian Forest Act or recognised as revenue villages depending on the circumstances.
- The various institutions and recent schemes designed to conserve and regenerate medicinal plants needs to be backed by well-defined policy and legal perspectives, which today are conspicuous, by their absence.
- The implications of the provision prohibiting 'non-forest use' under the Forest Conservation Act needs to be fully ascertained for its impact on promoting medicinal plants in forest areas. Besides, provisions relating to the medicinal plants under the Wildlife Protection Act are inadequate falling short of the spirit and mandate of the CITES.
- The system of auctioning the rights for NTFPs including medicinal plants with very little control over the Cooperative/Agents is liable to result in unsustainable harvesting practices. The functional autonomy of the cooperatives engaged in trading of NTFPs/Medicinal Plants have to go hand in hand with their responsibilities and accountability particularly towards the Forest Department.

5.1.3. Enhancement laws

- The numerous legal issues on JFM relating to institutional arrangements, impacts of other legislation's, tenurial security and benefit sharing mechanisms need to be addressed if JFM has to sustain itself legally as well as administratively. These are of crucial significance if the forests are to be jointly

managed by the people and the agencies of the State. The notification of JFM that is proposed need to be discussed with a much wider audience as well as experts.

- The potential impacts of other legislations relating to Panchayat, tribal welfare, becomes extremely crucial in case of conservation of biodiversity especially in its role vis-à-vis JFM.
- The Panchayat is competent to legislate on items that relate to biodiversity including land improvement, soil conservation, watershed development, social forestry, farm forestry, minor forest produce, fuel, fodder, etc. Further, it regulates the right to minor forest produce, management of water bodies, etc. The JFM agreements need to be looked afresh in this light.
- The rules of JFM need to be legally analyzed to evaluate its strengths and weaknesses. Specifically, the legal implications of the JFM rules on other forest related legislation, the aspects of contractual benefits to all stake holders, and the potential valid claims by people outside the village committee (resource users from far away) and other relevant aspects need to be examined in detail.

5.2. Legal Coverage to Outside PAs

- Corridors between PAs need to be protected under Environment Protection Act, 1986 under its broad provisions.
- There is a need to frame a law on in-situ conservation by designating "critical habitats" for critically endangered species that exist outside the PA network.
- A comprehensive land use planning and management policy is fundamental to conservation and regeneration of forest areas in the State. A nexus between inefficient land use and forest management can be seen in the over-use, and abuse of the provision that enables the State Government to denotify reserve forests and protected areas under the Indian Forest Act and the Wildlife Protection Act including persistent violations of the Forest Conservation Act.
- Participation of the local communities need to be ensured in the conservation and management of PAs
- Appropriate Management Planning is required for the community conserved areas.

5.2.1. Training in Laws on biodiversity

- Training of "authorised complainants" in forest and wildlife related cases is a must to ensure faster conviction.
- Substantive law training on biodiversity related legislation to Legal Counsels is an important pre-requisite to ensure speedier justice for biodiversity conservation.
- Sensitization of Judicial Officers on ecological significance of biodiversity conservation would go a long way in setting judicial precedents that may have far reaching implications in addressing concerns on biodiversity.

5.2.2. Formation and Coordination of Biodiversity Cell

- A State Level and District Level Biodiversity Cells having representation from various stakeholders including forests, wildlife, irrigation, education, industry and among others need to be created for effective implementation of biodiversity laws. Universities actively engaged in biodiversity studies, Research

organizations and Forest Department should take the lead. This could be under the broad lines of the State Forestry Committee the District Forestry Committee under the JFM Schemes as well as the Water Users Committee as for instance the Committees in Andhra Pradesh.

5.2.3. Legal Awareness

- Apart from imparting general awareness on laws on biodiversity the rules made under the WLPA must receive wide publicity. This is crucial because citizens have now been empowered to take erring authorities to court who do not take timely action in case of commission of wildlife crimes. Further, lack of knowledge of provisions of the Act and rules have often resulted in the failure of prosecution of cases.

5.2.4. Implementation Concerns

- A regional wildlife trade study is required urgently and a comprehensive strategy focussing on prevention of illegal trade is essential.
- A two – pronged strategy in improving the implementation aspect as well as regulating, trade of biodiversity and its components is suggested. Firstly, the 'Scheduled animal' cases need to be rigorously pursued at the trial level in forest land, ensure the presence of witness, presence of Investigating Officer along with the prosecution and working on the weak defences. Secondly, the State needs to follow the cases in appellate Courts with a more sound strategy that may include biodiversity training to legal counsels and a comprehensive, easy to read brief to counsels whom we are pursuing the appellate Court
- ***Procedural Delays*** need to be minimised as it is used as a standard tactic by accused to obtain easy exemptions from appearance at the slightest pretext and thus prolong the 'evidence stage' immensely.
- Careful vigilance is required on another major dilatory tactic that is often resorted to, and that is, of filing frivolous appeals especially on Interim Orders and thus stalling the case at the trial courts.
- ***Lack of trained legal manpower*** is another major lacuna. The various stages of forests and wild life cases warrant expert knowledge both of adjective and substantive laws relating to forests and wild life.
- There exists ***minimal Professional Agencies backup*** in prosecution of wildlife and forests related cases. At present the courts recognise only Central Forensic Sciences Laboratory as well as State Forensic Sciences Laboratory as institutions, which can corroborate evidences. This is mandated by the Criminal Procedure Code, 1973. The facility of identification of wildlife and its products need to be developed at the State Forensic Sciences Laboratories apart from the ones that exist at the Wild Life Institute of India (WII).
- Special focus needs to be given to ***Un-represented/minimally represented cases***. It is a normal practice that the Public Prosecutors /Asst. Public Prosecutors, delegate powers to Wild Life Inspectors, Rangers/Officers who are not specially trained in legal procedures or substantive law. This needs to be avoided as far as possible.
- Further, after transfers of the complainant officers, it is difficult to conduct cases at a different Division or Circle. The non-availability of competent and trained lawyers who can push prosecution further accentuates the problem. There is a need to create a special fund for prosecution of offenders of wildlife and forests. This could cover costs that are incurred in legal cases.

CHAPTER–9

REQUIRED ACTIONS AND FOLLOW-UP

Keeping in mind the Gaps highlighted (Chapter 7) and Strategies proposed (Chapter 8), following actions are being recommended for the State Uttar pradesh. For each action a tentative follow up action viz., required time, names of possible nodal institutions and the major activities are also suggested (proposed follow up actions can vary as per the efforts and intensity of implementation process).

9.1. Gaps in Information

9.1.1. Preparing documents on State flora, fauna, and sensitive habitats (Max-5 yrs)

- **Extensive exploration and documentation of under explored districts and strengthening of efforts in fairly explored districts** (3 years; BSI, ZSI, University Departments, Forest Department, Research Organizations; a uniform methodology/format need to be adopted).

- **Compilation of information and preparation of State document** (2 years; identified individuals/experts for specific groups; information generated as above may be used along with existing information).

- **Documentation of sensitive habitats of the State** (2 years; UPFD, BSI, ZSI, Research organizations; Wetlands and Forests, may receive priority attention; all identified habitat should be mapped and put into GIS domain).

9.1.2. Documentation of indigenous knowledge base (3yrs)

- **Preparation of ethnobiological inventories** (3 years; NGOs and Government Departments working on tribal communities; Uniformity in format be maintained; this should also include inventory of local land races).

- **Documentation of specific practices, systems of resource conservation/utilization** (3years; Community organizations, NGOs, Government Departments and community groups; this should cover documentation of success stories related to wild and domesticated diversity).

9.1.3. Documentation of States' weed flora (2yrs)

- **Preparing complete inventory** (2 years; Agriculture Departments of Universities; inventory should include information on impact of specific weed).

- **Documenting irradication methods** (2 years; Agricultural Universities and NGOs; both scientific and traditional methods of weed irradication should be considered).

9.1.4. Identification of priority biodiversity elements (3 yrs)

- **Inventory of threatened floral and faunal elements** (2 years; subject experts, based on the information generated under 9.1.1 and 9.1.2)

- **Inventory of high value biodiversity elements** (2 years; subject experts, based on 9.1.1 and 9.1.2; priority focus should be on Medicinal plants, wild edibles, NTFPs, fuel and fodder.)

- **Listing and mapping priority sites** (2 years; subject experts, Forest Department, NGOs; priority sites may be classified into their conservation and use values; information from 9.1.1- 9.1.3 can be used; priority sites should also include sites/areas with rich in races of crops and livestock).

9.1. 5. Establishment of a State Biodiversity network (2 yrs)

- **Establishing biodiversity cell at Tehsil, District and State levels** (2 years; representatives from various stake holder groups including forests, Wildlife, academic, industry, rural people, community groups, etc; the network should be connected through computerized system (as much as possible).

9.2. Gaps in Vision

9.2.1. Ensuring long term monitoring of biodiversity elements (20 yrs+)

- **Monitoring of priority species such as commercially viable, native, endemic and threatened species** (20 years; UPFD, Department of Agriculture, Government Institutions; select priorities from 9.1.4 also including domesticated species; a uniform monitoring protocol be followed and contemporary tools like RS, GIS, GPS utilized. Monitoring agencies may involve school/college students/teachers in monitoring).

- **Monitoring of Priority Sites** For priority sites please see Chapter- 3 (20 years; UPFD, Government institutions; Priorities as under 9.1.4; Uniform protocols, use of modern tools and involvement of students/ teachers).

- **Monitoring changes in indigenous practices/systems** (20 years; selected NGOs, groups identified from 9.1.2; should consider impacts of changes in biodiversity-Wild/domesticated status and on socio economic structure of community).
- **Monitoring the impacts** of Biodiversity management programmes including wildlife management in PAs (5 years; UPFD, Research Organizations and selected NGOs should take the responsibility).

9.2.2. Ensuring ecosystem approach in research and development activities (10 yrs)

- **Determining the impact of harvesting goods** (e.g., fuel, fodder, medicinal plants etc.) and services (e.g., tourism etc) (5 years; UPFD, University Departments, Research Organization, selected NGOs; impact on both structural and functional properties of ecosystems should be considered also impacts on regeneration rates of harvested species be observed; simultaneously impacts on social system be monitored).

- **Proper valuation of NTFPs** (5 years; NGOs, Research Organization, community groups; UPFD; ecological and economic viability of harvested NTFPs need be assessed, economic valuation should consider potentials in raw and processed form).

9.2.3. Maintaining indigenous races/varieties (crops and livestock) and improving livestock production (10 yrs)

- **Developing conditions and incentives (such as Public Distribution System links for bioferlilizers, and others) for rural masses to conserve local varieties through traditional farming** (5-10 years; Department of Agriculture and other relevant Departments; sites/areas identified based on information obtained from 9.1.2 and 9.1.4 may receive priority attention; Incentives provided should ensure food/economic security of involved farmers).

- **Developing decentralized financing system for the livestock production sector and support breeders association to promote animal husbandry** (5-10 years; Department of Agriculture and other relevant Department, community groups, NGOs; focus should be to improve quality of animal by using local races and improving quality of feed by identifying/ suggesting potential alternative sources- Box).

Box *(Based on Agriculture Policy Uttar Pradesh 1999, and other relevant documents**)***

Implement a decentralized financing system for the livestock, production sector and support breeder's association / to promote animal husbandry

Action plan: Agriculture and livestock production is often poorly integrated and conflicts frequently exist between their uses of biodiversity. However, the full potential of milk has not been realized. The livestock consist mostly of local non- descript type of animals. The productivity levels are very low due to poor quality of animals, shortage of feed and fodder and poor management practices. It is relatively higher in three regions of Gangetic plain as compared to Bundelkhand region .The present number of livestock is clearly leading to inadequate nutrition and low productivity. Infact, availability of fodder is not sufficient even to maintain half of the livestock at adequate level of nutrition. The cattle are left free to graze causing damage to crop and vegetation and aggravating the problems of the soil erosion and land degradation. There is an urgent need to adopt a strategy of livestock development aiming at reduction of their numbers and improving their quality and productivity through scientific animal husbandry practices. The new agriculture policy promises to pay special attention to make full use of awareness about proper management practices, preventive measures.

Goat farming –a profitable enterprise at Bundalkhand region By S. B. Maity and M. M. Das (Indian farming November 2000)

Mustard straw- a potential roughage source for sheep feeding By O. H. Chaturvedi, A.S. Mishra, R. Prasad (Indian farming February 1998)

Efficient use of non- conventional feed resources and under or un- utilizing roughages like mustard straw can be alternative to bridge the gigantic gap between availability and requirement of feedstuff for livestock. Urea treatment of mustard straw improves its feeding value and thus urea-treated mustard straw (UTMS) in conjunctions with 200 g concentrated or all roughage based ration containing UTMS (75%) and Khejri leaves (25%) can maintain the sheep during scarcity.

Bundel jai 851 oat a new high quality multicast fodder variety By R.N. Choubey, A. K. Roy, S. N. Zadoo and S. V. Prasad

(Indian farming May 2001)
Bundel jai 851 Oat was developed from the exotic Japanese germplasm 'Hiugakaryokuro' at IGFRI, Jhansi. This variety showed an average of 400 Q/ha green fodder yield in 34 locations and 71-Q/ha dry matter yields in 24 locations, which was higher than Kent, ISPO 94, and UPO 212. This variety is resistant to crown rust, leaf blight, sclerotial and aphids.

9.2.4. Maintaining representativeness in PAs and promotion of ex-situ backup (5-10 yrs)

- **Design and planning a PA network to cover representative biodiversity elements** (3-5 years, UPFD/Wildlife Department, Research Institutions such as WII; based on the information obtained under 9.1.1 and 9.2.1 and the earlier recommendations made by W I I a PA network be designed but rights of the people inside/around the PAs should be taken care off; this plan should adequately cover the wetlands and the agrobiodiversity areas-as identified under 9.1.2 and 9.2.3).

- **Planning community involvement in PA management** (3-5 years; UPFD/Wildlife Department, NGOs, Community groups; a plan for critically reviewing the proposed PA network (as above) for assessment of impact of these PAs on rural population of surroundings. The evaluation should cover aspects of socio-economics particularly the employment opportunity, culture diversity and depletion of IKS. This should cover possibilities of developing join management eco-development projects adjacent PAs and inside.

- **Planning a network of captive reserves for endangered biodiversity elements** (5-10 years; UPFD/Wildlife Department, Research Organizations like CIMAP, NBRI, BSI, ZSI, Community groups, based on the recommendations of 9.1.4 species and sites be identified/prioritized for action; reserves may be established close to natural habitats of the prioritized species, community groups may be involved for planning reserves for domesticated elements e.g., indigenous races of crops/livestock, etc.) For details please see Chapter- 3.

- **Planning and implementation of research on ex-situ conservation** (5-10 years; Research Organization, Universities, Wildlife Department; this planning should clearly define a mechanism for identifying, defining, planning and coordination of research required for *ex-situ* conservation. This should focus on protocols for multiplication, reintroduction and behavioural changes, etc.)
- **Establish effective network of community conserved areas** (3-5 years; UPFD, Research Orgnizations and NGOs; a plant for the establishment of effective network of community conserved areas need to be established)

9.2.5. Imparting education on biodiversity/ Conservation (5-10 yrs)

- **Inclusion of subject in school curriculum** (5-10 years, Department of Education, Universities, Research Organization, NGOs; efforts be made to include subject in formal education, also planning for regular inputs from non-formal means to school children be developed. Research Organizations may plan for orientation courses of teachers; NGOs may involve in imparting biodiversity education through non-formal means; the programme should also focus on infusing traditional values, culture skill and knowledge into young generation).

- **Planning for awareness raising among masses** (5-10 years; Educational Institutions, NGOs, UPFD, and other relevant Departments; masses be made aware of uses and consequence of losses of biodiversity through News Papers, documentary films, posters, demonstrations, etc.; this

should cover training of NGOs and GOs for developing sense of commitment for cause of biodiversity conservation).

Gaps in policies and legal structure

9.3.1. Formulation of State biodiversity legislation (3-5 yrs)

- **Formulation of State Biodiversity Board** (2-3 years; an Independent body (separate than the recommendation of 9.1.5) having representation from various stakeholder groups; the board should look into implementation of biodiversity laws, policies and programmes, it should channelize the inter institutional linkages and ensure fund availability for various biodiversity programmes/projects; also the board should have responsibility for protecting farmers rights).

- **Formulation of state biodiversity legislation** (3-5 years; State Biodiversity Board, involved Departments, community representatives, legal experts, etc; clear laws should be framed to use, enhance and conserve biodiversity; clear definitions about some ambiguous terms i.e., community resources, farmers rights, access, benefit sharing, IPRs, etc.; while this legislation should take care of States biodiversity-both wild and domesticated, the national - under proposed Biodiversity Bill, and international (under Conventional Biological Diversity), etc., commitments, should also be looked into).

9.3.2. Formulation of State biodiversity accounting system

(5 years; UPFD, Department of Agriculture, Community representatives, State Cooperatives; system should consider ecological and economic valuation of harvestable resources especially NTFPs; techniques of non destructive harvesting; provision for equitable sharing of benefits, valuing other benefits of biodiversity, including ecosystem services, and the cost of loss of biodiversity, and inputting this into the accounting system).

9.3.3. Planning for human resource development (5-10 yrs)

- **Developing scientific expertise** (5-10 years; all the concern Departments especially Universities, Research Organizations and UPFD; the policy should focus on development of expertise in gap areas, for example-lower groups of plants and animals, microorganisms; social sensitivity and skills to work with people; use of recent tools in monitoring, *ex situ* methods of conservation, processing of raw material, biodiversity valuation and communication, etc.).

- **Policy for Developing Management Expertise** (5-10 years; UPFD, Wildlife Departments and other relevant organizations, Community groups; this should involve improving the management skill of concerned staff such as PA managers, volunteer groups involved in management of PAs and non PAs, community groups involved in management of village/pachayat forests, etc.).

- **Developing skills of rural people for economic optimization** (5-10 years; NGOs, UPFD and other relevant Departments such as Horticulture, Agriculture, Floriculture, Fisheries, etc., focus should be on training of rural masses especially women groups to harness optimum benefits from the available resources; including processed products, cultivation techniques, post harvest and storage techniques and marketing skills).

9.3.4. Review and reforming forest and PA policies (5-10 yrs)

- **Policy for targeted expansion and protection of forest cover** (10-20 years; UPFD; Agriculture Department, NGOs and Community groups; this should focus on target oriented aforestation/protection programmes for different categories; promotion of social and farm forestry; ritual and sacred groves, etc.).

- **The PA policy considers holistic view of biodiversity** (5 years; UPFD, Wildlife Department, Research Organization such as WII; policy should not consider only the high profile animals but include ecosystem approach wherein all species, their habitats and interactions are taken care; policy should incorporate recommendations of 9.1.1 and 9.2.4).

- **The PA policy incorporates community participation as integral element** (5-10 years; UPFD, Wildlife Department, NGOs, Community groups; policy should advocate joint PA management system wherein local communities are involved in management planning and implementation, the recommendations of 9.2.4 may form basis for the policy development).

9.3.5. Review and reforming state agriculture policies

- **Increase in cultivated area, productivity and cropping intensity** (5-10 years; Department of Agriculture, Wasteland Development, Soil Conservation and Allied Departments; this should consider plans for treatment of problematic (salt affected, ravinous, usar) and culturable wasteland; also consider the possibilities of developing agriculture on scientific lines-see Box). Effective and improved land management should also form an integral component of this policy-Box).

Box *(Mainly based on Agriculture Policy Uttar Pradesh, 1999)*

Action Point: Increase in cultivated area and cropping intensity

Action plan: By treating problematic (salt affected, ravinous, usar, etc.) and culturable wastelands of the State. State Land Use Commission has identified some problem areas of the State and now proper reclamation programmes/schemes should be formulated for increasing the cropping land of the State. However, an impact assessment of this would be absolutely necessary, before implementing it.

Action point: Water resource management for agriculture

Action plan: Gangetic plains are the main fertile region of the State, which produces highest food grain. The main regional problem due to water (rivers) is soil erosion (ravination), usar and bhur lands, floods and water logging. There is a need for rational utilization of surface and under groumd water resources for checking land degradation. Catchment protection and command area development must form an integral part of the water resource development and utilization.

- **Participatory management of common property** (5-10 years; UPFD, Revenue, Agriculture, Community groups, etc; this policy should clearly define the common property resources, root causes of the crisis with respect to common property resources and suggest the potential uses of such resources and sharing of benefits).

- **Policy on crop diversification** (5-10 years; Department of Agriculture, Horticulture, Sericulture, Fisheries and other relevant Department; Community groups etc.; this policy should promote multiple cropping systems, integrated production system combining traditional crops, livestock, fish, poultry, etc.; encouraging cultivation of medicinal plants, sericulture, floriculture, apiculture, etc.; also desired with a proper definition to area of operation which should not affect the traditional crop diversity-see Box).

Box *(mainly based on Agriculture Policy Uttar Pradesh, 1999)*

Crop diversification for increasing the economic growth and prosperity of rural masses

Action point: To promote cash crops

***Action plan*:** Agricultural economy should be boosted up particularly by providing incentives to small and marginal farmers. Higher priority should be given to cash crops, paddy, maize, pulses and oil seeds. Improvement of agricultural productivity for more income gainful employment for eastern region is required. Productivity of agricultural resources must be improved by giving high priority to paddy, maize, pulses and oil seeds cultivation for increasing the income of farmers, animal husbandry, poultry farming and fisheries should be promoted for employment. Commerical crops like sugarcane, oil seeds (including ground nut), pulses and fruits should be promoted in view of the metropolitan markets of Kanpur and Lucknow.

Action point: To expand the fruit and vegetable production (horticulture)

Action plan: Traditional horticulture crops will be expanded to new areas in order to increase the productivity of fruits, vegetables and use of hybrid seeds will be promoted.

Action point: To promote fish farming

***Action plan*:** Fish farming should be supported by developing cooperatives with restocking and enhancement of indigenous fish species and integrated fish –cum-crop systems. Introduction of exotic fishes displaces indigenous fish species, some times disposes traditional fisher folk, and affect wildlife dependent on indigenous fish species.

Utilization of water logged land –a story of successful farmer By J. C. Markanday (Indian farming January 1999) (For Fish Farming)

Action point : To develop a management plan for the pastoral land

Action plan: Livestock grazing should be allowed on rotation basis in the pastoral land to ensure the preservation of pastoral ecosystems. Pastoral land supports the preservation of pastoral ecosystems, a better distribution of water points and their management. Livestock production give rise to significant pressures due to localized over grazing, access to water points etc. Uncontrolled growth of livestock may lead to degradation of pastoral land.

Action point: Cultivation of medicinal plants

***Action plan*:** Regulation of Medicinal Plants in U.P. with special reference to cooperative trading in Medicinal Plants. Farmers' Cooperatives should be developed at district and regional levels to ensure the sustainability and equity.

Action point : To promote Sericulture, Floriculture, Apiculture, and Poultry Farming and Dairying

***Action plan*:** U.P. has a long tradition of silk reeling and is a major production center of silk garments. Agroclimatic conditions in the State are suitable for large-scale production of silk, Mulberry cultivation and cocoon rearing business for farmers and agricultural labours. There are good prospects for floriculture in western area in the State. There is a tradition of growing aromatic flowers in the Kannaje area. There are many success stories of private entrepreneurs in floriculture. Bee keeping is also an important income geenerating enterprise for the poor farmers and agricultural labourers. At least **10,000 birds** will be given the status of agriculture farms with similar facilities the participation of livestock rearers and private sectors will be augmented for production of green fodder. U.P. is the largest milk producing State, there are 32 milk processing plants in cooperative sectors having a capacity of 2.286 million litters also there are 120 dairies in the private sectors with a capacity of 0.91 million litters per day.

- **Policy on promoting agricultural practices to conserve diversity** (5-10 years; Department of Agriculture and other relevant agencies; this policy should focus on effective management of weeds in different agro ecosystems of State consider recommendation under 9.1.3, planning for elemination of crop uniformity and maintenance of traditional crop/ livestock varieties consider recommendations under 9.1.2 and 9.2.3. See Box).

Box *(Mainly based on Agriculture Policy, Uttar Pradesh, 1999)*

Action point : Develop eco-friendly farming systems, which would improve the soil fertility

Action plan: Establishment of laboratories, which can produce large quantities of various biomaterials including biofertilizers and adequate supply of quality seeds for green manuring.

Action point: Eleminate agricultural policies that promote excessive uniformity of crops and crop varieties or that encourage the over use of chemical fertilizers and pesticides.

Action plan: Organic farming should be promoted to avoid greater use of chemical fertilizers and pesticides

Action point : Management of weeds in agro- ecosystems

Action plan: Weeds not only compete with the crop plants for nutrients, water, light and space, but also release allelochemicals detrimental to the crop plants. Several measures advocated for controlling weeds require extra manpower, materials and money since they are to be executed separately on specific day/time. However,

although not completely controlled, the competition by weeds could be through manipulation of several agronomic practices, such as choice of crops or crops' cultivars, row spacing, seed rate, timely sowing, intercropping, selective stimulation of crops by placement of fertilizers, proper irrigation schedule, mulching, soil solarization, etc.

Action point: Elemination of crop uniformity

Action plan: Strengthen local capacity for maintaining and benefiting crop and varietal diversity. Traditional crop farming should be encouraged, strengthen crop and livestock genetic resources conservation and implement the State initiatives for the security and sustainable use of plant genetic resources.

Maize –based crop sequence in U.P. tarai region By J.K. Kwatra and R.C.Gautam (Indian farming May 2001)

A system analysis approach has to be adopted for maize- based crop sequence to increase the production of various levels of management. Besides there is an urgent need to plan an alternate cropping system in view of the needs, prizes, priorities, returns and ecology. The maximum benefit: cost ratio was observed in maize –lentil (1.44) intercropping when compared with 12 intercropping present systems - (1) Maize –wheat, (2) Maize-maize, (3) Maize- mustard, (4) Maize-lentil, (5) Maize –gram, (6) Maize+soybean-maize, (7) Maize+urd- maize, (8)Maize- maize+toria, (9) Maize –toria- maize, (10) Maize-toria – wheat, (11) Maize –mustard- moong, (12) Maize-potato-wheat.

- **Policy for agriculture education, awareness and extension** (5-10 years; Agriculture Universities, other relevant Departments; this should focus on formulation of farmer based curriculum; training material; policy should take note of recommendations made under 9.2.3 and 9.3.5; also special provision be made for women empowerment. see Box).

Box *(mainly based on Agriculture Policy Uttar pradesh, 1999)*

Action point: Promote agricultural education and introduction of farmer based curriculum

Action plan: Only two Agricultural Universities are working in this large State. New Agricultural Universities should be established in western and Bundelkhand region of U.P. Farmer based curriculum should be formulated. Regional agricultural problems must be incorporated in the curriculum. Farmers should be educated on these lines. There is a need to move into farmer based and farmer led R & D, cross exchange of innovations from farm to lab and back rather than only one way, and so on.

Action point : Appointment of Kishan mitras in each village

***Action plan*:** Techonology of the lab should be transferred to fields through the appointment of Kisan mitras. Agriculture Universities and Krisi Vigyan Kendras must educate the people/ farmers of the region. Special training programmes should be organized for NGO's and community groups.

9.3.6. Policy development for involving biodiversity in inter-sectoral integration

(10-20 years; representations from various sectors, this policy should clearly mention the integration of biodiversity with different sectors e.g., Urban development, mining, industry, energy, ecotourism, etc. see Box).

Box *(based on Agriculture Policy Uttar Pradesh 1999; Uttar Pradesh main Audhiyogik Vikas – Pragati Evam Samiksha, 1998-99; Planning Atlas of U.P. 1987; outcome of the NBSAP Northern Zone Meeting, Chandigarh October 2001; and other relevant documents)*

(i) Urban /Rural development sector

Action point: To develop State land use planning for whole State

Action plan: Regional land use palnning at whole State level should be done and integration of developmental plans of land uses regional land use plans should be integrated. Government notification requiring all Departments to harmonize there plans and schemes.

Action point: Implementation of rural development schemes for land, water and forest regeneration

Action plan: Rural Development Schemes for land, water and forest regeneration should be implemented by NABARD, IDRB, RES and various other Departments. Rural people must be educated about the various schemes, which are for their welfare.

Action point: Promotion of the creation of a network of green space with diversity in villages/ cities.

Action plan: Rural and Urban Planning Departments should create some green belts in or around the village and city, which can fulfil their demands along with the cleaning of environment.

Action point: Improve the surface collection and treatment system

Action point: Formulation of urban development policies that incorporate biodiversity concerns

Action plan: Urban planning should be done in such a manner that causes lower impact on natural habitats. Municipal waste should be managed in such a way that city can remained in clean conditions. Demographic pressure is increasing in urban areas due to which local disappearance of species and loss of aesthetic values is taking place.

Action point: Prevention of migration of rural population by ensuring adequate livelihood and employment options

Action plans: Employment generating schemes like poultry farming, dairying, fishing, apiculture, sericulture, lac culture, etc. should be introduced in the village sector to reduce the pressure on biodiversity.

(ii) Regional planning sector

Action point : To develop infrastructure like roads which should connect the rural areas with the growth centers / mandi in western region

Action plan: Western region is highly fertile and it has largest net sown area. Infrastructural facilities are very poor in this region due to which market system is not available for rural areas. At least one mandi site is developed in each tehsil. Private entrepreneurs will be encouraged to establish cold storage and cool chains for the strong of perishable commodities in fruits and vegetable markets and fish markets.

Action point: Development of agro/social forestry programmes

Action plan: There are various models of agro forestry/ social forestry programmes which can be adopted in different regions of the State as below:

Main models: Agri – silviculture; Agri – horticulture; Silvi – horticulture; Agri – silvi – horticulture; Agri - silvi –pasture; Silvi – pasture; Horti – pasture; Horti – silvi – pasture and Homestead planting

Sub models: Neem -based agroforestry; Bamboo -based agroforestry and Agro-medicinal plants

Curry leaf – an ideal tree for social forestry By N. Pathak , B.R. Yadav and P.Vasudevan (Indian farming October 2000)
In the present study, it is seen that although the curry leaf is essentially looked upon as flaviurant, there is perhaps sound traditional wisdom in understanding its preservative, nutritive and medicinal nature. The scientific analysis indicates that it is rich in vitamins and mineral and has anti-fungal and anti- bacterial properties.

Exploitation of intercroppong of wheat with fruit trees in Bundelkhand region By A.S. Gill and R. Deb Roy (Indian farming April 2001)
The field trails on interspaces (6mx6m) between wheat and fruit trees were made in Karari, Bhattagaon and Simaradhan from 1989 to 1994 in Bundelkhand region. The highest grain yield of wheat (3654 kg/ha, 4170 kg/ha, and 3791 kg/ha) was observed in all field trials followed by Citrus species in Karari, mausambi in Bhattagaon and pomegranate in Simardha respectively. The interspacing showed following wheat grain yield with other fruit trees: 3474 kg/ha with guava, 3313 kg/ha with jujbe in Karari; 3957 with nibbu, 3919 kg/ha with kinnow in Bhattagaon; and 3214 kg/ha with guava, 3408 kg/ha kinnow, and 3317 kg/ha with jujbe.

Action point: Rotational utilization of surface and underground water resources for western regions to check the land degradation and master plan preparation for harnessing its water resources which can help in the management of floods for eastern region.

***Action plan*:** Development of small water harvesting structures like low–cost farm, pond, gully, bund, stock dam, etc. Rational use of canal water, promotion of minor irrigation schemes like lift irrigation, check dams on the nalas and construction of boundaries. Rural water supplies under 20-point programme.

Action point : Equal dispersal of agro-based industries in the central region.

***Action plan*:** At present most of the industries are concentrated at Kanpur and Lucknow. There is need for their dispersal and balanced regional development of industries particularly agro-based industries like flour mills, oil mills in Rai Bareli, Fatehpur , Unnao, Hardoi , Sitapur, Kherti, Bara Banki and forest based industries like paper and plywood in Kheri and Sitapur and engineering industries in

Unnao,Fatehpur and Bara Banki, Small scale and cottage industries should be developed in a big way because of their employment potential.

(iii) Energy sector

Action point: Promote technologies that contribute to energy conservation in rural and urban areas

Action point: Implement an energy conservation information compaign

Action plan: Awareness programmes about the conservation of energy must be organized at community levels in urban and rural areas

Action point: Development of a guide to good practices for energy development production and transportation

Action point: To develop small hydropower systems

Action plan: Small hydropower systems should be developed in small catchments areas, which will avail lower cost and lesser disturbance to ecosystems.

Action point : Promotion of renewable energy resources

Action plan: Use of hydro and solar powers should be encouraged and use of fuel wood would be promoted. Careful sustainable management and utilization of fossil fuel, high priority to efforts in improving energy use efficiency and conservation.

Action point: To promote the use of energy forms other than wood in arid zones.

Action plan: Use of solar power will be promoted and building up of biomass energy sources.

Action point: To formulate appropriate sitting and clearance policies

Action plan: Appropriate policy formulation should be done for conservation and utilization of energy

Action point: Strengthen policies those exist already

Action plan: Policies and laws those exist already are to be strengthened and these should followed strictly.

(iv) Mining and Mineral sector

Action point: To explore the mineral rich areas

Action plan: Through exploration of mineral rich areas throughout the State. Proper quantification and costing should be done for extraction of those minerals. It may be useful to produce a map overlaying the rich biodiversity areas with the mineral rich areas, as an aid to ecologically sensitive land use planning.

Action point: Promote ecologically sustainable mining excavating practices

***Action plan*:** Environment impact and cost analysis must be done before starting mining in that particular area. How much mineral resources are present in that particular area.

Action point: Formulate norms of mining specifying those ecologically fragile areas are off –limits to mining.

Action plan: Identification of ecologically fragile areas must be done and these zones must consider specifically.

Action point: Build implementation of environmental measures, and restoration, into mining proposed budget.

***Action plan*:** Strengthen environmental impact analysis procedures. The impact analysis must be done for each mining site. Impact of mining on soil, land, flora, and fauna, forests and other parameters must be determined. Integration of biodiversity concern into Environmental Impact Analysis and ensure public participation in Environmental Impact Analysis, through public hearing, full transparency of reports and data, and so on..

Action point: Pollution estimation from these industries

Action plan: What type of pollution these industries are causing. Proper drainage systems should be implemented for wastes of these industries. Recycling of mining wastes should be done.

Action point: Create reforestation areas around quarries and mines

Action plan: Live fencing of multipurpose trees and shrubs should be done around the mining areas and ore processing units. Promote the restoration of mining sites to as close to as original habitats. Involve the local affected communityin this, and ensure that benefits reach them.

(v) Industrial sectors

Action point: Estimation of biodiversity used in the industries

Action plan: Forests based, agricultural based and textile based industries directly use the biodiversity. Forest based industries- paper and pulp, gum and resin, lakh and match industries are based on various tree species. Therefore, plantation of such tree species, which are used in these industries, should be encouraged. For sustaining these industries proper ecological attention should be paid in the amount and type of bio- resources they are using.
Mainly the industries are divided into seven groups based on the industries that are dependent on using bioresources, and those that impact bio-resources/biodiversity through other means including diversion of ecosystems.

1: Mineral based industry	- Destroy biodiversity
2: Forest based industry	- Use biodiversity
3: Agricultural based/food industry	- Use biodiversity
4: Chemical based industry	- Destroy biodiversity
5: Engineering based industry	- Destroy biodiversity

6: Textile based industry - Use biodiversity
7: Service industry - Destroy biodiversity

Action point: Separate staff for biodiversity maintenance

***Action plan*: W**ell-trained staffs should be appointed in each industry for the special maintenance of biodiversity. Regular training of managerial and work staff on environment and biodiversity issues.

Action point: Effect of industries on environment /biodiversity

Action plan: Environmental Impact Analysis including biodiversity must be done. Promotion of both, persuasive and punitive approach for motivation and facilitation of industries for pollution control. People's participation need to be ensured.

Action point: Consumption of biodiversity related resources by the industry

Action plan: Consumption of biodiversity in a particular industry should be estimated and detailed study must be done that either this industry is going to arrange the consumed biodiversity or what type of arrangements it has made for the sustainable use of this biodiversity.

Action point: Special tax incentives for biodiversity based enterprises

Action plan: Tax arrangements must be done for these industries. Separate tax incentives should be made for biodiversity consuming and using industries. Tax relaxation or some reward should be given to those industries, which have special interest in biodiversity conservation.

Action point: Promotion of resources efficient and low cost technologies

Action plan: Low cost technologies should be promoted which can make resources more efficient for people

Action point: To establish medicinal industry on the basis of production of medicinal plants

Action plan: Documentation of indigenous uses of medicinal plants, promotion of cultivation and popularization of these species in the medicinal industries are urgently required. **(**According to the report of World Health Organization, in the recent time also world's 80% population depends on the traditional plants for their primary treatments. Due to their renewability of the plant medicines the man is very much dependent on these medicines as demand of these medicines are increasing due to increasing population and the habitats of these plants are destroyed, any effective step is not taken by the Government for their availability for future generation also. Today many of the medicinal plants are going to be extinct or their hereditary sources are on the verge of extinction. But the detailed information about these is totally lacking. No any solid plan is made for the conservation of most of these extinct species. e.g., there is a low quality of material conserved in gene banks. Similarly discoveries of new medicines are paying more attention whereas the uses of traditional medicines are remained uncared).

Action point: Promotion of ecotourism

Action plan: Ecotourism can, increase the value of maintaining ecosystems in their natural state; there by providing both Government and local communities with incentives for conservation. In general, ecotourism should –

- Provide significant benefits for local residents
- Contribute to the sustainable management of natural resources
- Incorporate environmental education for tourists and residents
- Be developed and managed to minimize negative impact on the environment and local culture

9.4. Gaps in Institutional and human capacity

(Please also see recommendations under 9.1.5, 9.3.1, 9.3.3 and 9.3.5)

9.4.1. Reducing the rigid mindsets and isolated approach of working

(5 years; the recommendations under 9.1.5 and 9.3.1 are believed to improve flexibility of mindsets of Departments and interdepartmental/inter Institutional coordination; also coordination between GOs, NGOs and local communities).

9.4.2 Participatory planning and resource management

(5 years; please see recommendations under 9.2.4, 9.2.5, 9.3.3, 9.3.4 and 9.3.5).

9.4.5.Improving infrastructure and funding support

(5-10 years; please see recommendations under 9.1.5, 9.2.1, 9.3.1 and 9.3.3).

ACKNOWLEDGEMENT

We thank to the Director, Dr. Mohinder Pal for his support and encouragement. Dr. L.M.S. Palni provided able guidance all through. The document has been prepared on the basis of inputs of Drs. B.S. Burphal, Pia Sethi, S.K. Srivastava, K.N.Bhatt, Jamal A. Khan, A.K. Singh, Satthya Kumar, Awdesh Kumar Sharma and Arun Kumar (all members of the group); Dr. V. K. Shukla (Special invitee), Dr. D. K. Pande, ICAR, Jabalpur and our own compilation, collation and analysis. Dr. S.S. Samant helped a great deal in compiling the information. He was ably supported by Dr. Asha Tiwari who did hard work in putting various aspects together. Dr. R.S. Rawal also did hard work and helped in compilation. Help received from Dr. Kishor Kumar Kothari, Mr. Shreekar Pant, Mr. H. C. Joshi, Mr. S.C. Arya and Mr. B.M. Joshi during word processing is also acknowledged**.**

BIBLIOGRAPHY

Agriculture Policy of Uttar Pradesh, 1999. Government of Uttar Pradesh,Uttar Pradesh.

Agriculture Statistics, Uttar Pradesh (Annual) Director of Agriculture , Uttar Pradesh.

Ahmad, S., 1942. Three new species of *Riccia* from India. *Curr. Sci.* **11**: 433-434.

Ahmad, M.R. 1967. Algal flora of some ponds of Kanpur. *Hydrobiologia*, **29(1&2)**: 156-164.

Ahmad, M.R. 1972. Algae of Allen forest lake Kanpur, India. *Nova Hedwigia*, **23 (1)**: 125-129

Asthana, A.K. and S.C. Srivastava 1991. Indian Hortworts. *Bryophyt. Biblioth.*, **42**: 1-158.

Bapna, K.R. and P. Kachroo 2000. *Hepaticology in India **I & II***. Himanshu Publication, India.

Bendre, A.M. and S. Kumar. 1975. Cyanophyceae of Meerut. *Phykos*, **14 (1&2)** : 1-7.

Bhatia, P.C., N.T.Yaduuraju and B. Daury 1999. Argemone- the killer weed. *Indian Farming*, **48(10)**:16.

Bilgrammi, K.S., Jamaluddin and M.A. Rizvi 1991. *Fungi of India*. Today & Tomorrow, New Delhi.

Brufal, B.S. 2001. *Report on socio- economic profile of Uttar Pradesh*, submitted for NBSAP U.P. Project. Conservator of Forest, North Kumaun Circle Nainital.

Bulter, E.J. and G.R. Bisby 1931. *The Fungi of India*. Imp. Coun. Agr. Res. India, Sei. Mono, **1.** pp. 237.

Central Zoo Authority, 1998. Zoo-Instrument for conservation. National Zoo Policy and Status & guidelines related with Zoo management, Ministry of Environment and Forests, Government of India, New Delhi.

Central Zoo Authority, 2000. List of mini-zoos and Deer Parks of Uttar Pradesh, Ministry of Environment and Forests, Government of India, New Delhi.

Chaturvedi, U.K. and U.C. Pandey 1976. A list of blue green and green algae from Rohilkhand division, U.P., India-IV. *Phykos*, **15(1&2)**: 127-131.

Chaturvedi, O.H., R. Mishra, and R. Prasad 1998. Mustard straw – a potential roughage source for sheep feeding . *Indian Farming*, **47(11)**: 23-24.

Chandra, A. and. D.C. Pandey 1982. Distribution of algae on the walls of buildings. *Phykos*, **21**: 122-123.

Chawdhury, N.P. 1973. *The Pteridophyte Flora of the Upper Gangetic Plain*. Navyug Traders. New Delhi.

Choubey, R.N., A.K. Roy and S.V. Prasad 2001. Bundel jai 851 oat a new high quality multicast fodder variety. *Indian Farming*, **51(2):**6-7.

Das, T.K. and N.T. Yaduraju 2000. Nitrogen combats and weed menace in wheat. *Indian Farming*,**50(8):** 17-19.

Das, A.K., A.C. Shukla and A.B. Gupta 1965. The Utilization of hydrophytes as sources of subsidiary protein food. *Ichthyologica*, 4(1&2) : 50-52.

Mohan, D., Pia Sethi, K.K. Mohapatra, and D.D.B. Rao 2000. Ex-situ conservation position paper series for the Biodiversity Strategy and Action Plan Development Process. Prepared for the Uttar Pradesh and Uttaranchal Pradesh Forest Departments under the U.P. Forestry Project. Report prepared by TERI Forestry and Biodiversity Group, New Delhi.

Mohan, D., Pia Sethi, K.K. Mohapatra, and D.D.B. Rao 2001. Ecosystems of conservation value outside the Protected Area Network of Undivided Uttar Pradesh Prepared for the Uttar Pradesh and Uttaranchal Pradesh Forest Departments under the U.P. Forestry Project. TERI Forestry and Biodiversity Group, New Delhi.

Diwakar, D.M. 2000. Urbanisation and conflict of prime agricultural land in Uttar Pradesh. *M. P..J. Soc. Sci.* **5 (2)**: 43-58.

Lal, A.K. and S. S. Ahmad 2001. Book *Social Change in Post Independent India* ed., Govind Ballabh Pant Social Science Institute, Allahabad, Rawat Publications, Jaipur and New Delhi.

Divakar, V. S. 2000. Dainik Jagran, Statement of Divakar Vikram Singh, Ministry for Ministry of Agriculture, Government of Uttar Pradesh, December 23.

Dixit, R.S. and H.C. Pandey, 1984. Plant used as folk medicine in Jhansi and Lalitpur sections of Bundelkhand, Uttar Pradesh. *International J. Crude Drug Res.*, **22**: 47-51.

Dubey, A. N.,V. Pandey, D.K. Upreti and I. Singh 1999. Accumulation of laid by lichens growing in and around Faizabad, U.P., India. *J. Environ. Biol*. **20(3)** : 223-225.

Gill, A.S. and R. Deb 2001. Exploitation of intercropping of wheat with fruit trees in Bundelkhand region. *Indian Farming*, **51(1):**8-10.

Gupta, A.B. 1956. A contribution to the algal flora of the Allahabad district. *J. Res*., **3(1):** 76-81.

Gupta A.B. 1957. The algal flora of some paddy fields an its importance in soil economy. *J. Res***., 4(1):** 1-24.

Gupta, A.B. 1966. Algal flora and its importance in the economy of rice fields. *Hydrobiolagia***, 28(2):** 213-222.

Gupta, A.B. and D.C. Ray 1975. Utilization of algae by some common fishes of two ponds. Nova Hedwigia**, 26(2&3)**: 509-515.

Kachroo, P. 1954b. Morphology of Rebouliaceae II on some seccies of *Mannia*, *Astrella* Beauv., *Plagiochasma* Let L. *J. Hatt. Bot. Lab.* **12**: 34-52.

Kamat, N.D. 1973. Soil algae of a rice field at different depths. *Botanique*, **4**: 101-106.

Kashyap, S.R. 1929. *Liverworts of Western Himalayas and the Punjab Plain*. Vol. I, Lahore.

Kashyap, S.R. 1932. *Liverworts of Western Himalyas and the Punjab Plain*. Vol. II, Lahore.

Khanna, L.P. 1927. *Cyathodium cavernarum* Kunje from Burma. *J. Burma Res. Soc*. **16**: 227-229.

Khanna, K.K., V. Mudgal, G. Shukla and P.K. Srivastava 1994. Unreported Ethnomedicinal Uses of Plants as Aphrodisiac from folklores of U.P. Plain, India. *Bull. Bot. Surv. India***, 36(1-4):** 91-94.

Kumar, H. 1970. Cyanophyceae of Sardhana. *Phykos*, **9(2)**: 79-85.

Kwatra, J.K. and R.C. Gautam 2001. Maize- based crop sequence in U.P. tarai region. *Indian Farming*, **51(2)**:11.

Lindenberg, J.B.W. and J.G.C. Lehman 1832. *Novarum et minus cognitarum stirpium.* Pugillus. IV.

Live stock Census 1993. Board of Revenue, U.P.

Maheshwari, J.K. and J.P. Singh 1987. Traditional Phytotherapy among the Kol tribes of Banda District, U.P. *J. Econ. Tax. Bot***., 9**: 165-171.

Maheshwari, J.K. , K.K. Singh and S. Sah 1981. *Ethnobotany of the Tharus of Kheri district*, Uttar Pradesh, NBRI, Lucknow.

Maheshwari, J.K., K.K. Singh and S. Sah 1986. *Ethnobotany of the Tribals of Mirzapur Distt*. Uttar Pradesh, NBRI, Lucknow.

Maity, S.B. and M.M. Das. 2000.Goat farming – a profitable enterprise at Bundelkhand region. *Indian Farming*, **50(8):**28-29.

Majumder, B. 2001. Social Change in Post Independent Uttar Pradesh in book *Social Change in Post Independent India* (ed. A.K. Lal and S. Sami Ahmad). Govind Ballabh Pant Social Science Institute, Allahabad. Rawat Publications, Jaipur and New Delhi.

Markanday, J.C. 1999. Utilization of water logged land- a story of successful farmer. *Indian Farming*, **48(10):** 15.

Mitra, A.K. 1951. The algal flora of certain Indian soil. *Indian Journal of Agricultural Science* **21(4):** 357-373.

Pal, S, 1975. A checklist of algae from Ghaziabad. *Phykos*, **14(1&2):** 67-76.

Pal, S. and A.K. Yadav, 1974. Some Cyanophyceae from Saharanpur district; A taxonomic enumeration. *Phykos***, 13(1):** 38047.

Pandey, D.C. 1965a. A Study of the algae from paddy fields soils of Ballia and Ghazipur. Districts of Uttar Pradesh, India-I. *Nova Hedwigia***, 9(1-4):** 299-334.

Pandey, D.C. 1965b. A study of the algae from Paddy fields Soils of Ballia and Ghazipur, Districts of Uttar Pradesh, India –I. *Nova Hedwigia*, **10(1-2):** 177-207.

Pandey, D.C. 1966. On the morphology and life history of a form of Gloeocapsa showing some new stages. *Hydrobiologia*, **27(3&4):** 379-384.

Pande, S.K. 1938. Studies in Indian Liverworts- a review. *Journal of Indian Botnical Society*, 221-233.

Pandey, S.N. 1969. Studies on Planktonic algae of Kanpur. *Labdev J. Science Techniques of India*, **78(2)**: 163-167.

Pandey, U.C. and U.K. Chaturvedi, 1979. Algae of Rohilkhand division, U.P., *India. Phykos*, **18(1&2):** 37-43.

Pandey, U.C. and D.C. Pandey, 1980. Diatoms-flora of Allahabad (India)-I. *Proceedings Indian National Science Academy*, **46(3):** 350-355.

Pandey, U.C. and D.C. Pandey, 1982. Additions to the algal flora of Allahabad-VIII, Cyanophyeae. *Phykos*, **21**: 76-79.

Pathak, N.C. and R.N. Ghosh 1962. Fungi of Uttar Pradesh Bull. Nat. Bot. Garden No. **62**: 1-139.

Pathak, N., B.R. Yadav and P. Vasudevan 2000. Curry leaf – an ideal tree for social forestry. *Indian Farming*, 50(7):42-44.

Planning Atlas, 1987. Planning Atlas of Uttar Pradesh. Govind Ballabh Pant Social Science Institute, Allahabad

Prasad, B.N. 1952. Some Nostocaceae from Uttar Pradesh. *J. Indian Bot Soc*., **31(4):** 358-361.

Prasad, B.N. 1964-65. On the algal flora of river Yamuna in Varanasi district. *Journal of Science Research* BHU, **15(1):** 142-151.

Prasad, B.N. and D.K. Asthana 1975. Genus Chaetopeltis Berthold in India. *Curr. Sci.*, **44(21)**: 781.

Prasad, B.N. and Asthana, D.K. 1976. On genus Chlorotylium Kuetz, A new addition to the India flora. Geophytology, **6(1)**: 82-86.

Prasad, B.N. and D.K. Asthana 1978. Coleochaete pseudosoluta. New addition to the Indian flora. *Curr. Sci.*, **47(5)**: 176.

Prasad, B.N. and D.K. Asthana 1979. A wadhietta. A new genus of family Coleochaetaceae. *Hydrobiologia*, **62(2):** 131-135.

Prasad, B.N. and R.K. Mehrotra 1978. Some new addition to cyanophyceae flora of India. *J Ind.Bot Soc*., **57(1):** 98-101.

Prasad, B.N. and R.K. Mehrotra 1979. Some Cyanophyceae new to Uttar Pradesh. A. Check list. *New Botanist*, **6(1):** 1-9.

Prasad, B.N. and P.K. Mishra 1979. On a Xanthophycean alga new to India. *Curr.Sci*., **48(2):** 544-545.

Prasad, B.N. and R.K. Mehrotra 1980. Blue green algae of paddy fields of Uttar Pradesh. *Phykos* **19(1):** 121-128.

Prasad, B.N. and M. Saxena 1980. Ecological study of Blue green algae in river Gomati. India Journal of Environment Hitn., **22(2)**: 151-168

Prasad, B.N., R.K. Mehrotra and Y. Singh 1978. Four new taxa of the genus Lynghya Ag. From Paddy fields of Uttar Pradesh. Acta Botanica Indica. **6:** 75-80.

Ramachandran, R. 1989. *Urbanization and Urban system in India*, Oxford University Press, New Delhi, ch. X, PP. 293-301.

Rao, C.B. 1935. A new species of *Stichosiphon* (*Stichospihon indica* sp. nov.) *Proc. Ind. Acad. Sci.* (b), **2(6)**: 535-538.

Rao, C.B. 1936. The myxophyceae of the United Provinces, India II. *Proc. Ind. Acad. Scien.* **3(2):** 165-174.

Rao, C.B. 1937. A new species of *Anabaena* (*Anabaena ambigue* sp. nov.) *Ind. Acad. Sci.* **5(b):** 101-108.

Rai, L.C. and Kumar, H.D. 1976. Systematic and ecological studies on algae of some habits polluted with fertilizer factory effluent. *Nova Hedwigia* **27**: 805-811.

Rai, L.C. and H.D. Kumar 1979. Studies on some algae of polluted habitats. *Recent Research in plant science*. (ed. S.S. Bir) Kalyani Publisher. New Delhi, India.

Rai, L.C. and H.P.D. Kumar 1980. Algae and the problems of water pollution. *Recent advance in biology of microorganisms*, **1**: 127-140.

Saxena, S.K. and J.P. Tripathi 1989. Ethnobotany of Bundelkhand-I. Medicinal uses of wild trees by the tribal inhabitants of Bundelkhand region. *J. Econ. Tax. Bot.* **13(2):** 381-389.

Saxena, A.P. and K.M. Vyas 1981. Ethnobotanical records of infectious diseases from tribals of Banda district. *J. Econ. Tax. Bot*. **2**: 191-194.

Saxena, A.P. and K.M. Vyas 1993. Antimicrobial activity of *Alectra parasitic. A. Rich* var. *chitrakutensis* Rao. *J. Econ. Tax. Bot.* **17(1)**: 55-59.

Shah, N.C. 1982. Herbal folk medicine in Northern India. *J. Ethnopharmacology*, **6**: 293-301.

Singh, D.K. 1997. Liverworts. In (eds. V. Mudgal and P.K. Hajra) Floristic Studies and Conservation Strategies in India I. Dehradun. pp. 235-300

Singh, D.K. 2001. Diversity in Indian Liverworts : Their status, vulnerability and conservation. In (eds. V . Nath and A.K. Asthana) Perspective in Indian Bryology. Dehradun. pp. 325-354.

Singh, R.B. 2001. Provisional Population Totals Series 10;Uttar Pradesh. Census of India 2001; Directorate of Census Operations, Uttar Pradesh.

Singh, R.N. 1959. Contribution to our knowldege of the freshwater algae of Northern India-I. Oedogoniales. *Proc. Indian Acad. Sci*., **4(2)**: 97-107.

Singh, C.S. 1961. A systematic account of the freshwater diatoms of Uttar Pradesh II. *Proc. Nat. Acad. Sci. India*, **31(b)**: 203-223.

Singh, C.S. 1963. A systematic account of the freshwater diatoms of Uttar Pradesh III. Diatoms flora of river Ganga and Baruna of Varanasi. *Proc. Nat. Acad. Sci. India* **29**: 622-631.

Singh, U.P. and O.N. Saxena 1969. Preliminary Studies on algal succession in raw and stablized sewage. Hydrobiologia. **34(3&4):** 503-512.

Singh, A. and D.K. Upreti 1991. Lichen flora of Lucknow with special reference to its Historical monuments. In Biodeterioration of Cultural Property, Proceedings of the International Conference, Feb. 20-25, 1989(eds. Agrwal O.P. and Dhawan). Lucknow.

Sinha, B.K. and S.K. Srivastva 1998. Utilization of Ethnobotanical Plant resources of Southern U.P. Plea to conserve. Agriculture in 21st Century Proceeding 161-170.

Srivastava, S.C. 1994. Bryophyta : Morphology, Systematic, reproductive Biology. In (ed. B.M. Johri) Botany in Indian- History and progress. New Delhi. pp. 387-436.

Srivastava, S.K. 2001. Floristic Diversity of Uttar Pradesh –An Overview .Report submitted for NBSAP U.P. Project, BSI, Dehradun.

Srivastava, P.K., K.K. Khanna and V. Mudgal 1992. New Traditional herbal remedies from the rural folklore of Hamirpur district U.P. *J. Econ. Tax. Bot. (Addl. Ser.)* **10**: 399-404.

State of Forest Rreport 1999. Forest Survey of India, MoEF, New Delhi.

Statistical Diary, U.P. 1995. State Planning Department, Planning Directorate, Lucknow, Uttar Pradesh.

Statistical Diary,U.P. 1995. Economics and Statistics Division, State Planning Institute,U.P., Uttar Pradesh.

Pia Sethi 2001. Biodiversity conservation and law in Uttar Pradesh- Constraints, Opportunities, Strategies Report prepared by Tata Energy Research Institute New Delhi.

Udar, R. 1976. Bryology in India, New Delhi

Udar. R. and V. Chandra, 1956. Morphology and Life Histroy of *Plagiochasma intermedium* L.et G. *J. Hatt. Bot. Lab*. **28**: 75-93.

Upreti, D.K. and A. Bajpai (ms) Pollution monitoring in Lucknow City with help of lichen transplatation technique, M.Sc. Environmental Dissertation submitted to Lucknow University, Lucknow.

Uttar Pradesh Forest Department (Silviculture Division, Working Plans and Research Circle), 1950: List of Preservation plots and Protected trees.

Uttar Pradesh main Audhiyogik Vikas 1998-99; Pragati evam samiksha,Udhyog nideshalaya, Uttar Pradesh(neyojan avem samanaya anubhag, Kanpur)

Vani, S. 1997. Data collected by Sanjay Vani, World Bank, New Delhi as cited in UPFD, 1997.

Venkataraman, G.S. 1957. The algal flora of the Ponds and Puddles in side the Banaras Hindu University Grounds, India. *J. Bombay nat. Hist. Soc*., **54(4):** 908-919.

Venkataraman, G.S. 1959. Some new and interesting forms of oedogonium from Uttar Pradesh, *J. Bomb. nat. Hist Soc*., **56(1):** 60-65.

World Resources, 1998. WORLD resources Institute, United Nations Environment Programme, United Nations Development Programme. Oxford University Press New York. 369 pp.

Wildlife Institute of India (WII), 1994. Report on disease investigations on the captive musk deer, Kanchula Kharakh Musk Deer Breeding Centre. P.O. Bag 18, Chandrabani, Dehra Dun.