Chapter 14

Environment: Status and Strategies

14.1 Introduction

The principles of ecologically sustainable development (ESD) are increasingly being accepted locally, nationally and internationally. Legislative initiatives, strategies, action plans, policies and programmes that incorporate ESD principles have been initiated at all institutional levels from the United Nations, national governments, business organisations, corporations, and network of community groups. ESD terminology has become interchangeable with the more commonly used term 'sustainable development' or 'sustainability'. The wider acceptance of ESD principles has shifted the goals for management of environment towards long-term sustenance. At the same time, the inherent risks of irreparably depleting or degrading the natural resources over the short to medium term are increasingly being recognised.

Population growth places additional pressure on the natural environment through the consumption of natural resources and the generation of wastes and other inputs capable of degrading the quality of soil, water and air. This causes loss of native flora and fauna and, as more recently noted, influences global climate change.

The natural resource base on which all human activities rely is often described as renewable or non-renewable. Limits may be more apparent in terms of non-renewable resource consumption, but there is increasing recognition of the limits or thresholds for renewable resources as.

The main objectives of this chapter are to delineate framework for environmentally sustainable development of Uttar Pradesh so as:

- To ensure a path of economic well-being that safeguards the welfare of future generations, often referred to as 'intergenerational equity'.
- To enhance the individual and community well-being within and between generations, often referred to as 'intergenerational equity'.
- To conserve and protect biological diversity and essential ecological processes and life-support systems.

The chapter considers major environmental themes *viz*., Air, Water, Biological and Noise and their current status using available data to highlight responses or actions under way to address them.

Accordingly the chapter is organised as follows: Section 14.2 discusses the air environment in terms of the sources of air pollution, status and assessment of air quality, areas of critical air quality and the impacts on human healh. Section 14.3 deals with the water environment in terms of the sources of water pollution, status and assessment of water quality, both surface and groundwater quality in the different regions. Section 14.4 discusses the biological environment of Uttar Pradesh. Noise pollution is discussed in Section 14.5. The last section 14.6 brings out the summary and recommendations.

The study region of Uttar Pradesh is divided into two parts on the basis of the resource base and eco-system dynamics:

- The upper Indo-Gangetic plain and the central Indo-Gangetic plain.
- The Bundelkhand region.

Six districts have been selected considering the above classification *viz*. Varanasi, Jhansi, Agra, Lucknow, Kanpur and Ghaziabad. The other factors responsible for short-listing these districts are eco-resources, geology, geographical location, political and industrial zones and also the availability of data for environmental parameters. These six districts of Uttar

Pradesh are representative of the general environmental status of the state.

The Indo-Gangetic Plain represents Varanasi, Kanpur and Ghaziabad. The two districts, Agra and Lucknow have been selected based on environmental considerations. Jhansi belongs to Bundelkhand region. The data for environmental parameters was not available except for Jhansi, hence, only one district has been chosen for Bundelkhand region.

14.2 Air Environment

Air pollution encompasses a diverse array of natural and anthropogenic emissions, including gaseous constituents, volatile chemicals, aerosols (particulate) and their atmospheric reaction products. Ambient air acts as an atmospheric sink where all emissions are released. Many such emissions are in such small quantities that they get immediately dissipated and absorbed but continuous release of these pollutants build up in the air and pose hazard to human health.

Assimilative capacity of air environment is the maximum amount of pollution load that can be discharged without violating the best designated use of the air resource in the planning region. The phenomena governing the assimilative capacity of air environment include dilution, dispersion, phase transformation and absorption.

14.2.1 Climate of Uttar Pradesh

The climate in the state is both hot and cold. The climate is cool or cold from November to early March although the days are pleasant and often warm. After the middle of March, it gets to be hot and in May, it could rise to 45°C or even more. June is both hot and humid until the south-west monsoon breaks in all its fury. Thus, the temperature varies from 3°C to 46°C. The humidity varies from 45 per cent-50 per cent. The wind speed varies from 3.7-9.6 km/hr.

14.2.2 Sources of Air Pollution

(i) **Point Sources**: Chemical plants, refineries, power plants, paper mills, cement plants, etc.

(ii) **Area Sources**: Dry cleaners, petrol stations, electroplaters, etc.

(iii) **Line Sources**: Automobiles, railways, airways, Vehicles, etc.

(iv) **Natural Sources**: Dust storms, volcanoes, forest, fires, etc.

14.2.3 Emission Inventory

Secondary data on source emission (point, area and line), collected from various sources is analysed for the identification of critical parameters and hot spots. List of type of industries contributing to air pollution is shown in Table 14.1 for some districts.

TABLE 14.1

Type of Industries in Uttar Pradesh

District	*Type of Industries*
Lucknow	Distillery, Brewery, Iron & Steel including foundries, Rolling & Pickling, Casting, Pesticides, Chemicals, Asbestos, Cement, Electronics, Silicates, Timber
Varanasi	Food Products, Tobacco and Tobacco Products, Silk, Textile Products, Wood Products, Leather Products, Rubber, Petrochemical Products, Non metallic & Mineral, Basic metal & Alloy Industries, Metal Products & Parts, Machinery & Machine Tools
Kanpur	Cotton Textiles, Leather Industry, Jute Mills, Woollen Mills, Edible Oil Industries, Chemicals and Chemical Products, Basic Ferrous Industries, Manufacture of Non-Electrical Machinery
Ghaziabad	Heavy & Medium Industries, Small Scale Industries, Handicraft, Rural Industries
Agra	Foundry, Glass Industries, Lime Kiln, Silicates, Refractory, Eriquette, Rubber Industries, Leather industries
Jhansi	Thermal Power Plant, Heavy Electricals, Fertilisers, mostly stone based industries, Handicraft

Source: District Industrial Development Centres, various.

14.2.4 Status and Assessment of Air Quality

The aerometric secondary data pertaining to Uttar Pradesh is collected from all possible sources like UPPCB, CPCB, etc.

The ambient air quality status in the studied region is assessed, based on secondary data collected. The parameters selected for AAQM include SPM, SO_2 and NOx as these are the major criteria pollutants representing emission from fuel usage in all commercial/industrial and domestic activities. The quality is assessed in cities—Kanpur, Lucknow, Agra, Jhansi, Varanasi, and Ghaziabad. The values of SPM, SO_2 and NOx have been compared with standards of CPCB, which is given in Appendix A-14.1.

14.2.4.1 Lucknow

The data for ambient quality were collected from secondary sources and studied. Table 14.2 represents the ambient air quality data of different areas from year 1996 to 2001. The parameters selected for AAQM include SPM, SO_2 and NOx as these are the major

TABLE 14.2

Ambient Air Quality Data (Lucknow)

Location	*Category*	*1996*			*1997*			*1998*			*1999*			*2000*			*2001*		
		SPM	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*
Hazratganj	Commercial	530	33	36	547	34	39	470	31	31	370	24	29	321	28	30	322	28	30
Mahanagar	Residential	399	29	32	368	28	31	386	28	29	328	25	27	354	29	30	358	28	30
Talkatora	Industrial	556	33	35	575	30	33	503	29	33	529	31	34	500	31	33	478	32	34

Source: Uttar Pradesh Pollution Control Board.

Notes: All values in mg/m^3; SPM-Suspended Particulate Matter; SO_2-Sulphur Dioxide Gas; NOx-Nitrogen's Oxide Gas.

criteria pollutants representing emission from fuel usage in all commercial/industrial and domestic activities.

The SPM levels in the commercial areas (from 1996–2001) exceeded 200 μg/m^3 (the CPCB limit for residential/commercial area). But the levels of SO_2 and NOx are within the prescribed limit (i.e. for SO_2 and NOx 80 μg/m^3) by CPCB.

In the residential areas, levels of SPM in all the years exceeded the prescribed limit. However, for SO_2 and NOx the values are within prescribed norms. In case of industrial areas, the SPM levels are near the limit by CPCB (i.e. 500μg/m^3) and levels of SO_2 and NOx are within the prescribed limit.

14.2.4.2 Kanpur

In Kanpur also, values of SPM at all the locations are exceeding the prescribed norms. For commercial areas it varies from 422 μg/m^3 to 597 μg/m^3, for residential areas from 466 μg/m^3 to 568 μg/m^3 and for industrial areas 504 μg/m^3 to 663 μg/m^3 (Table 14.3), these are exceeding from standard values of SO_2 and NOx within the safe limits.

14.2.4.3 Agra

The ambient air quality is extremely poor with reference to SPM in Agra. Prescribed locations are in sensitive category, for which standard limit of SPM is 100 μg/m^3 but in these cases values are very much higher i.e. vary from 312 μg/m^3 to 969 μg/m^3 shown in Table 14.4. Although the level of SO_2 and NOx are within prescribed limits.

14.2.4.4 Ghaziabad

The industrial area of Ghaziabad has been considered for the purpose. At different sites as shown in Table 14.5, SPM concentration in Sahibabad in year 1996, 1997 and 2001 is exceeding the limit is 500 μg/m^3. In 1998–2000, it is within limit. At Bulandshahr road, the SPM values are exceeding the limit to some extent. The values of SO_2 and NOx are again within limit.

14.2.4.5 Varanasi

In Varanasi, the data available are from Jawahar Nagar (residential area). In this SPM of year 1998-2001 is given which are exceeding the standard limit. The

TABLE 14.3

Ambient Air Quality Data (Kanpur)

Location	*Category*	*1996*			*1997*			*1998*			*1999*			*2000*			*2001*		
		SPM	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*
Deputy Ka Parav	Commercial	498	19	16	514	16	14	597	21	17	542	21	17	422	19	17	581	18	15
Kidvai Nagar	Residential	520	20	15	568	16	14	466	21	16	474	22	17	461	21	18	558	18	15
Fazalganj	Industrial	504	20	15	528	16	14	663	21	17	566	21	18	503	21	18	609	19	16

Source: Uttar Pradesh Pollution Control Board.

Notes: All values in μg/m^3; SPM-Suspended Particulate Matter; SO_2-Sulphur Dioxide Gas; NOx-Nitrogen's Oxide Gas.

TABLE 14.4

Ambient Air Quality Data (Agra)

Location	*Category*	*1996*			*1997*			*1998*			*1999*			*2000*			*2001*		
		SPM	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*
Taj Mahal	Sensitive	425	15	12	568	17	16	468	13	10	479	10	09	503	10	09	312	9	8
Bodala	Sensitive (Jaipur House)	383	13	10	504	16	15	460	10	09	435	08	07	535	07	07	477	10	9
Nunhai	Sensitive (Water Works)	474	16	16	808	16	17	798	26	21	969	21	16	549	16	12	600	11	9

Source: Uttar Pradesh Pollution Control Board.

Notes: All values in μg/m^3; SPM-Suspended Particulate Matter; SO_2-Sulphur Dioxide Gas; NOx-Nitrogen's Oxide Gas.

TABLE 14.5

Ambient Air Quality Data (Ghaziabad)

Location	*Category*	*1996*			*1997*			*1998*			*1999*			*2000*			*2001*		
		SPM	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*
Taj Mahal	Sensitive	601	58	79	579	44	44	487	38	52	489	35	27	496	34	31	535	31	41
Bodala	Sensitive (Jaipur House)	666	67	93	471	27	43	536	39	46	526	35	36	514	33	30	513	30	40

Source: Uttar Pradesh Pollution Control Board.

Notes: All values in μg/m^3; SPM-Suspended Particulate Matter; SO_2-Sulphur Dioxide Gas; NOx-Nitrogen's Oxide Gas.

values of SO_2 and NOx are available for only year 2001 and these are under prescribed norms as shown in Table 14.6.

TABLE 14.6

Ambient Air Quality Data (Varanasi)

Location	*Category*	*1998*			*1999*			*2000*			*2001*		
		SPM	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*	*SPM*	*SO_2*	*NOx*
Jawahar	Residential Nagar	446	-	-	396	-	-	467	-	-	466	11	11

Source: Uttar Pradesh Pollution Control Board.

Notes: All values in μg/m^3; SPM-Suspended Particulate Matter; SO_2-Sulphur Dioxide Gas; NOx-Nitrogen's Oxide Gas.

14.2.4.6 Jhansi

In the district Jhansi, only SPM data is available for year 2001. Within air environment, UPPCB is monitoring only SPM because the area is dominant with stone-related industries. The secondary data obtained from different sampling places of Jhansi are shown in Table 14.7. In residential and commercial areas, the SPM values are within limit except in Kishan Mela ground where SPM is 386.38 mg/m^3 which is exceeding the limit i.e. 200 mg/m^3.

TABLE 14.7

Ambient Air Quality Data (Jhansi) 2001

Location	*Category*	*SPM (μg/m^3)*
UPPCB, Jhansi	Residential	188.10
M/s Natraj Mobiles	Commercial	175.93
Kishan Mela Ground	Commercial	386.38
M/s Diamond Cement	Industrial	290.28

Source: Uttar Pradesh Pollution Control Board.

14.2.5 Areas of Critical Air Quality

In view of the analysis of the above data of six districts, it has been observed that value of SPM is greater than the prescribed (standard) limits. Ghaziabad, Kanpur, Agra, Varanasi can be categorised as alarming cities at the view of SPM consideration. The reasons may be attributed as follows:

- industrial operations for steel, iron, cement, etc;
- combustion and incineration of non fossil fuels;
- agriculture, flash from coal;
- vehicular emissions; and
- domestic fuel (wood, coal) consumption.

14.2.6 Impacts on Human Health

The adverse impact due to high level of SPM in consumption with SO_2 and NOx envisaged as:

- considerable increase in illness;
- acute worsening of chronic bronchitis;
- increased absence of industrial workers; and
- children likely to experience increased incidence of respiratory disease.

This AQI analysis indicates that there is a significant increase in emission causing much alarm, imposing more stringent control requirements on sources of air pollution than ever before. Hence, it is necessary to characterise air pollutant emission sources and the best technology available to control them. Air pollution control strategy provides the guidelines needed to comply with the most recent air pollution standards and regulations for preservation of safe and better environment for the future generation. It aims at maximising the control of gases and particulate emissions.

14.3 Water Environment

The existing scenario of water environment essentially deals with the availability of water resources of acceptable quality and the prevailing quality of utilisation pattern. The water resources of the region depend on the precipitation and the water available from the adjoining region by way of surface water flows through canals. The recharge potentials of groundwater reserves also influence the availability of annual utilisable groundwater resources. The water resources are thus influenced by climate, physiography and hydrogeology of the region.

Assimilative capacity of water bodies is defined as maximum amount of pollutant load that can be discharged without impairing water quality for their designated best usage. The basic phenomenon governing the assimilative capacity of water sources is the self-purification capacity.

14.3.1 Sources of Water Pollution

(a) Point Sources

The two major point sources of pollution in water bodies in study area are municipal and industrial wastes.

(b) Non-point Sources

Run off from rural settlement and agricultural fields is a major nonpoint sources of water pollution due to the excessive use of chemical fertilisers and pesticides for agriculture, the prevailing practices of open defecation and cattle swimming or wallowing. Inadequate solid waste handling and disposal systems in most of the towns further add to the problems.

14.3.2 Status and Assessment of Water Quality

Water quality and the aquatic environment are closely related. Both are strongly influenced by water quantity and all three are interrelated with land use. Urban development altered vegetation cover and other human activities create point and diffuse sources of pollution and change the run off regime, adversely affecting the quality, quantity and seasonal availability of water. Water resource developments also have adverse impacts, to varying degrees depending on the nature of development.

Poor quality water is a concern for nearly all water uses, particularly with regard to potable water supplies. It causes human health problems and environmental damage in waterways. This leads to economic losses through increased costs of health services, disease control and loss of production due to illness, through siltation of estuaries.

Most water uses produce polluted return waters, compounding riverine water quality problems and related impacts on health and the aquatic environment. The cumulative impact of water quality problems is evident at regional, national and global levels.

In developing water resources while maintaining an acceptable standard of water quality, management strategies are necessary to ameliorate the impacts of large scale developments, including release strategies for water supplies, identification of instream flow needs,

fish migration, sediment management and disease management. Preferably, water resource developments should be evaluated in a holistic way, and this can be achieved by undertaking the evaluation in the context of regional planning. The water quality of main cities *viz*. Lucknow, Varanasi, Kanpur, Ghaziabad, Agra, Jhansi of Uttar Pradesh are assessed.

14.3.2.1 Water Quality of Main Rivers and Lakes of Study Area

To determine the quality of surface water of main rivers of study area *viz*. Ganga, Saryu, Yamuna, Gomati, Sai, Kalinadi, Ramganga, Rihand, Gahaghara, Rapti, Betwa, Ramgarh lake, etc. UPPCB provided the data on oxygen content and bacteriological parameters of the surface water from the samples of main cities like Kanpur, Kannauj, Allahabad, Dalmau Rae Bareli, Varanasi, Faizabad, Saharanpur, Sitapur, Jaunpur, Renukut, Hamerpur, etc. Water quality category is also assigned to different waters. It is depicted in Table 14.8. The water quality of the rivers/lakes have been categorised by UPPCB as A, B, C, D and E on the basis of CPCB standards.

In Kanpur (D/S) because of low DO content, higher BOD (higher than desirable limit) and enormous number of coliform, the water belongs category E, which is suitable for irrigation, industrial cooling, controlled waste disposal, etc. The Ganga water is of category C in Kannauj (D/S) and (U/S) and Allahabad (U/S) and (D/S). Industrial pollution in Dalmau Rae Bareli, Varanasi (U/S) and in Tarighat (D/S) makes the water unsuitable for drinking. This water quality falls in category D and can thus be used for propagation of wild life fisheries, etc. In Varanasi (D/S), the water is totally contaminated and belongs to category E.

The water of Saryu in Faizabad is also not suitable for drinking because of higher coliform number (category D). The water of river Yamuna in Allahabad can be used for drinking purposes after conventional treatments. Hindan river water in Saharnpur is totally deteriorated because of pollution load. As parameters also depicts the same. In other major rivers of study area, the water quality is not very good because of pollution load and higher number of microbes and the water quality category is C, D or E.

TABLE 14.8

Water Quality of Main Rivers and Lakes of Study Area (Jan-Dec. 2001)

Name of Rivers	*Sampling Point*	*DO (Mg/L)*	*BOD (Mg/L)*	*Total Coliform (MPN/ 100 Ml)*	*Water Quality Category*
Ganga	Kanpur Bithorr	7.6	2.7	2895	C
"	Kanpur (U/S)	7.0	2.5	4600	C
"	Kanpur (D/S)	5.9	4.8	72625	E
"	Kaunauj (U/S)	7.1	2.8	1225	C
"	Kaunauj (D/S)	7.3	3.1	4150	C
"	Allahabad (U/S)	7.5	2.6	1450	C
"	Allahabad (D/S)	7.3	3.0	2263	C
"	Dalmau Rae Bareli	8.7	2.4	5775	D
"	Varanasi (U/S)	8.6	2.3	31833	D
"	Varanasi (D/S)	7.3	9.8	233333	E
"	Tarighat (D/S)	7.8	2.8	43875	D
Saryu	Faizabad, Saryu	9.4	2.2	5475	D
Yamuna	Allahabad, Yamuna	7.5	2.1	1500	C
Hindan	Saharanpur, Hindan (D/S)	1.6	30	≥16000	E
"	Kulsera, Hindan (D/S)	3.7	10.4	2032	E
Gomati	Sitapur, Gomati(U/S)	8.3	1.6	1950	C
"	Lucknow, Gomati (U/S)	7.8	2.3	2761	C
"	Lucknow, Gomati (D/S)	3.7	7.3	50741	E
"	Jaunpur, Gomati (D/S)	7.8	2.9	51333	D
"	Gomati before Meeting Ganga	7.7	2.9	31555	D
Sai	Sai Hardoi	8.0	2.5	2300	C
Kalinadi	Kannauj, Kalinadi	9.0	4.7	65000	D
Ramganga	Kannauj, Ramganga	6.9	2.8	2813	C
Rihand	Renukut (U/S)	8.4	2.7	2125	C
"	Renukut (D/S)	8.3	2.8	2513	C
Ghaghra	Dewaria, Ghaghara (D/S)	8.1	1.9	147	C
Rapti	Gorakhpur, Rapti (D/S)	8.0	2.0	122	B
Ramgarh Lake	Gorakhpur, Ramgarh Lake	9.3	3.3	169	C
Betwa	Hameerpur, Bewa	7.7	2.1	2515	C

Source: UPPCB.

14.3.2.2 Water Quality of Uttar Pradesh

Six districts from Uttar Pradesh namely Lucknow, Varanasi, Kanpur, Ghaziabad, Jhansi, Agra have been chosen for the purpose. The surface and groundwater quality have been studied on the basis of secondary data. These data have been compared with standards given in Appendix A-14.2.

Lucknow

Surface Water Quality

The raw water quality for the physicochemical and bacteriological parameters are depicted in Table 14.9. The data have been taken for the year 1996 and 2000 from CPCB report.

TABLE 14.9

Intake Raw Water Quality (Surface Water)-Lucknow

Parameters	*Range during 1996*	*Values on Dec. 15, 2000*
PH	8.4-8.8	7.9
Turbidity (NTU)	12-29	18.2
Total Alkalinity (as $CaCo_3$)	230-255	260
Conductivity (μmhos/cm)	325-450	600
Hardness (as $CaCo_3$)	160-196	-
Calcium (as Ca^{++})	29-38	-
Magnesium (as Mg^{++})	21-24	-
Chlorides (as Cl^-)	6-8	18.5
Sulphate (as SO_4^-)	5-12	5.7
Iron	0.7-2	46.25
Fluorides (as F)	0.4-0.5	-
Nitrates	0.3	4.51
COD	-	43.6
DO	-	7.96
BOD	-	11.0
SAR	-	1.05
Total Coliform	1700-9000	$10x10^4$
Faecal Coliform	50-9000	$24x10^4$

Source: CPCB.

After going through the values presented in the Table, it can be seen that as compared to 1996, the values of chlorides, nitrates and coliform in year 2000 at the intake point are on higher side. This is due to the following reasons:

The Nagariya drain having significant discharge is meeting the dredge channel meant for drawing water from Gomti just before intake point. Dead and decaying bodies carried into dredge channel, improper desludging of channel and discharge from rehabilitation/rearing of buffaloes in area just upstream of intake point are contributing high pollution loads onto raw water just before intake.

Groundwater Quality

The groundwater quality for the physicochemical and bacteriological parameters is shown in Table 14.10. The data for groundwater quality were collected from secondary sources (CPCB). As water is being drawn from enough depth, the quality of water is conforming the norms laid down for coliform (MPN/100 ml).

Very low fluoride concentrations (below 1.0 mg/l) were found. Therefore, the groundwater at Lucknow is not fit for drinking. In respect of other physicochemical properties, the samples are conforming to either the desirable limits or permissible limits.

The concentration of chromium is exceeding in three locations (>0.05mg/l). Repetitive investigations are needed to check the same. Iron concentration is exceeding the desirable limit at all the locations. One of the reasons may be the characteristic of the stratums of

TABLE 14.10

Groundwater Quality in Lucknow (Dec. 2000)

Sampling Location	*Parameters*																	
	pH	*Conductivity (μhos/Cm)*	*TDS (Mg/L)*	*Chloride (Mg/L)*	*Alkalinity (Mg/L)*	*Total Hardness (Mg/L)*	*Fluorides as F (Mg/L)*	*Sulphate as SO_4 (Mg/L)*	*Nitrates (Mg/L)*	*COD (Mg/L)*	*Coliform (MPN/ 100 ML)*	*Cadmium (Mg/L)*	*Chromium (Mg/L)*	*Copper (Mg/L)*	*Iron (Mg/L)*	*Nickel (Mg/L)*	*Lead (Mg/L)*	*Zinc (Mg/L)*
Alam Bagh	7.4	1410	750	76	480	452	NT	63	19.0	12.0	<2	NT	0.03	0.08	11.98	0.05	NT	0.94
Rajaji Puram	7.8	840	452	51	260	288	0.72	16	4.0	5.1	<2	NT	0.41	0.03	3.69	0.04	NT	0.66
Chowk	7.7	610	348	21	230	229	0.70	55	2.6	NT	<2	NT	4.23	0.02	1.78	0.04	NT	1.01
Hardoi Road	7.6	630	356	8	330	234	0.40	NT	NT	NT	<2	NT	0.30	0.02	2.70	0.02	NT	1.68
Puraina, Sitapur Road	7.4	1160	650	55	410	363	0.60	193	NT	13.7	<2	NT	0.04	0.04	44.24	NT	NT	2.92
Tadi Khana Sitapur Road	7.5	680	388	33	250	240	0.16	NT	NT	12.0	<2	NT	NT	0.03	5.02	0.01	NT	0.49

Source: CPCB.

Note: NT-stands for not traceable.

that area. The samples in respect of copper and zinc concentration were found as meeting either the desirable limits or permissible limits.

Varanasi

Surface Water Quality

The main source of raw water for municipal supply is River Ganges. Intake of water form the river is about 11 MLD, which is about 50 per cent of the total water supplied. The information (secondary data) regarding surface water qualities were obtained through UPPCB.

After going through the values presented in the Table 14.11. It can be seen that all physicochemical parameters are confirming the norms laid down for standards. However, the chloride, alkalinity and hardness are below desirable limits. But pH, DO and BOD are in desirable limits.

Microbiological analysis shows the total coliform (MPN/100ml) is exceeding the desirable even permissible limits. This water can be used as drinking water after conventional treatment.

Groundwater Quality

The groundwater quality for physicochemical and bacteriological parameters are depicted in Table 14.12. Secondary data extracted from CPCB report shows that none of the collected samples is confirming the norms, to be a safe and pure drinking water.

Alkalinity and hardness are exceeding the desirable limits everywhere in Varanasi. It is a natural cause for groundwater in tropical alluvial basin. Therefore, Varanasi being a city in Ganga basin, these high alkalinity and hardness values are common.

Very low fluoride concentrations (below 1.0 mg/l) in all samples were found. Thus, the groundwater at Varanasi is not so fit for drinking particularly for children to whom fluoride above 1.0 mg/l is very much essential for the development of their teeth and bones.

Microbiological analysis confirms that except Sarainandan, the groundwater is contaminated and unfit for drinking. This may be due to poor environmental condition, very poor sanitation and solid waste disposal practices by which the leachates reach the groundwater just below the surface and contaminate it. The concentrations of heavy metals namely cadmium, chromium, copper, lead and zinc were found with in desirable limits.

Kanpur

Surface Water Quality

The surface water quality of river Ganga in Kanpur is not worth drinking. However physicochemical

TABLE 14.11

Water Quality of River Ganga (Surface Water) in Varanasi (March 2002)

Sampling Point	*Parameters*						
	pH	*D.O. (Mg/L)*	*BOD (Mg/L)*	*Chloride (Mg/L)*	*Alkalinity (Mg/L)*	*Hardness (Mg/L)*	*Total Coliform (MPN/100 ML)*
Ganga U/S Varanasi	7.42	8.7	2.3	33.48	174	236	14000
Ganga U/S Assighat	7.44	8.5	2.3	33.98	174	236	17000
Ganga at Wks Intake	7.82	8.4	2.4	34.48	176	238	17000
Ganga D/S Shivlaghat	8.12	8.3	2.4	34.98	176	238	27000
Ganga H. CH Ghat	8.16	8.3	2.4	38.98	180	238	26000
Ganga U/S D'Medh Ghat	8.28	8.0	2.2	35.48	182	240	26000
Ganga U/S D'Medh Ghat	8.36	7.8	2.2	35.48	182	240	34000
Ganga U/S s Jalsen Ghat	8.34	7.7	2.3	34.98	184	242	33000
Ganga M'Larnika Ghat	8.37	7.5	2.4	36.48	184	242	34000
Ganga Trilochan	8.42	7.6	2.2	36.98	188	244	43000
Ganga Telinala	8.46	7.4	2.4	37.48	190	242	46000
Ganga Rajgha	8.52	7.2	2.6	38.48	192	246	63000
Ganga U/S Varuna Conflu.	8.64	7.1	3.4	39.98	192	248	94000
Ganga D/S of Varanasi	8.84	6.7	13.6	42.98	198	259	180000
Ganga U/S Ghazipur	7.25	8.6	2.4	35.48	176	242	17000
Ganga D/S Ghazipur	8.32	7.4	2.8	37.98	189	248	16000

Source: Uttar Pradesh Pollution Control Board.

TABLE 14.12

Groundwater Quality in Varanasi City

Stations	Parameters																	
	pH	*Conductivity(µmhos/Cm)*	*Turbidity (NTU)*	*Alkalinity (Mg/L)*	*PO_4^- (Mg/L)*	*SO_4^- (Mg/L)*	*Cl^- (Mg/L)*	*Hardness (Mg/L)*	*Ca^{++} (Mg/L)*	*NO_3^- (Mg/L)*	*Fluoride (Mg/L)*	*Total Coliform (MPN /100ml)*	*Cd (Mg /L)*	*Cr (Mg/ L)*	*Cu (Mg/ L)*	*Ni (Mg/ L)*	*Pb (Mg/ L)*	*Zn Mg/ L)*
Lanka (BHU)	6.6	780	2.0	350	NT	37	47	429	72	5.6	0.05	>1100	NT	0.02	NT	0.03	NT	0.12
Sarai-nandan	6.68	760	9.5	326	NT	23	42	473	82	5.0	0.08	09	NT	NT	0.01	NT	NT	0.06
Lahartara	6.98	910	8.1	307	NT	96	74	491	62	7.5	0.16	1100	NT	0.01	NT	0.04	NT	0.11
Cantt, Rly. Station	6.90	660	1.6	298	NT	28	32	358	68	4.2	0.10	1100	0.01	NT	0.03	NT	NT	0.26

Source: CPCB.

Note: NT - stands for not traceable.

parameters are in desirable limits but microbiological analysis shows that total coliform is exceeding all limits and totally unfit for drinking. It is shown in Table 14.13.

TABLE 14.13

Water Quality of River Ganga (Surface Water) in Kanpur (March 2002)

Parameters	Sampling Point				
	Bithoor	*Rani Ghat D/S*	*Kanpur U/S*	*Budhiya Ghat*	*Kanpur D/S*
pH	8.5	8.5	8.6	8.0	7.9
DO (Mg/L)	8.4	7.8	8.6	7.2	7.0
BOD (Mg/L)	2.8	4.0	2.4	6.2	6.8
Alkalinity (Mg/L)	152.0	160.0	148.0	168.0	176.0
Total Coliform (MPN/100ml)	2300	4300	1500	9300	4300

Source: UPPCB. Jalsansthan is from May 2001 to April 2002, is presented in Table 14.15.

Groundwater Quality

The groundwater quality for the physicochemical and microbiological parameters in Kanpur is depicted in Table 14.14. The water shows moderate to high mineral content in terms of alkalinity, sulphate, chloride, nitrogen and confirming the norms. But hardness is exceeding permissible limit in Naraindheda station and is little greater in Rakhimandi. Turbidity of water is very high in Rakhimandi. Coliform are in desirable limits except in Jajmau where it is little greater. Heavy metal content of water is confirming norms laid down and is either in desirable limit or below it.

Agra

Surface Water Quality

Physicochemical and bacteriological parameters have been used to determine the surface water quality of Agra. The data provided by Agra Jalsansthan is from May 2001 to April 2002, is presented in Table 14.15.

TABLE 14.14

Groundwater Quality-Kanpur (1995)

Stations	Parameters																	
	pH	*Temp.*	*Alkalinity*	*Sulphate*	*Chloride*	*Hardness (N)*	*SAR*	*Nitrogen*	*Colour*	*Fluoride*	*Coliform*	*TDS*	*DDT*	*Lindane*	*Iron*	*Lead*	*Nickel*	*Zinc*	*Chromium*
Jajmau	7.88	27.17	150.73	17.83	19.43	155.60	5.55	0.32	3.33	0.24	13.33	224	0.00	5.41	0.42	10.8	0.05	0.08	0.00
Panki	7.65	27.5	576.43	176.98	188.38	383.43	16.69	5.41	7.5	1.16	0.0	1208.75	23.53	1.88	25.73	3.67	0.09	0.59	0.03
Naraindheda	7.41	26.75	350.23	69.52	182.38	1534.80	6.34	11.84	2.5	1.37	0.0	858.25	25.51	33.76	0.80	0.00	0.04	0.10	0.01
Rakhimandi	7.65	27.25	413.30	315.15	185.15	617.2	8.82	10.85	45.00	1.28	9.25	1437.75	35.49	15.94	1.10	0.04	0.09	0.54	1.72

Source: CPCB.

pH, DO and chloride of samples of Agra Jal Sansthan are in desirable limits. But BOD and COD in range 4.9-19.25 and 30.15-73.55 mg/l respectively. Which is exceeding the desirable limit and can be attributed to non-degradable organic matter.

Jhansi

Surface Water Quality

For ascertaining the surface water quality status in Jhansi, physicochemical and biological parameters have been used. To determine the quality of surface water, secondary data of representative sampling locations selected by UPPCB for each of the rivers *viz*. Betwa, Mandakini, Ken Yamuna, Pahunj, Govindsagar dam were used. It is depicted in Table 14.16.

Presence of fluoride at different locations was found as not traceable. In terms of mineral content and other physicochemical parameters the quality is confirming the norms.

Groundwater Quality

To determine the quality of groundwater, physicochemical parameters were concerned and obtained through UPPCB (Table 14.17). The water quality in terms of mineral content is with in permissible limits except, in sampling location, near

TABLE 14.15

Surface Water Quality (Yamuna) of Agra at Water Work Intake

Year	*Month*	*Parameters*					
		pH	*DO (Mg/L)*	*BOD (Mg/L)*	*COD (Mg/L)*	*Chloride Demand (Mg/L)*	*Total Coliform (MPN/100 Ml)*
2001	May	8.40	10.2	12.5	64.00	23.25	1280000
	June	8.60	9.6	12.5	49.00	21.50	1280000
	July	8.20	6.1	7.3	35.50	13.25	825000
	August	8.10	6.7	4.9	29.00	6.5	650000
	September	8.08	8.2	7.2	27.00	10.56	1180000
	October	8.80	10.4	19.25	55.00	37.00	1750000
	November	8.69	10.1	15.20	52.50	23.65	1450000
	December	8.61	7.7	12.1	42.00	24.00	1450000
2002	January	8.40	6.7	15.40	73.65	35.00	2000000
	February	8.46	6.85	15.75	48.00	46.50	2100000
	March	8.5	5.6	10.00	30.15	34.50	2000000
	April	8.75	8.7	11.00	37.90	25.80	2000000

Source: Agra Jal Sansthan, Agra.

TABLE 14.16

Surface Water Quality of Jhansi District (2001-2002)

Name of the Rivers	*Parameters*											
	pH	*Colour*	*Odour*	*DO (Mg/L)*	*BOD (Mg/L)*	*COD (Mg/L)*	*TDS (Mg/L)*	*Total Hardness*	*Ca++ Hardness (Mg/L)*	*Mg++ hardness (Mg/L)*	*Chloride. (Mg/L) (Mg/L)*	*Fluoride. (Mg/L)*
Betawa	7.54	-	-	7.8	2.8	24	310	128	72	56	38.34	-
Mandakini	7.0	-	-	6.8	3.0	28	365	164	92	72	32.66	-
Ken	7.3	-	-	6.8	3.6	28	420	130	72	58	39.76	-
Yamuna	7.6	—	-	6.4	4.0	48	384	242	156	86	90.82	-
Pahunj	7.46	Algal	-	7.0	4.0	32	456	130	74	56	44.02	
Govind Sagar Dam	7.5	-	-	7.8	2.9	32	306	104	72	32	29.82	-

Source: UPPCB.

main gate of district hospital, where TDS is 1117 mg/l.

Ghaziabad

Groundwater Quality

For determining the groundwater quality of Ghaziabad the data is obtained through NCR report 1998. Parameters described are physicochemical, bacteriological and demand parameters. It is shown in Table 14.18. Physicochemical parameters are confirming the laid down norms for concentrations of mineral contents. Heavy metal concentration is also under desirable limits but water is fluoride and iron deficient in respect of norms prescribed for their concentration. Microbiological analysis shows that total coliforms are insignificant making it suitable for drinking.

14.4 Biological Environment

Forest is natural habitat for variety of flora and fauna. Uttar Pradesh is endowed with good natural wealth. The diversity of flora and fauna is displayed here due to vast area, large and small rivers, and

TABLE 14.17

Groundwater Quality-Jhansi

Sampling Point	*pH*	*Colour*	*Odour*	*TDS. Mg/L*	*Total Hardness Mg/L*	*Ca++ Hardness Mg/L*	*Mg++ Hardness Mg/L*	*Chloride Mg/L*
Mission Compound near GIC	7.02	Colour - less	Odour - less	340	280	64.13	29.24	58.22
Pahunj Dam, Gwalior Road	7.52	"	"	324	168	36.88	22.90	73.84
Shivaji Nagar, near GSP School	7.38	"	"	348	304	54.51	40.93	115.02
Christian Hospital, Jhokan Bagh	7.30	"	"	364	388	124.25	19.00	122.12
Bus Stand, Kanpur Road, Jhansi	7.57	"	"	338	368	106.61	24.85	132.06
Shri. B.D. Ahirwar Shivaji Nagar	7.56	"	"	364	338	86.16	33.62	130.64
Dr. Dela Mandir, Sadar Bazar	7.20	"	"	860	296	98.11	12.18	120.7
Shiv Mandir, Sadar Bazar	7.08	"	"	744	290	88.18	17.05	107.92
Govind Choraha Road, near Elite	7.34	"	"	659	252	52.10	29.71	136.32
Near Main Gate of District Hospital	7.38	"	"	1117	376	75.35	45.78	122.12
Near Bipin Bihari College	7.52	"	"	362	146	28.86	18.02	51.12
Near Water Tanki, Shivaji Nagar	7.48	"	"	125	80	24.05	4.87	26.98

Source: UPPCB.

TABLE 14.18

Groundwater Quality-Ghaziabad

Stations	*Parameters*																
	pH	*Conductivity(µmhos/Cm)*	*Total Alkalinity as CaCO3*	*Total Hardness as CaCO3 (Mg/L)*	*Chlorides as Cl (Mg/L) (Mg/L)*	*Sulphates as SO_4 (Mg/L)*	*Nitrate as N (Mg/L)*	*Fluo-Rides As F*	*Chro-Mium (Mg/L)*	*Copper (Mg/L)*	*Nickel (Mg/L)*	*Cadmium (Mg/L)*	*Lead (Mg/L)*	*Manganese (Mg/L)*	*Iron (Mg/L)*	*Zinc (Mg/L)*	*Coliform (MPN /100Ml)*
Ghaziabad	7.0	1200	416	244	50	87	11	0.92	ND	ND	0.012	ND	ND	0.063	ND	ND	Nil
Muradnagar	7.0	600	296	252	30	25	18	0.73	0.035	ND	0.013	ND	ND	0.031	ND	0.026	Nil
Hapur	7.1	700	202	244	52	25	24	0.6	ND	ND	0.008	ND	ND	0.016	ND	0.087	Nil
Chopala	7.3	500	258	244	24	113	ND	0.62	0.031	ND	0.004	ND	ND	0.050	ND	ND	Nil
Dansa	7.4	620	322	280	24	13	2.2	0.52	0.034	ND	ND	ND	0.034	0.047	ND	0.021	Nil

Source: *NCR Report*, 1998.

Note: ND-Not detectable.

variety of climatic conditions and different kinds of soils. The plains of Uttar Pradesh were very rich in natural vegetation which however is diminishing due to wide ranging needs of people. Only a few patches of natural forests are found scattered in the plains.

Uttar Pradesh has only 7.05 per cent of forest area (based on records) and 4.46 per cent of forest cover (based on satellite imagery) out of which only 2.09 per cent is dense forest (i.e. crown density about 40 per cent). The Vindhya forest consists mostly of scrub. The districts of Jaunpur, Ghazipur and Ballia have no forest land, while 31 other districts have marginal forest cover.

The soil and climate of Uttar Pradesh mainly support tropical moist deciduous forest in Terai region, tropical dry deciduous forest in all parts of the plain usually in central, eastern and western region and tropical thorny forest in southern-western parts of the state.

Tropical moist deciduous forests are found in the region of Terai. They grow in regions that record 100 to 150 cm of rainfall annually, have an average temperature between 26 and 27°C and considerable degree of humidity. A special feature of the forest is that deciduous trees of uneven size grow on higher altitude regions. Lower altitude regions show several species interspersed with bamboo, climbers, cane and evergreen shrubs. Main trees are *Sal, Ber, Gular, Jhingal, Palas, Mahua, Semal, Dhak, Amla, Jamun, Aruna, Dhausi, Haldu, Khair, Kunju*, etc.

Tropical dry deciduous forests are found in all parts of the plains and usually in central eastern and western regions. The trees are mostly deciduous. Since sunlight reaches the ground in abundance, shrubs and grasses also grow here. Large tracts of these forests have been cleared for cultivation. Important trees are *Sal, Palas, Amaltas, Bel, Anjeer,* etc. *Neem, Peepal, Sheesham, Mango, Jamun, Babool, Imli,* etc. grow along river banks and in other moist regions.

Tropical thorny forests are mostly found in southwestern parts of the state. Forests are confined to the areas which have low annual rainfall (50-70 cms), mean annual temperature between 25°C and 27°C and low humidity (less than 47 per cent). Widely scattered thorny trees, mainly, *Babool*, thorny legumes and Euphorbias are extensively found here. During rains, short grasses also grow here. The trees are generally small here forming open dry forests. Important trees of the region are *Phulai, Khair, Kokke, Dhaman Danjha, Neem*, etc. various types of resin and gum are obtained from these trees.

14.4.1 Types of Forest in Uttar Pradesh

Following forests are present in the state:

Damar Sal Forest, Moist Terai Sal Forest, Moist Plains Sal Forest, Terminalia Tomentosa Forest, Alluvial Savannah Forest, Syzygium Cumini Swamp Forest, Dry Teak Forest, Southern Dry Mixed Deciduous Forest, Northern Dry Mixed Deciduous Forest, Dry Savannah Forest, Anogeissus Pendula Forest, Babul Forest, Aegle Forest, Alkaline Scrub Savannah, Khair—Sissoo Forest, Inundation Babul Forest, Desert Thorn Forest, Ravine Thorn Forest, Zizyphus Scrub, and Euphorbia Scrubs.

BOX 14.1

Plant Species Recorded in Uttar Pradesh

Local Name	*Botanical Name*
	Tree Species
Akola	*Alangium salvifolium (Linn.f.) Warg*
Agar	*Sasbania grandiflora (Linn.f.) Pers.*
Arjun	*Terminalia arjuna W. & A.*
Amrud	*Psidium guajava (Linn)*
Amaltas	*Cassia fistula (Linn)*
Ajan	*Ailanthus excelsa (Roxb)*
Aal	*Morinda tinctoria (Roxb)*
Aallu bukhara	*Prunus communis*
Aam	*Mangifera indica (Linn)*
Aara	*Prunus persica (Stokes)*
Adana	*Terminalia alata (Heyne)*
Akash Neem	*Millingtonia hortensis (Linn)*
Anjan	*Hardwickia binata (Roxb)*
Anjir	*Ficus carica (Linn)*
Ashok	*Polyalthia longifolia (Thw)*
Awala	*Emblica officinalis (Gaerth)*
Babool	*Acacia acacoa aranoca (Willd). Syn. A. Nilotiea (L.) Willd.*
Bahera	*Terminalia belerica (Roxb)*
Bakain	*Melia azedarach (Linn)*
Bargad	*Ficus bengalensis (Linn)*
Barhal	*Artocarpus lakoocha (Roxb)*
Bausa	*Alibizzia odoratissima (Benth)*
Bel	*Aegle marmelos (Corr)*
Ber	*Zizyphus xylopyra (Retz) Willd.*
Ber	*Zizyphus mauritiana (Lamk)*
Bhilava	*Semecarpus anacardium (Linn)*
Bija Sal	*Pterocarpus marsupium (Roxb)*
Chakotara	*Citrus maxima (Merr. & Lee).*
Chandan	*Santalum album (Linn)*
Chilkiya	*Wendlandia excreta (Roxb) DC.*
Chilla	*Casearia tomentosa (Roxb)*
Chitwal	*Alstonia scholaris (Linn.) R. Br.*

Contd. ...

...Contd. ...

Local Name	Botanical Name
Chuka	Croton roxburghii (Bel)
Dhak	Butea monosperma (Lamk.) Taub.
Dhamia	Grewia tiliaefolia (Wall)
Dhatura	Datura stramonium (Linn)
Dhaul	Erthrina suberosa (Roxb)
Dudhi	Holarrhena antidysenteroca (Wall)
Eucalyptus	Eucalyptus bybird L '(Herit)
Gair	Olea glandulifera (Wall) Ex. Dm.
Gamhar	Gmelina arborea (Roxb).
Ganthi	Boehmeria rugulosa (Wedd)
Gaunj	Derris scandens (Benth).
Gawadi	Cochlospermum religiosum (Linn.) Alston
Ghai	Anogeissus latifolla (Wall)
Ghont	Zizyphus xylopyra (Retz.) Willd.
Godani	Cordia rothil (Roem & Schult).
Gogina	Saurauja napaulensis (DC).
Goolar	Ficus glomerata (Roxb).
Gorakh Imli	Adansonia digitata (Linn).
Gudgudala	Sterculia villosa (Roxb).
Gulkher	Althaea officinalis. (Linn)
Gulmohar	Delonix regia (Boj.) Raf.
Gutail	Trewia nudiflora (Linn)
Hainkur	Prosopis cineraria (Linn) D, Ruce.
Haldu	Adina cordifolia (Hook.) f.
Harra	Terminalia chebula (Retz)
Imli	Tamarindus indica (Linn)
Jakranda	Jacaranda mimesifolia (Don)
Jalebi	Pinthecolobium dulce (Benth)
Jalmalaha/Virsa	Salix tetreasperma (Roxb).
Jamrasi	Elaeodendron glaucum (Pers)
Jamun	Syzygium cumini (Linn.) Skeels.
Jarul	Lagerstroemia flosreginae (Retz)
Jhingan	Lannea coromandeliea (Haott.) Merr.
Kachnar	Bauhinia variegata (Linn)
Kadam	Mitragyna parvifolia (Korth)
Kadamb	Anthocephalus indieus (A. Rich)
Kafal	Myrica esculanta (Bunch Ham)
Kaitha	Feronia limenia (Linn.) Swingle.
Kakar	Flacourtia indica (Eurm.F) Merr.
Kala Siras	Albizzia lebbek (Bensh)
Kanak champa	Pterospermum acerifolium (Willd)
Kaner	Nerium indicum (Mill)
Kanji	Pongamia pinnata (Linn.) Piewe.
Karar	Sterculia urens (Roxb)
Karghai	Anogeissus pendula (Edgew)
Kari	Milliusa tomentosa, (Roxb.), Sinclair
Karjua	Caesalpinia crista (Linn.)
Kasia	Cassia siamea (Lam)
Katera	Solanum surattense (Burm).f.
Kathal	Artocarpus heterophyllus (Lamk).

Contd. ...

...Contd. ...

Local Name	Botanical Name
Katsagaun	Haplophragma adonoghylium (Wall.) Dop.
Keeker vilayah	Parkinsonia aculeate (Linn)
Kekara	Phoebe lanceolata (Nees)
Khadik	Celtis tetrandra (Roxb)
Khaina	Ficus semicordata (J.E. smith)
Khair	Acacia catechu (Willd)
Khajeda	Prosopis spicigera (Linn)
Khajur	Phoenix sylvestris (Roxb)
Khardala	Sterculia pallens (Wall)
Kharhar	Gardenia turgida (Roxb)
Kharpat	Garuga pinnata (Roxb)
Khatua	Bauhinia malabarica (Roxb)
Khemri	Ficus palmate (Forst)
Khirani	Manilkara hexandra (Roxb.) Dub.
Kijelia	Kigeilia pinnata (D.C)
Kumbhi	Careya arborea (Roxb)
Kumhar	Callicarpa arborea (Roxb)
Kumhar	Averrhoa carambola. (Linn)
Kussum	Schleichera trijuga (Willd).
Lasora	Cordia dichotoma (Forst) f.
Lichi	Nepheliul litchi (Gamb)
Mahua	Madhuca indica
Malta	Citrus sinensis (Linn)
Maulshri	Mimusops elengi (Linn)
Mausambi	Citrus aurantium (Linn)
Mitha Nimbu	Citrus limmettioides (Tanaka)
Muhuli	Bauhinia racemosa (Lamk)
Nakfal	Pyrus commumis (Linn)
Nashpati	Pyrus communis (Linn)
Neem	Azadirachta indica A. (Juss)
Neem Chameli	Millingtonia hortensis (Linn) f.
Nimbu	Citrus aurantifolia (Christm.) Swingle. Syn. C. Adida (Roxb)
Nimbu	Citrus medica (Linn)
Pakar	Ficus lacor buch. (Ham)
Papara	Gardenia latifolia (Aiton)
Papari	Holoptelea integrifolia (Roxb.) Planch.
Phalasa	Grewia subinaequalis (D.C)
Pharai	Erythrina suberosa (Roxb)
Pharash	Tamarix aphylla (Linn.) Karst.
Pilkhan	Ficus rumphil (Bl).
Pilu.	Salvadora oleoides (Decne)
Pindar	Randia uliginosa (D.C).
Pipal	Ficus religiosa (Linn)
Popular	Populus spp.
Pula	Kydia calycina (Roxb)
Putranjiwa	Putranjiva roxburghii (Wall)
Ritha	Sa pindus emarginatus (Vahl).
Riyong	Acacia leucophloes (Willd).
Rohini	Mallotus phillipensis
Sadan	Ougenia oojeinensis (Roxb.) Hocst.

Contd. ...

...Contd. ...

Local Name	*Botanical Name*
Sagaun	Tectona grandis (Linn).f.
Sal	Shorea robusta (Gaeertn)
Samal	Bombax ceiba
Satpatia	Hesperethusa crenulata (Roxb.) Roem.
Sejana	Moringa oleifera (Lam)
Shahtut	Morus alba (Linn)
Sharifa	Annona squamosa (Linn)
Shikakai	Acacia rugata (Lam) Meer.
Shisham	Delbergia sissoo (Roxb)
Siras white	Albizzia procera (Benth)
Subabool	Leucaena leucocephala.
Tar	Borassus flaballifer (Linn)
Tarcharnbi	Sapium sebifeerum (Linn.) Roxb.
Tendu	Diospyrus melanoxylon (Roxb)
Tilphada	Cocculus laurifolius (DC).
Timala	Ficus roxburghii (Wall).
Timru	Zanthoxylum alantum Roxb.
Tun	Toona ciliata (Roen).
Vilayati Babool	Prosopis juliflora (D.C)
Vilayati papari	Wrightia tinctoria (R.Br.)
Vishtandu	Diospyros Cordifolia (Roxb)
	Herbs & Shrubs
Aak	Calotropis procera R.Br.
Arhar	Cajanus cajan (Linn) Miu
Asair	Solanum uerbascifolium (Linn)
Bankapas	Thespesia lampas (Cav) Dalx. & B Gibs.
Bansi	Crotolaria medicaginea (Lam)
Bhat	Clerodendron viscosum (Vent)
Bhatkataiya	Solanum indicum (Linn)
Bindu	Grewia sclerophylla Roxb. Ex. C.Don.
Chakunda	Cassia occidentalis (Linn).
Chirchita	Achyaranthes aspera.
Dadmari	Cassia alata (Linn).
Dhawai	Woodfordia fruticoss (Kurz)
Dhota	Woodfordia frntieosa (Kurz)
Gandhela	Murraya koenigii (Sprong)
Gharberi	Zizyphus mauriuiana lamk.
Ghau	Tammix dioica (Roxb)
Gokharu	Echinops echinatus
Gorakhbuti	Aena lanata A. (Juss)
Hansraj	Adiantum capillus-veneris (Linn)
Harawa	Capparis zeylanica (Linn)
Harsingar	Nyetanthes arbortristres (Linn)
Hingot	Balanites aegyptican (Linn.) Dalile.
Hinsalu	Rubus spp.
Inni	Clerodendron phlomoidis (Linn)
Jaltunga	Rhus cotinus (Linn)
Jawasa	Alhagi camelnrum (Fisch)
Kadu	Clerodendron infortunatum
Kairi	Dichrostachys cinerea (Linn) W&A

Contd. ...

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Local Name	Botanical Name
Kakai	Abutilon inaicum (Linn) Sweet.
Kantla	Agave veracruz (Mill)
Karanji	Caeslpinia bonduc (Linn)
Karauda	Carissa spinarum (Linn)
Kareel	Capparis deciduas (Forsk) Edgw.
Kariyar/piluwa	Salvadora persica (Linn)
Kharbair	Zizyphus nummularia (Surm.f.)W.& A.
Kharenti	Sida rhembifolia (Linn)
Kinjora	Berberis spp.
Kuri	Lantana camara (Linn)
Mainphal	Randia dumetorum (Lam)
Mala	Vitex negundo (Linn)
Marchula	Murraya paniculata (Linn) Jack Syn.
Millar	Bischofia javanica (Bl).
Mola	Vitex negundo (Linn)
Nagphani	Cyperus scariosus (Br)
Neel	Indigofera hirsute (Linn)
Panwar	Cassia tora (Linn).
Paterai	Typha elephantine (Roxb)
Pindara	Randia uliginosa
Rambansa	Agave americana (Linn)
Ramdaton	Smilex prolifera
Sakina	Indigorera herterantha
Sarphok	Tephrosia purpurea (Linn) pers.
Surai	Euphorbia royeleana (Boiss)
Tulasi	Ocimum sanctum (Linn)
Vansa	Clerodendron phlomoidis (Linn)
	Climbers
Aal	Mimosa himalayana gamble
Alai	Cesalpinia decapetala
Amarbel	Cuscuta reflexa Roxb.
Anita	Hiptage benghalensis (Linn). Kurz.
Barasin	Butea superba (Roxb)
Beensa	Phragnites karka (Trin).ex.
Bel	Porana paniculata (Roxb)
Bel	Calamus tenusi (Roxb).
Chabuk chari	Cryptostegia grandiflora (Roxb.) R.Br.
Dol	Erianthus ravennae P.(Beaw)
Duddti bel	Vallaris solanacea (Retz) O. Ktze.
Dudhia	Ichnocarpus frutescens (F)
Gaug	Milletia auriculata (Baker)
Ghonghchi/Ratti	Abrus precatorius (Linn)
Gurich	Tinospora malabarica (Lam) Miers.
Indrayan	Trichosanthes bracteata (Lam) Voigt
Kakrora	Capparis sepiaria (Linn)
Kali bel	Combretum decandrum (Roxb)
Kanj	Toddalia asiatica (Linn.) (lamk.)
Keracha	Mucuna pruriens (Linn.) DC. Hook.
Kounch	Mucuna prurita (Hook)

Contd. ...

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Local Name	Botanical Name
Kumeria	Themeda spp.
Kundaru	Coccinea indica W. & A.
Mahur	Cymbopogon martini (Roxb.)
Makoha	Zizyhpus oeonoplia (Mill).
Maljhan	Bauhinia vahlii W. & A.
Malkangani	Celastrus paniclatus (Willd)
Maurain	Bauhinia vahlii W. & A.
Mochgandh	Saccnarum bengalense (Retz.) Syn.
Nakali Bhabhad	Eriophorum comosum (Wall)
Nakul	Phragnites karka (Trin) ex.Sterd.
Pani bel	Vitis repanda W. & A.
Pareth	Cissamelos pareira (Linn)
Parwal	Trichosanthes dioica (Roxb)
Patera	Typha angustata (Bory & Chaub)
Porlu	Thysanolaena maxima (Roxb.)
Puraina	Cissampelos pareira (Linn)
Ramdatun	Smilax prolifera (Roxb)
Rati	Abrus pecatarius (Linn)
Satawar	Asparagus racemosus (Willd)
Turad	Dioscorea belophylla
Ulla	Themeda arundinacea (Roxb.)
	Grasses
Anjan	Cenchrus ciliaris (Linn).
Chakawa	Chrysopogon montanus (Trin)
Dab	Desmostachya bipinnata (Stapf).
Dub	Cynodon dactylon (Linn.) Perp.
Gangeruwa	Andropogon pumilus (Roxb)
Guner	Themeda quadrivalvis (Linn) O. Ktze.
Jarga	Dichanthium annulatum (Forsk) stapf
Kansa	Saccharum spontaneum (Linn)
Khas	Vetiveria zizanioides (Linn) Nash
Kush	Chry sopogon Fulvus
Mung	Saccharum munja (Roxb) Jesweit.
Murjhaina	Eremopogon foveolatus (Del) stapf
Naldura	Arundo donax (Linn)
Safed lappa	Aristida dopressa (Retz)
Saidar	Cymbopogon martini (Roxb)
Sain/Seta	Sehima nervosum (Rotti) Stapf.
Sandur	Chloris dolichostaonya (Lag)
Siru	Imperata cylindrical (Linn)P.Beauv
Usari	Sporbolus marginatus (Hochst). ex. A. Rich.
Vindra	Setaria glauca (Linn.) P. Beauv.
	Bamboo
Bans	Dendrocalamus strictus (Roxb)
Burma	Bambusa arundinacea (Willd)
	Parasites
Akash bel	Cuscuta reflexa
Banda	Dendrophthoe falcate (Linn.) f.

Contd. ...

...Contd. ...

Local Name	Botanical Name
Banda	Helixanthera cocoinea (Jack)
Dam Dobada	Oplismensu compositus (Linn) Beauv.

Source: Working Plan of Forest.

14.4.3 Fauna

Animals depend on forest not only for food but also for habitat. The diversity of fauna living in water and land are found in the state. Since their list is long, the important species mainly found in the state are mentioned here.

Fish

Mahaser, silsa, saul, tengan, parthan, rasela, vittal, rohu, mirgal, kata, labi, mangur, cuchia, eel, elinghi, mirror carp, trout, etc.

Amphibia

Frog, toad, etc.

Reptiles

Bamania, pit-viper, lizard, *goh*, cobra, tortoise, krait, *dhaman*, crocodile, etc.

Aves

Cheel, vulture, peacock, nightingale, pigeon, parrot, owl, *nikanth*, sparrow, etc.

Mammals

Shrew, porcupine, squirrel, hare, mongoose, cow, buffalo, mouse, etc.

Other common species found in UP are tiger, panther, snow leopard, *sambhar*, *cheetal*, *kastura*, *chinkara*, black deer, *nilgai*, back-brown bear, mountain goat, hyena, hill dog, elephant, etc. Among birds fowl, pheasant, partridge, florican, duck, goose and wader are common.

BOX 14.2

Animal Species (Fauna) Recorded in Uttar Pradesh

Local Name	English Name	Scientific Name
Class-Mammalia		
Order-Carnivora		
Family-Felidae		
Sher	Tiger	*Panthera tigris*
Tendua	Panther	*Panthera pardus*
Chita billi	Leopard Cat	*Felis bengalensis*

Contd. ...

...Contd. ...

Local Name	English Name	Scientific Name
Jangli billi	Jungle Cat	*Felis chaus*
Mach billi	Fishing Cat	*Felis vivarina*
Family-Uiverridae		
Small Indian Civet *(Kasturi)*	Desmarest	*Viverricula indica*
Family-Herpestidae		
Newala	Geoffroy	*Herpestes edwardsi*
Newala	Hodgson	*Herpestes auropunctatus*
Family-Hynidae		
Lakkarbaggha	Hyaena	*Hyaens hyaena*
Family-Canidae		
Gidhar	Jackal	*Canis aureus*
Lomri	Shaw/Indian Fox	*Vulpes bengalensis*
Family-Ursidae		
Bhalu	Sloth Bear	*Melursus ursinus*
Family-Mustilidae		
Udbilao	Hodson/Common Otter	*Lulra lulra*
Udbilao	Clawless Otter	*Aonyx cinerea*
Bejao	Schreber	*Mellivora capensis*
Chitrola	Yellow Throated Marten	*Martes flavigula*
Order–Insectivora		
Chuchunder	Gray Musk Shrew	*Suncus murinus*
	Suborder–Micro Chiraptera	
Family–Rhunolophidae		
Chamgadar	Horseshoe Bat	*Rhinolophus luctus*
Chamgadar	Pipistrelle	*Pipistrellus coromandra*
Order–Rodentia		
Family-Pseuridae		
Lal Gilahari	Red Flying Squirrel	*Petaurista ptaurista*
Gilahari	Striped Squirrel	*Funambulus pennati*
	Family-Muridae	
Antelope Rat	Antelope Rat	*Tatera indica*
Tebkrai	Indian Mole-rat	*Bandicota bengalensis*
Tree Mouse	Long Tailed Tree Mouse	*Vandeleuria cleracea*
Chuha	House Rat	*Rattus nattus*
Chuha	House Mouse	*Mus musculus*
Family-Hystrosidae		
Sehi	Indain Porcupine	*Hystrix indica*
Family-Leporidae		
Khargosh	Indian Hare	*Lepus nigricollis*
Order–Artiodactyla		
Family–Cervidae		
Sambhar	Sambar	*Cervus unicolor*
Kakar	Barking Deer	*Muntiacus muntjak*
Kala Hiran	Black Deer	*Antilope servikaipra*
Manipur Hiran	Manipur Deer	*Cervus eldi eldi*
Family-Suidae		
Suar	Indian Wild Boar	*Sus scrofa*

Contd...

...Contd. ...

Local Name	English Name	Scientific Name
Order–Primates		
Bandar	Rhesus	*Macaca mulata*
Langur	Common *Langoor*	*Presbytis entellus*
Bandar	Monkey	*Nigicollis*
Order–Artiodactyla		
Family–Bovidae		
Bhais	Buffalo	*Bubalus bubalus*
Nilgai	-	*Boselaphus tragocamelus*
Class Aves		
Orde–Falconiformis		
Family-Accipitridae		
Giddha	Oriffin Vulture	*Gyps fulvus*
Giddha	Himalayan Griffin	*Gyps himalayansis*
Bangal Vulture	Whitebocked Vulture	*Gyps bengalensis*
Vulture	White Scavenger Vulture	*Neophron percnopterus*
Giddha	Indian Longbilled Vulture	*Gyps indicus*
Raj Giddha	King Vulture	*Tergas ealvus*
Family–Falconidae		
Shahin	Shahin Faleon	*Flco peregrinus*
Kestrel	Kestrel	*Falco tinnunculus*
Garur	Goder Eagle	*Aquila chrysitas*
Kala Garur	Block Eagle	*Ietinaetus malayensis*
Garur	Crested hawk-eagle	*Spizaetus cirrhatus*
Garur	Hodgson Hawk Eagle	*Spizaetus nepalensis*
Cheel	Common Pariah Kite	*Milvus migrans*
Dhabia Cheel	Brahminy Kite	*Haliastur indus*
Order–Galliformes		
Family-Phasianidae		
Mor	Common Peafowl	*Pavo cristatus*
Kala Tital	Black Pat Ridge	*Francolinus francolinus*
Titar	Gray Pat Ridge	*Francolinus pondicerianus*
Jangli Murgi	Red Jungle Fowl	*Gallus gallus*
Chanak Bater	Rain Quail	*Coturnix coromandelica*
Bater	Common Quail	*Coturnix coturnix*
	Order–Columbiformis	
	Family-Columbidae	
Kokla	Wedgetailed Green Pigeon	*Treron sphenura*
Hariyal	Pintailed Pigeon	*Treron opicauda*
Kabutar	Blue Rock Pigeon	*Columba livia*
Ghughut	Rufous Turtle Dove	*Streptopelia orientalis*
Ghuguti	Ring Dove	*Streptopelia decaocta*
Dove Ghughuti	Emerald Dove	*Chalcophaps indica*
Order–Psittaciformes		
Family–Psittacidae		
Tota	Roseringedm Parakeet	*Pittacula krameri*

Contd...

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Local Name	English Name	Scientific Name
Order–Cuculiformes		
Family–Cuculidae		
Phaphua	Inidan Cuckoo	*Cuculus micropterus*
Cuckoo	Himalayan Cuckoo	*Cuculus operatus*
Koyal	Koel	*Eudynawys scolopacea*
Papiha	Common Hawk Cuckoo	*Cuculus varius*
Order–Strigiformes		
Family-Strigidae		
Ullu	Tony Wood Owl	*Strix oeluco*
Owlet	Himalayan Ward Owlet	*Glaucidium cuculoides*
Ullu	Pigmi Owlet	*Glaucidium brodisae*
Ullu	Barred Jungle Owlet	*Glaucidium radiatum*
Order–Coraciformes		
Family-Alcedinidae		
Korayala	Kingfisher	*Ceryle lugubris*
Kingfisher	Common Kingfisher	
Family–Miropidae		
Bee-eater	Bluebeared Bee-eateer	*Nyetyornis athertoni*
Family-Coracidae		
Blue Jay	Blue Jay	*Coracias beghalensis*
Family-Upupidae		
Hudhud	Hoopoe	*Upupa epopa*
Family-Bucerotidae		
Hornbill	Common Gray Hornbill	*Tockus birostris*
Order–Piciformes		
Family-Megalaimidae		
Barbet	Green Barbet	*Megalaima gilonicus*
Barbet	Lineated Barbet	*Negakauna linitus*
Barbet	Small Green Barbet	*Megalaima viridis*
Family-Picidae		
Kathforawa	Goldenbacked Woodpecker	*Dinopium benghalense*
Kathforawa	Scaly Green woodpecker	*Picus squamatus*
Order–Passeerformes		
Family-Hirundinidae		
Swallow	Common Swallow	Hirundo rustica
Family-Oriolidae		
Pilak	Golder Oriole	*Oriolus oriolus*
Pilak	Blackheaded Oriole	*Oriolw xanthornus*
Family-Sturnidae		
Myna	Jungle Myna	*Acridothersus fuscus*
Myna	Indian Myna	*Acridothersus tristis*

Contd. ...

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Local Name	English Name	Scientific Name
Family-Corvidae		
Kauwa	Jungle Crow	*Corus macrorhynchos*
Kauwa	House Crow	*Corvus splendens*
Tree Pie	Himalayan Tree Pie	*Dendrocitta formosae*
Magpie	Redbilled Blue	*Cissa erythrorinka*
Magpie	Yellowbilled	*Cissa flavirostris*
Shrikes	Grey Shrike	*Lanius excubitor*
Minivetes	Long Tailed Minivet	*Pericrocotus ethologus*
Drongo	Bronze Drongo	*Dicrurus aeneus*
Drongo	Crowbilled Drongo	*Dicrurus annectans*
Drongo	Haircrusted Drongo	*Dicrurus Hottentottus*
Family-Pycnonotidae		
Bulbul	White Cheeked Bulbul	*Pycnonotus leucogenys*
Bulbul	Redvented Bulbul	*Pycnonotus cafer*
Bulbul	Black Bulbul	*Hypsipetes madagascariensis*
Family-Muscicapidae		
Thrush	Blueheaded Rock *Thrush*	*Monticola cinclorhynchus*
Babbler	Scimitar Babbler	*Pomatoshinus horsfieldi*
Babbler	Rustycheeked Babbler	*Pomatorhinus erythrogenis*
Family-Passeridae		
Sparrow	House Sparrow	*Passer domesticus*
Munia	Green Munia	*Estrilda formosa*
Munia	White Backed Munia	*Lochura striata*
Munia	White Throated Munia	*Lonchura malabarica*
Baya	Black Treaster Weaver Bird	*Ploceus benghalensis*
Baya	Streaked Weaver Bird	*Ploceus manyar*
Family-Pittidae		
Pittas	Green Breasted Pittta	*Pitta sordida*
Family-Nectarinidae		
Sun birds	Maroon Breasted sunbird	*Nectarinia lotenia*
Sun birds	Yellow Backed Sunbird	Aethopyga siparaja
Order-Ciconiiformes		
Family-Ardeidae		
Bittern	Little Bittern	*Ixobrychus minutus*
Bittern	Chestnut Bittern	*Ixobrychus cinnamomeus*
Bittern	Yellow Bittern	*Ixobrychus sinensis*
Bittern	-	*Botaurs stellaris*
Egret	-	*Egertta garzetta*
Heron	Grey Heron	*Arclea cinerea*
Heron	Pond Heron	*Ardeola grayii*

Contd. ...

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Local Name	English Name	Scientific Name
Family-Phalacrocorcidae		
Cormorant	Little Cormorant	*Phalacrocorax niger*
Cormorant	Large cormorant	*Phalacrocorax carbo*
Family-Anhingidae		
Darter	Snake bimrd	*Anhinga rufa*
Family-Scolopacidae		
Snipe	Fantail snipe	*Gallinago gallinago*
Family-Pteroclididae		
Sand grous	Blackbilled sandgrous	*Pterodes orientalis*
Family-Ciconidae		
Stork	Black necked stork	*Ciconia nigra*
Stork	White necked stork	*Ciconia episcopus*
Stork	Painted stork	*Myctria leucocephala*
Stork	White stork	*Ciconia ciconia*
Stork	Open-billed stork	*Anastomus oscitans*
Family-Threskiornithidae		
—	Spoonbill	Platalea leucorodia
Family-Charadridae		
Plover	Golden plover	*Pluvialis dominica*
Plover	Grey plover	*Pluvialis squatarola*
Plover	Collared swallow plover	*Glareola pratincola*
Family-Charadridae		
Lapwing	White-tailed lapwing	*Vanellus leucurus*
Family-Laridae		
Tern	-	*Sterna hirundo*
Tern	Indian whisked tern	*Chlidonis hybrida*
Tern	Little tern	*Sterna albifrons*
Order-Anseriformes		
Family-Anatidae		
Duck	Brahminy duck	*Tadorna ferruginea*
Duck	Pochards	*Aythtya ferina*
Duck	Shelduck	*Tadorna tadorna*
Goose	Graylag goose	*Anser anser*
Cormorent	Cormorent	*Phalacrocorax niger*
Family–Dendrocygnidae		
Gray duck	Spotbill	*Anas poecilorhyncha*
Teal	Cotton teal	*Anas crecca*
Teal	Large whistling teal	*Dendrocygna bicolor*
Order–Gruiformes		
Family–Gruidae		
Saras	Crane	*Grus antigone*
Herons	Large Egret	*Ardea alba*
Family–Rallidae		
Moorhen	Purple Murhan	*Porphyrio porphyrio*

Contd. ...

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Local Name	English Name	Scientific Name
Order–Apodiformes		
Family–Caprimulgidae		
Nightjar	-	*Caprimuhgus asiaticus*
Class–Reptilia		
Order–Squamata		
Family-Geckonidae		
Chhipakali	Common house gako	*Hemidactylus glydovae*
Chhipakali	Asian house gako	*Hemidactylus cocty*
Family-Agamidae		
Lizard	Common garden lizard	*Calotes versicolor*
Family–Varanidae		
Monitor lizard	Varanus	*Varanus bengalensis*
Family-Viperidae		
Pohur	Himalayan Pit Viper	*Agkistrodon himalayanus*
Family-Allapidae		
Nag	Indian cobra	*Naja naja*
Kala nag	King cobro	*Naja Hannah*
Family-Karits		
Kata gandait	Indian Karit	*Bungarus caerulens*
Dhaman	Rat snake	*Ptyas mucosus*
Family-Pythnidae		
Ajgar	Indian Python	*Pythos molurus*
Order–Testudines		
Family–Cheoliniidae		
Kachua	Turtle	*Chilonea mydas*
Kachua	Green Turtle	*Lissenys punctata*
Kachua	Tortoise	*Geochelone elongata*
Order–Crocodylia		
Family–Gavialidae		
Gharial	Gharial	*Govialis gangetics*
Family–Crocodylidae		
Muggar	Crocodile	*Crpckodilus palusatrix*
Class–Amphibia		
Mendhak	Buffo	*Buffo melanostictus*
Class-Pisces		
Baiyan	-	*Mastaccmbelus (Lacep.)*
Bhangera/Gotyala	-	*Garra gotyla (Gray.)*
Bhangnera	-	*Giparshadi (Hora.)*
Bhangnera	-	*G. lamta (Ham.)*
Cuchia	-	*Notopterus cuchia*
Dhaur	-	*B. barna (Ham.)*
Dhaur	-	*B. vagra (Ham.)*
Dhaur/chilwa	-	*Bareillus bendelisis (Ham.)*
Gadera/Gunther	-	*Nemacherlus beyani - (Gunther.)*

Contd. ...

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Local Name	English Name	Scientific Name
Gadera/Gunther	- (Hora.)	N.rupicola inglishi
Gadera/Gunther	-	N.rupicola (Mc.Cell.)
Gadera/Gunther	-	N.multifaciatus (Day.)
Gadera/Gunther	-	N.botia (Ham.)
Gadera/Gunther	-	Lepidocephalichthys guntea (Ham.)
Hilsa	-	Hilsa hilsa
Karanchula	-	Barbus (Pantius) chillinoides (Mc. Clekl.)
Katharua	-	Pseudochemis salcatus (Mc. Clekl.)
Katharua	-	Glyotosternum peetinopterum (Mc.Clekl.) Barbus tor tor (Ham.)
Mahaseer	-	Putitora
Mahaseer	-	Barbus tor tor (Ham.)
Mrigal	-	Cirrhinus mrigala
Patholi	-	Chequnius chagunae
Pota	-	Barbus tiets
Rohu	-	Labeo rohita
Sewal	-	Ophioccplhalus pimctatus
Unera	-	Lobeo dero (Ham.)
Unera	-	Lobeo dyocheilus (Ham.)
Magur	-	Clarius batracus

Source: Working Plan of forest.

14.4.5 Threats to Forest Ecosystem

14.4.5.1 Injuries to which Flora is Liable

The main factors causing damage to floras are:

Fire

Incidents of fire in the division may be caused due to excessive dryness of land. There are many causes of fire. Unintentionally fire can be caused by passengers. The villagers deliberately burn the nearby forest areas to enhance the growth of some grasses. In the area of Mahua, deliberate fire is caused to burn the undergrowth of shrubs because it helps in collecting the flowers of mauha. In comparision to reserved forests, forest fires are more frequent in vested forests.

Frost

The harm due to frost on the vegetation is not so significant as the winters are short and less cooler.

Drought

From March to the onset of the monsoon hot westerly winds called 'Loo' blows. This hot and dry air damages the new crop and in some year when there is less rainfall the damages caused is high. In winters, the evaporation is very fast because of no rain therefore dryness increases and efficiency of trees also declines.

Climbers and Parasites

Makoh, Zizyphus, Cuscuta, etc. are mainly found here. Zizyphus is mainly responsible for the damage to this whole region. Other than these, some more are responsible for the damage and these are *Mausen Badrasin* and *Keyonti*, etc.

Human Factor

The forest blocks are scattered and surrounded by villages therefore transportation is difficult and results in big theft.

Grazing

In the whole forest division, the problem of grazing if very serious. The crop is seriously damaged in the areas, which are near to villages. Natural regeneration is very much reduced.

Urbanisation

Due to employment opportunities and good infrastructural facilities available in the urban centres, the rapid urbanisation is taking place which is also a responsible factor for deforestration.

14.4.5.2 Injuries to which Fauna is Liable

Fauna in the region is adversely affected by man, animals, fire, flood etc. brief description of factors affecting animal species is given below:

Man

Man is the biggest enemy of animals. The animals which are more useful and more innocent are destroyed the most. Many of the animal species are becoming extinct because of their unrestrained killing by man for his entertainment and other benefits. In the past tiger, bear, *guldar* were abundantly seen in forests of division but nowadays they are rarely seen. These forests of division have sufficient roads and are surrounded by villages. Hence theives, hunters and farmers illegally kill animals in these forests for flesh, skin and horns.

Animals

According to natures rule, animal feeds on other animals. Carnivores live on other herbivores. Animals destroy eggs and young ones but that does not have any harm on wildlife. In this process, the theory of ecological balance is applicable but sometimes because of destruction of particular type of species, this balance in disturbed.

Fire

Forest fire rarely destroys animals because they can sense the danger and run away. However, their eggs, young ones, nests, etc. are destroyed in the fire.

Flood

Sometimes unexpected rainfall causing flood may cause harm to wild animals.

Climate

Excessive heat and drought in summer limit the avialibility of water. Due to this the thirsty animals which come near water source get easily killed by hunters.

14.4.6 Role of Forests for Sustainable Development

Forest helps mankind in several ways. It provides bread and butter to many. It is home of varriety of flora and fauna. Apart from its role in improvement of environment, it has so many roles, which are listed below:

14.4.6.1 As Protectors of Mankind and Biodiversity

Forests are the natural habitat of diverse form of flora and fauna. It supports variety of life apart from its immense valuable uses to mankind. It is the homestead of good number of medicinal plants, wildlife and countless other things. The forest are the good reservoir of water, soil-binders and thus play an important role in soil conservation. It gives fuel wood to the poor to meet their daily cooking, demands, fodder for the animals and maintains the temperature balance and so on, thereby accomplishing productive functions.

14.4.6.2 As Promoters of Socio-economic Condition of People

Forests play an important role in socio-economic upliftment of the people. They contribute significantly in employment generation, as it is the most important consideration in all forestry works. Almost 60 per cent of total cost of all forestry projects is reserved for wags. On an average, one hectare of plantation generates about 350 man-days of work.

14.4.6.3 As a Tool of Poverty Alleviation

By contributing towards employment generation, it helps in poverty alleviation of the masses. In addition, the poor are benefited by collection of fuel wood, fodder, etc. the forest provides means of earning livelihood to many, thereby helping them to fight with their poverty.

14.4.6.4 As a Tool of Rular Development and Tribal Development

Forests contribute significantly towards rural and tribal development. This is the homestead of many tribal communities. It is the saviour of tribal culture. On the economic front also, forests provide them with the opportunities of earning livelihood.

14.4.6.5 As Vast Reserves of Natural Resources

Forests are also valued for their productivity. It gives timber, fuel wood, fodder, resins and gums, natural fibres, fruits and variety of other things. The productivity can further be increased though tree improvement programmes, which will help in greater volume yield thereby giving more money. Cultivation of medicinal and aromatic plants can give better economic returns.

14.4.7 Conservation of Forest

Great biotic pressure due to large-scale human colonisation, development of infrastruture and other amenities etc. immediate attention for the conservation of forest was required and the present practices were implemented accordingly.

14.4.7.1 Forest Plantations

Plantations started in the ravines of the Yamuna and the Chambal in 1884, which subsequently got extended to other areas. Besides plantations for ravine reclamation and soil conservation, industrial plantations for producing matchwood, pulpwood and timber were also undertaken. Forest Development Corporation (FDC) was created in 1974, to undertake plantation activity through financial support from different financial institutions. Plantation activity got accelerated after the launching of social forestry programme. The important plantation programmes include industrial and pulpwood plantation, economic plantation, rural fuelwood plantation, fuel and fodder plantation, energy plantation, etc. A total of 4.18 million ha has been planted between 1951 and 1999.

The increase in the forest cover has been recorded in the districts of Hardoi, Kheri, Pithoragarh, and Saharanpur, etc. The increase is on account of the plantations taken 4-5 years earlier and also due to effective protection measures. The decrease in forest cover has been observed in the districts of Banda, Jhansi, Mirzapur, Sonbhadra, etc., which is largely on account of biotic pressure.

14.4.8 National Park and Sanctuaries

In response to biodiversity conservation of Uttar Pradesh the total area of forest is 16966.22 sq. km. Out of which one National Park (Dudhawa National Park) is present in area of 5710 sq. km. and 23 national sanctuaries are present in the rest of the area, which is in 33.6 per cent area of the UP and 22.4 per cent of total geographical area.

In this approximately 500 species of birds has been detected, out of which migratory birds are, Pintel, Common Teal, Gargani Teal, Pochard, Bar Headed Guj, *Gaidwa, Surkhab*, Shawlar, Vision, Kut, Mallard, Crested Pochard, Brib and Flemingo.

14.4.8.1 Dudhwa National Park

The flora of Dudhwa National Park, Kheri District in Uttar Pradesh is of prime importance because of its interesting flora, fauna and ecological spreadouts. The park has a vital role to play in the conservation and sustainable use of biodiversity. The importance of the park is in large part due to its rich biological wealth. It is the main stronghold of the population of swamp deer. It is also one of the better known tiger reserves in the country and is a suitable additional habitat for rhinoceros.

Tall coarse grass sometimes forming impenetrable thickets, swampy depressions and lakes characterise the wetlands of the park. These are the habitat of large members of *barasingha*, the magnificent swamp deer, noted for their multi-tined antlers (*bara*-12 *singha*-horn). These in turn support the predatar's—the tiger and leopard. Though the Park has a fair population of tigers, they are rarely seen owing to the nature of the forest cover.

Other inhabitants include the sloth bear, jackal, wild pig and the lesser cats—the fishing cat, leopard cat, jungle cat and civet. Dudhwa has also an abundance of birds. Its marshes are home to a range of water-birds both local and migratory. There are spectacular painted storks, black and white necked storks, sarus cranes and varied night birds of prey, ranging from the great Indian horned owl to the jungle owlet. Colourful woodpeckers, barbets, kingfishers, minivets, bee-eaters, and *bulbuls* flit through the forest canopy. A fragile natural paradise, Dudhwa endeavours to protect its wild haven from the depredations of an expanding human population.

14.4.8.2 Samaspur Bird Sanctuary

Samaspur Bird Sanctuary is spread over an area of 799.371 ha. In the year 1987, Samaspur Lake and other six lakes were declared combinely as Samaspur Bird Sanctuary, in order to provide proper conservation to resident and migratory birds. Almost 250 species of resident and migratory birds find shelter at Samaspur Bird sanctuary. The important aquatic birds are, Egrets, Painted stork, Purple Moorhen, Purple Heron, White Breasted Water Hen, Whistling Teal, Phaesant Teal, Jacana, Little Grebs, Cormorants, Kingfisher, Bronzed Winged Jacana, Darter, Cotton Teal, Brahmany Kite, Black Drago, Green Bee Eater, Indian Sarus Crane, Pintail, etc.

14.4.8.3 Nawabganj Bird Sanctuary

Nawabganj Bird sanctuary is spread in an area of 2246 sq. km. In order to promote proper protection and conservation to the resident and migratory birds, Nawabganj lake and its surrounding area was declared as Nawabganj Bird Sanctuary in the year 1984. Approximately, 250 species of resident and migratory birds are found here. The arrival of migratory birds starts from the month of November and by the end of February, these migratory guests gradually start leaving to their respective destinations. Some resident birds stay here round the year, do nesting and lay eggs. The common aquatic birds inhabiting Nawabganj lake are Open Bill Stork, Painted Stork, White Necked Stork, Black Necked Stork, White Ibis, Glossy Ibis, Black Ibis, Darter, Cormorants, White Breasted Water Hen, Kingfisher, Spot Bill, Spoon Bill, Saras Cranes, Whistling Teal, Phaesant Teal, Jacana, Bronzed Winged Jacana, Purple Moorhen, Indian Moorhen, Grebs, Lapwing, Egret, Purple Heron and Pond Heron. Wetlands of Nawabganj Bird Sanctuary are left with small patches of pools of water in the entire area during the summer in July.

14.4.8.4 Sandi Bird Sanctuary (Sandi Lake)

Sandi Bird Sanctuary is spread over 3.0854 sq.km area. River Garra earlier named as Garun Ganga also located near the Sanctuary. Migratory birds rest for sometime in the river front before reaching to Sandi Bird sanctuary. The migratory birds start coming at the beginning of winter in the month of November. The bird sanctuary acquires its peak habitat during January-February. Some of the birds residing in Sandi Lake are Egrets, Black Drago, Saras Crane, Cattle Egrets, etc. At

the onset of summer season till March, the migratory birds gradually return back to their native places.

14.4.8.5 Sur Sarovar National Bird Sanctuary (Keetham Lake)

Keetham Lake is formed in a catchment area of 7.13 km^2. It has been declared as National Bird Sanctuary in 1991 by UP Forest Department and named as Sur Sarovar. Keetham Lake is pentagonal in shape with artificially created islands for shelter and breeding grounds to the migratory birds. More than 106 species of migratory and resident birds are known to have their resting habitats at Sur Sarovar. The important aquatic birds inhabiting Keetham lake are Little Gerbs, Cormorants, Darter, Grey Heron, Purple Heron, Paddy Bird, Cattle Egrets, Large Egrets, Smaller Egrets, Little Egrets, Night Heron, Indian Reef Heron, Black Necked Stork, White Ibis, Spoon Bill, Greying Goose, Bar Headed Goose, Lesser Whistling Teal, Ruddy Shelduck, Pintail, Common Teal, Spot Billed Duck, Gadwall, Wigeon, Shovler and Comb Duck. The riverine belt of River Yamuna surrounds the area of Sur-Sarovar. Recently, UP Forest Department has created woodlands and developed shallow areas near lake, making it a natural habitat for birds nesting sites, especially during summers which covers the entire lake area. The water quality of Keetham Lake supports wide range of avifauna during winter season.

14.4.8.6 Wildlife Sanctuaries

Van Vihar Wildlife Sanctury situated 50 km from Agra and spreads over an area of 52 sq. km harbours many species of animals and birds.

Deer Park

Chandraprabha Wildlife Sanctuary 70 km from Varanasi within which are the Rajdari and Devdari Waterfalls.

Kaimoor Wildlife Sanctuary 130 km from Varanasi spread over an area of 500 sq. km, having variety of wildlife.

14.4.9 Wildlife Conservation Projects

Presently, wildlife conservation is being carried out utilising scientific methods under following important projects.

1. Project Tigers

This project was started in 1973 in Corbette National Park and other areas to project tigers and other wildlife and their habitats. This was applied to Dudhwa National Park.

2. *Ghariyal* Breeding and Rehabilitation

This project was started in 1975 in 'Kukrel and Katarnia Ghat' in Chanbal and Geruva River. Around 3000 *ghariyals* produced in breeding project were released during 1975 to 2000 in different rivers namely Chambal, Geruva, Ramganga, Sharda, Ghagra, Son and Rapti and 192 *ghariyals* were distributed to different zoological parks.

3. Tortoise Rehabilitation Project

Under this project the breeding of tortoise is carried out in Kukrel and Varanasi and the tortoises are released in the Ganga River in Varanasi and Kanpur and in the Gomati River at Varanasi. These tortoises help in reducing the pollution of highly polluted Ganga and Gomati Rivers.

4. Rhinoceros Rehabilitation Project

This project is being carried out at Dudhwa National Park and Katarnia Ghat wildlife area where the rhinoceros are brought form Assam and Nepal and they are rehabilited at these places. Presently, there are 15 rhinoceros at this place.

5. Zoological Park

Two zoological parks have been established at Lucknow and Kanpur to educate the public about wildlife.

6. Rare and Endangered Wildlife Project

Under this project the centre has been established in 1985 at Kukrel Forest for breeding of rare and ebdangered wildlife species.

7. Ecodevelopment Project

Ecodevelopment project is being carried out to provide essential natural resources to the tribal and local population living near protected areas, utilising buffer zone identified around them. This project was implemented in 1996 to 1997 in Dudhwa Tiger Reserve and now to all protected areas in Uttar Pradesh.

14.5 Noise Environment

With the industrial revolution of the 19th century, noise has become a permanent part of man's life. In India, noise has rapidly become a source of environmental pollution with increasing industrialisation, urbanisation and the rapid expansion of the means of transport. Excessive sound is the one of the most common causes of hearing losses in the world from both industrial and military sources. Noise

in community environment is complex and typical combination of different sound levels emitted by various communication systems, construction, religions, social and family activities.

14.5.1 Sources of Noise Pollution

Various sources of noise are: industries, road, rail, air-traffic, construction and public works, indoor sources (air conditioners, air coolers, fans, radio, television and other home and office appliances), etc. In our study area, indiscriminate use of loudspeakers, generator sets and firecrackers has given a new dimension to the noise pollution problem.

14.5.2 Status and Assessment of Noise Environment

The assimilative capacity of the acoustic environment is the maximum amount of noise load that can be discharged into the environment without causing private or public nuisance (unlawful interference to individuals or community) for the designated use of land units. The phenomena governing assimilative capacity for noise include propogation of sound through ambient air, and its absorption, scattering and divergence. There is a decrease in sound pressure levels with distance from the source due to atmospheric effects or interaction with the objects in the transmission path. This decrease, called attenuation, is due to air absorption, availability of vegetation, and barriers.

The air absorption is significant at longer distances and at higher frequencies. The consideration of air absorption in reducing noise levels in the environment is accorded low priority.

Walls or barriers located in the transmission path provide a significant noise reduction. The barrier consists of solid walls, earth berms and other solid nonporous objects interrupting direct path or line of sight between the source and the receiver. An attenuation of 24 dB is regarded as a practical limit for barrier attenuation.

Attenuation due to vegetation is also important and is of the order of 10 dB per 100 metre width of vegetation at the frequency of 1000 Hz.

The study of assimilative capacity for the noise environment involves:

- Identification of driving forces i.e. location of industries, commercial zones, traffic activities, etc. in the region that are likely to result in increase of noise levels.
- Characterisation of sources of noise by measurement of noise equivalent levels (Leq) during the day and night times.
- Monitoring of spatial and temporal variations of noise is sampled land units.
- Prediction, and distribution, of noise equivalent levels in sampled land units.
- Estimation of assimilative capacity in critical zones *vis-à-vis* noise standards considering the attenuation factors.
- Establishment of upper limits of noise load in the critical pockets.

The assimilative capacity determination for the acoustic environment involves characterisation of noise and consideration of sound attenuation due to vegetation and barriers in the form of solid barriers, earth berms, etc., so as to ascertain the maximum amount of noise load that can be discharged into the air environment without causing private or public nuisance for the designated use of land units. The noise level of the following districts have been compared with CPCB standards, which is given as Appendix A-14.3.

TABLE 14.19

Ambient Noise Quality Data (Lucknow)

Area	*Sampling Location*	*Date*	*Noise Level (dB)*	
			Day	*Night*
Residential	Mahanagar near Boys School	01/08/01	67.14	60.20
Commercial	Hazaratganj near Sahu Cinema	01/08/01	77.14	55.40
Industrial	Tal Katora near Eveready Factory	02/08/01	76.40	65.80
Silence Zone	Lucknow University Gate No. 3	02/08/01	68.82	55.86

Source: UP Pollution Control Board.

14.5.2.1 Noise Levels in Lucknow

The noise levels in different areas of Lucknow are studied i.e. residential, commercial, industrial and silence zone area (Table 14.19). In residential area, noise level is 67.14 dB in day and 60.2 dB in night, which is more than standard valued for residential area i.e. 55 dB for day and 45 dB for night. The high noise levels in the residential areas are due to traffic movements. For commercial area, Hazaratganj is considered. The value of noise level at day is 77.14 dB and at night 55.4 dB which are slightly exceeding the prescribed limits i.e. 65 dB (day) and 55 dB (night). In industrial area the noise level at day is 76.4 dB which is slightly higher than standard is 75 dB and at night 65.8 dB which is under the standard limit i.e. 70 dB. The movement of heavy and medium vehicles, loading and unloading of materials, and construction and fabrication work contribute to ambient noise levels in these areas. In Lucknow number of educational institutes and hospitals fall under the 'Silence Zone'. The noise level at prescribed silence zone is 68.82 dB at day and 55.86 dB at night which is slightly above the standard limit i.e. 50 dB (at day) and 40 dB (at night).

14.5.2.2 Noise Levels in Jhansi

The noise levels in different areas of Jhansi are studied i.e. residential, commercial, industrial and silence zone area (Table 14.20). In different residential locations in Jhansi the noise levels varies from 58 to 107.55 dB for day and 53.98 to 96.94 dB for night, which is higher than standard limit i.e. 55 dB (at day) and 45 dB (at night). This high level of noise is due to traffic movement. For some commercial area noise level varies from 74.62 to 92.87 dB for day and 65.16 to 88.28 dB for night which is higher than prescribed standard i.e. 65 dB (at day) and 55 dB (at night) because of the activity status of areas. In industrial area the noise level at day time is 75.06 dB and 79.48 dB which is higher than CPCB limit. During night time, the values are 68.34 dB and 65.78 dB which are under prescribed limit. In silence zone the noise levels at daytime is 59.06 dB and 92.34 dB and at night 52.22 dB and 75.22 dB. These values are higher than standard limits.

14.5.2.3 Noise Levels in Ghaziabad

The noise levels in different areas of Ghaziabad are studied i.e. residential, commercial, industrial and silence zone area (Table 14.21). The noise equivalent level for residential area is 59 dB, which is slightly higher than standard value. L_{min} and L_{max} are 45 dB and 90 dB. For the commercial area clock tower area is studied. The equivalent noise level is 75 dB at day, 65 dB at night and minimum and maximum noise level are 57 dB and 91 dB. This exceeding value of noise is due to high activities in commercial areas. In industrial area

TABLE 14.20

Ambient Noise Quality Data (Jhansi)

Area	*Sampling Location*	*Date*	*Noise Level (dB)*	
			Day	*Night*
Residential	(i) Railway Colony Near Central School	25/10/2000	58.98	53.98
	(ii) Railway Colony Near MGBV	14/11/2001	107.55	96.94
	(iii) Near Gyan Sthali Public School, Shivaji Nagar	14/03/2002	62.14	54.72
Commercial	(i) Bus Stand	25/10/2000	74.62	65.16
	(ii) Bus Stand, Kanpur Road	14/12/2001	92.87	88.28
	(iii) Elite Crossing	14/03/2002	84.08	69.04
Industrial	(i) Bijoli Industrial Area	25/10/2000	75.06	68.34
	(ii) Bijoli Near M/s Sonata Enterprises	13/11/2001	79.48	65.78
Silence Zone	(i) D.M. Residence	25/10/2000	59.06	52.22
	(ii) Germony Hospital	14/11/2001	92.34	75.22

Source: UP Pollution Control Board.

TABLE 14.21

Ambient Noise Quality Data (Ghaziabad)

Area	*Location*	*Noise Level (dB)*					
		Day			*Night*		
		Leq	L_{min}	L_{max}	*Leq*	L_{min}	L_{max}
Industrial	O.C.C. Ltd.	77	59	95	68	64	89
Commercial	Clock Tower	75	57	91	65	63	75
Residential	31, West Model Town	59	45	90	54	42	89
Silence Zone	Mukandlal Hospital	63	42	72	59	57	62

Source: *NCR Report*, 1998.

the noise level is contributed by movement of heavy vehicles, construction and fabrication etc. In Ghaziabad, L_{min} and L_{max} is 59 dB and 95 dB at day and 64 dB and 89 dB at night, which are higher than standard limit. The L_{eq} in day is 63 dB and at night 59 dB. The minimum and maximum value of noise level are 42 dB and 72 dB for day and 57 dB and 62 dB for night.

14.5.2.4 Noise Levels in Kanpur

The noise levels in different areas of Kanpur are studied i.e. residential, commercial, industrial and silence zone area (Table 14.22). In residential area, noise level is 74.1 dB in day and 66.1 dB in night, which is more than standard value for residential area i.e. 55 dB for day and 45 dB for night. The high noise levels in the residential areas are due to traffic movements. In commercial area the value of noise level at day is 75.7 dB and at night is 70.85 dB which are slightly exceeding the prescribed limits i.e. 65 dB (day) and 55 dB (night). Because of the activity status of areas, the noise levels are higher than CPCB standards. The noise level in the industrial area, at day is 73.5 dB which is within the standard value i.e. 75 dB and at night 70.45 dB which is near the standard limit i.e. 70 dB.

In Kanpur number of educational institutes and hospitals fall under the 'Silence Zone'. The noise level is 72.5 dB at day and 62.6 dB at night, which is above the standard limit i.e. 50 dB (at day) and 40 dB (at night).

TABLE 14.22

Ambient Noise Quality Data (Kanpur) 2001

Area	*Location*	*Noise Level (dB)*					
		Day			*Night*		
		L_{avg}	L_{min}	L_{max}	L_{avg}	L_{min}	L_{max}
Residential	Govind Nagar	74.1	55.9	92.3	66.1	54.8	77.4
Commercial	Deputy Ka Parav	75.7	61.8	89.8	70.85	62.5	79.2
Industrial	Dada Nagar	73.5	64.5	82.5	70.45	55.9	85.0
Silence Zone	Cardiology Hospital	72.5	59.6	85.5	62.65	55.2	70.1

Source: UP Pollution Control Board.

14.5.2.5 Noise Levels in Varanasi

The noise levels in different areas of Varanasi are studied i.e. residential, commercial, industrial and silence zone area (14.23). Ambient noise quality data of Varanasi is shown both day and night time. In residential areas the minimum noise level at day time is 39 and 46 dB and maximum is 61 and 66 dB. The value of L_{min} for night is 47 dB and L_{max} is 34 dB in both locations. These values are nearly equal to or slightly higher than standards. In commercial area two location are studied namely Badi Bazar and Dashashwamedh. In these areas L_{max} are 74 and 79 dB but L_{min} are 79 and 60 dB at day. This is somewhat less at night. In night, L_{max} is 67 and 49 dB and L_{min} is 56 and 40 dB. In Dashashwamedh region, the noise level is under standard value but in Badi Bajar it is exceeding the standard limits. In industrial area two locations are examined-Lahartara industrial area and DLW industrial area. In these regions L_{min} are 41 dB and 42 dB and L_{max} are 68 dB and 66 dB at daytime. In night L_{min} are 52 dB and 41 dB and L_{max} are 62 dB and 49 dB. Thus, the noise level is under the standard norms. The area of court and BHU is studied as silence zone area. In these regions at daytime L_{max} is 62 and 69 dB. L_{min} is 49 dB. For night L_{max} is 49 dB and L_{min} is 34 and 36 dB. These noise levels are under the safe limit.

TABLE 14.23

Ambient Noise Quality Data (Varanasi) 2000

Area	*Sampling Location*	*Average Noise Level*	*Noise Level (dB)*			
			Day		*Night*	
			L_{max}	L_{min}	L_{max}	L_{min}
Residential	(i) Nadesar	50	66	46	47	34
	(ii) Sunderpur	45	61	39	47	34
Commercial	(i) Badi Bazar	70	74	63	67	56
	(ii) Dashashwamedh	65	79	60	49	40
Industrial	(i) Lahartara Ind. Area	54	68	41	62	52
	(ii) DLW Ind. Area	50	66	42	49	41
Silence Zone	(i) Court	54	69	49	49	36
	(ii) BHU	50	62	49	49	34

Source: UP Pollution Control Board.

14.5.2.6 Noise Levels in Agra

The noise levels in different areas of Agra are studied i.e. commercial and silence zone area (Table 14.24). Mainly Raja Ki Mandi and Sadar Market areas are studied as commercial area. Values given for two days. In day the values vary between 64.47 dB to 72.37 dB and in night values are between 53.16 dB to 66.4 dB, which are higher than standard values. S. N. Medical College is studied as silence zone in different days. The values of noise level in day lies between 57.71 to 59.7dB. In night the level is vary between 49.13 to 53.3 dB. These levels are slightly higher than standard values.

TABLE 14.24

Ambient Noise Quality (Agra)

Sampling Location	*Noise Level (dB)*	
	Day Time	*Night Time*
Commercial Area		
Date : 24/10/2000		
Raja Ki Mandi	72.37 ± 06.54	66.40 ± 06.29
Sardar Market	64.47 ± 05.87	55.13 ± 06.40
Date : 26/10/2000		
Raja Ki Mandi	69.66 ± 05.58	66.40 ± 06.29
Sardar Market	64.73 ± 08.95	53.16 ± 07.89
Silence Area (S. N. Medical College) Agra		
Date : 24/10/2000	57.71 ± 06.29	53.33 ± 05.31
Date : 28/10/2000	59.54 ± 05.16	49.13 ± 03.56
Date : 28/10/2000	57.74 ± 08.69	52.59 ± 08.38

Source: UP Pollution Control Board.

14.5.3 Impacts of Noise on Human Health

They are as follows:

- hearing impairment,
- sleep disturbance,
- interference with speech communication,
- performance,
- annoyance, and
- impact on physiological functions.

14.6 Summary and Recommendations

14.6.1 Summary

Under the air environment of some urban centres of Uttar Pradesh, it is observed that values of SPM concentrations are exceeding the standard limits. The NOx and SO_2 are within the standard norms at all the places. It is important to note that the major portions of the suspended particulate matter are of natural origin resulting from dust storms, vehicular movement and agricultural activities. Rest of them may be contributed by fuel consumption in residential area, industrial area and commercial area or by vehicular load. Although in the industrial area the SPM concentration is not too much high.

Within the water environment, it has been observed that surface water quality in most of the locations is exceeding the specified norms for drinking water but the water is being used as drinking water after treatment. On discussions held with different officials responsible for water supply, the treated water is purely fit for all the purposes. During the field visit at some places and the data presented in Section 14.3, it has also been observed that groundwater quality is being deteriorated because of very poor sanitation and solid waste disposal practices by which the leachates reach the groundwater just below the surface and contaminate it. The water can be used for drinking purposes only after appropriate treatment and disinfection, etc.

In eastern UP, the districts of Chandauli, Mirzapur and Sonbhadra are also rich in flora and fauna. However, the whole forest area is facing the problem of severe damage to the forest caused by unrestrictive and destructive lopping of valuable species. Grazing by domestic animals and illegal felling of trees in the forest is a serious problem. Forests are sacrificed for developmental activities in these regions. Another problem that the study area's forests are facing is habitat fragmentation of wildlife as in the case of Haridwar district (Rajaji National Park). The habitats are fragmented for erecting transmission lines, construction of roads and transfer of land to other departments for developmental works and for railway line, etc.

According to available secondary data, it has been observed that noise levels are exceeding the standard limits set by CPCB in Kanpur, Lucknow, Varanasi and Agra mainly in residential, commercial and silence areas. This increased noise level may be contributed by inadequate infrastructure like roads, transportation which results in vehicular pollution. Noise from diesel generators sets in almost all the area during power-off is also a contributing factor.

14.6.2 Recommendations

It has been observed that though the local authorities have taken some precautionary steps, yet mere designating the areas as unsafe or vulnerable may not be the complete solution. These warnings in turn help to protect integrity of biodiversity and ecological processes. There are certain concrete steps required to first identify sources, principal causes of contamination, ecological imbalance and then to come out with the recommendations.

The recommendations for sustainable development of Uttar Pradesh are as follows:

1. The problems pertaining to traffic, transport and vehicular pollution may be overcome by removal of encroachments along the roadsides particularly in old city areas.
2. Banning the slow moving vehicles during busy hours in congested areas, introduction of a

suitable rapid mass transport system and creation of awareness in the public to keep their vehicles tuned to minimise the pollution due to exhaust.

3. Special emphasis may be given to improve the geometries and conditions of the roads and the traffic management to permit free and speedy flow of the vehicles. Regulating heavy tonnage vehicle and slow moving vehicles during peak hours, making certain roads, one-way, providing suitable parking spaces may be helpful.
4. Restriction on registration of tempos without scrubber may be continued.
5. In order to reduce the spread of air pollution from gaseous emissions from industrial sources, plantation of trees around the industry has been recommended. It has been found that the planting of trees is very helpful in reducing air pollution due to dry fly-ash and coal dust from coal handling systems in the industries. So trees should be planted all around such plants.
6. Nagural gas, if available, should be preferred instead of domestic fuels like wood, coal which are one of the important contributing factor in increasing SPM concentration.
7. The industries should treat their effluent to confirm the specified requirement. The common effluent treatment plant should be installed at the earliest for organised industrial areas. Strict vigilance should be made to enforce the provisions of various environmental laws.
8. The industrial and domestic wastes should be properly treated before dischage into natural drain. The drains and *nallahs* carrying untreated industrial effluents, domestic wastes should be diverted from the river channels, waste should be properly treated and then allowed to flow to water bodies
9. Cattle wading in the rivers should be restricted as it leads to deterioration of water quality.
10. The other religious activities like offering flowers, milk, sweets, etc. into the river water should be controlled as it increases the pollution load on water body.
11. Open defecation in river catchment areas should be strictly prohibited
12. Dumping of dead animals, human dead bodies in the water body should be prohibited.
13. Clothes washing at bank of water bodies should be strictly banned because it not only causes organic, inorganic and biological contamination but also increase the detergent contents. It hampers oxygen diffusion rate in the river water affecting the self-purification capacity as well as other biological activities.
14. Fishing activity should be regulated to maintain the ecological balance of aquatic ecosystem.
15. Assimilative capacity based standards for discharge of effluent should be prescribed for industries so that designated use of receiving water body is not affected. Suitable laws, standards and practices should be framed to regulate the discharge of undesirable flow of water in water bodies and such regulations should be modified from time to time in order to accommodate changing requirements and technological advancements.
16. All the specific locations as indicated in Section 14.3 exhibit contaminated groundwater be immediately declared as unsafe area by the local authorities and be supplied with alternative measures of drinking water.
17. The well-established natural forests need full protection for retaining soil fertility and productivity in the forest area.
18. Development has to be planned on the basis of watershed management on a sustainable basis so that the area can be kept alive with regenerating and well managed forests. Such a habitat can sustain healthy wildlife also.
19. Human development strategies covering their settlement needs should be synchronised with the conservation status of the forest area.
20. Illegal felling and unrestrictive lopping of trees, hunting of animals, enhanced animal grazing in forest land, collection of fire woods from forest floor, over utilisation of medicinal plants, etc. should be strictly prohibited.
21. Protection of wild life and improvement of its habitat in forest area comprising national parks, bio-reserves, sanctuaries should be emphasised.
22. Restoration of degraded and eroded lands by afforestation, agroforestry, improved pastures, use of of combination of bio and chemical fertilisers, ecologically compatible farming systems, etc. should be promoted.

23. The noise generating sources like use of loud speakers at religious places, marriages, commercial advertisements and use of pressure horns on the roads should be restricted.
24. Use of vibration isolators, damps material, etc. in sound generating machines with proper maintenance should be enforced particularly for places like pumping stations, factories, etc. located in residential areas.
25. Generators should be strictly provided with acoustic hoods and acoustic walls should be as per CPCB standards.
26. Special care needs to be taken in case of sensitive areas like hospitals, courts, etc. For this purpose, educating the people through awareness programmes apart from enforcement of preventive measures are suggested.
27. Decongestion of commercial areas is needed on priority. The means suggested are laning of roads, restricting certain categories of vehicles during peak hours, providing and enforcing proper parking for vehicles, etc.
28. Mass awareness programme should be conducted through press, radio and TV in order to highlight the ill effects of air, water and noise pollution.

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APPENDIX A-14.1

National Ambient Air Quality Standards (NAAQS) (1994)

Pollutant	*Time Weighted Average*	*Concentration in Ambient Air*			*Method of Measurement*
		Industrial Area	*Residential, Mixed Use Area*	*Rural and Sensitive Area*	
Sulphur Dioxide (SO_2)	Annual average*	80 $\mu g/m^3$	60 $\mu g/m^3$	15 $\mu g/m^3$	Improved West & Geake method
	24 hours**	120 $\mu g/m^3$	80 $\mu g/m^3$	30 $\mu g/m^3$	Ultraviolet
Fluorescence					
Oxides of Nitrogen Method (as NO_2)	Annual average*	80 $\mu g/m^3$	60 $\mu g/m^3$	15 $\mu g/m^3$	Jacab & Hochheiser (Na-Arsenite)
	24 hours**	120 $\mu g/m^3$	80 $\mu g/m^3$	30 $\mu g/m^3$	Gas phase chemiluscence
Suspended Particulate	Annual average*	360 $\mu g/m^3$	140 $\mu g/m^3$	70 $\mu g/m^3$	High volume sampling (average flow rate
Matter (SPM)	24 hours**	500 $\mu g/m^3$	200 $\mu g/m^3$	100 $\mu g/m^3$	not less than 1.1 m^3/min)
Respirable Particulate Matter (Size Less than 10 mm) (RPM)	Annual average*	120 $\mu g/m^3$	60 $\mu g/m^3$	50 $\mu g/m^3$	Respirable particulate matter sampler
	24 hours**	150 $\mu g/m^3$	100 $\mu g/m^3$	75 $\mu g/m^3$	
Lead (Pb)	Annual average*	1.0 $\mu g/m^3$	0.75 $\mu g/m^3$	0.50 $\mu g/m^3$	AAS method after sampling using
	24 hours**	1.5 $\mu mg/m^3$	1.00 $\mu g/m^3$	0.75 $\mu g/m^3$	EPM 2000 or equivalent filter paper
Carbon Monoxide	8 hours**	5.0 $\mu g/m^3$	2.0 $\mu g/m^3$	1.00 $\mu g/m^3$	Non-dispersive
Infrared (CO)					spectroscopy
	1 hour	10.0 $\mu g/m^3$	4.0 $\mu g/m^3$	2.00 $\mu g/m^3$	

Note: * Annual arithmatic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24 hourly/8 hourly values should be met 98 per cent of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.

1. National Ambient Air Quality Standards : The levels of air quality necessary with an adequate margin of safety, to protect the public health, vegetation and property.
2. Whenever and wherever two consecutive values exceeds the limit specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations
3. The above standards shall be reviewed after five years from the date of notification.

APPENDIX A-14.2

Indian Standards/Specifications for Drinking Water IS: 10500 (1991)

Substances or Characteristic Max.	*Requirement (Desirable Limit)*	*Undesirable Effects Outside the Desirable Limit*	*Permissible Limit in Absence of Alternate Source*	*Method of Test Cl Ref of IS : 3025*	*Remarks*
		Essential Characteristics			
Colour, Hazen Unit	5	Above, consumer acceptance decreases.	25	4 of 3025, 1983 only if toxic substances are not suspected in absence of alternate source.	Extended up to 25
Odour	Unobjectionable	-	5 of 3025, 1983	a. Test cold and when heated.	b. Test at several dilutions.
Taste	Agreeable	-	-	Test to be conducted only after safety has been established	
Turbidity, NTU	5	Above, consumer acceptance decreases.	10	8	-

Contd. ...

...Contd. ...

Substances or Characteristic Max.	*Requirement (Desirable Limit)*	*Undesirable Effects Outside the Desirable Limit*	*Permissible Limit in Absence of Alternate Source*	*Method of Test Cl Ref of IS : 3025*	*Remarks*
pH Value	6.5-8.5	Beyond this range the water will affect the mucous membrane and/or water supply system.	No relaxation	8	-
Total Hardness, Mg/L as $CaCO_3$	300	Encrustation on water supply structure and adverse effects on domestic use.	600	-	-
Iron (as Fe), Mg/L	0.3	Beyond this limit, taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.	1.0	32 of 3025, 1964	-
Chlorides (as Cl)m Mg/L	250	Beyond this limit, taste, corrosion and palatability are affected.	1000	32 of 3025, 1988	-
Residual Free	0.2 Chlorine, Mg/L	-	-	26 of 3025, 1986	To be applicable only when water is chlorinated. Tested at consumer end, when protection against viral infection is required, it should be min 0.5 Mg/L.
		Desirable Characteristics			
Dissolved Solids,	500 Mg/L	Beyond this palatability decrease. and may cause gastrointestinal irritation.	2000	16 of 3025, 1984	
Calcium (as Ca),	75 Mg/L	-	200	40 of 3025, 1984	
Copper (as Cu),	0.05 Mg/L	Astringent, taste discoloration of pipes, fitting and utensils will be caused beyond this.	1.5	36 of 3025, 1964	
Manganese (as Mn),	0.1 Mg/L	Astringent taste, discoloration of pipes, fitting and utensils will be caused beyond this.	0.3	35 of 3025, 1964	
Sulphates,	200 (as SO_4), Mg/L	Beyond this causes gastro intestinal irritation when magnesium or sodium are present.	400	24 of 3025, 1986	May be extended up to 400 provided (as Mg)does not exceed 30 Mg/L.
Nitrates (as NO_3),	45 Mg/L	Beyond this methaemoglobinemia takes place.	100	-	-
Fluoride (as F),	1.0 Mg/L	Fluoride may be kept as low as possible. High fluoride may cause fluorosis.	1.5	23 of 3025, 1964	-
Phenolic Substances, Mg/L	0.001 (as C_6H_5OH)	Beyond this, it may cause objectionable taste and odour.	0.002	54 of 3025, 1964	

Contd. ...

...*Contd.* ...

Substances or Characteristic Max.	*Requirement (Desirable Limit)*	*Undesirable Effects Outside the Desirable Limit*	*Permissible Limit in Absence of Alternate Source*	*Method of Test Cl Ref of IS : 3025*	*Remarks*
Mercury (as Hg), Mg/L	0.001	Beyond this, the water becomes toxic.	No relaxation	see note mercury ion analyser	To be tested when pollution is suspected.
Cadmium (as Cd), Mg/L	0.01	Beyond this, the water becomes toxic. is suspected.	No relaxation	see note mercury ion analyser	To be tested when pollution.
Selenium (as Se) Mg/L	0.01	Beyond this, the water becomes toxic.	No relaxation	28 of 3025, 1964	To be tested when pollution is suspected.
Arsenic (As), Mg/L	0.05	Beyond this, the water becomes toxic.	No relaxation	37 of 3025, 1988	To be tested when pollution is suspected.
Cyanide (CN), Mg/L	0.05	Beyond this, the water becomes toxic.	No relaxation	27 of 3025, 1986	To be tested when pollution is suspected.
Lead (Pb), Mg/L	0.05	Beyond this, the water becomes toxic.	No relaxation	See note 86	To be tested when pollution plumbosolvency. is suspected
Zinc (as Zn), Mg/L	5	Beyond this limit.	15 It can cause astringent taste and an opalescence in water.	39 of 3025, 1964	To be tested when pollution is suspected.
Anionic detergents,	0.2 Mg/L (as MBAS)	Beyond this limit, it can cause a light froth in water.	1.0	Methylene blue extraction method.	To be tested when pollution is suspected.
Chromium (as Cr^{+6}),	0.01 mg/L	May be carconogenic above this limit.	0.05	28 of 3025, 1964	To be tested when pollution is suspected
Polynuclear Aromatic	-	May be carcinogenic hydrocarbons (as PAH), mg/L.	-	-	-
Mineral Oil, Mg/L	0.01	Beyond this limit undesirable taste and odour after chlorination takes place.	0.03	Gas chromatographic method	To be tested when pollution is suspected.
Pesticides, Mg/L	Absent	Toxic	0.001	58 of 3025, 1964	-
Radioactive Materials	a. Alpha emitters Bq/L b. Beta emitters pci/L	- -	- -	0.1 1.0	- -
Alkalinity 200	(as $CaCO_3$), mg/L	Beyond this limit taste becomes unpleasant.	600	13 of 3025, 1964	-
Aluminimum (as Al), Mg/L	0.03	Cumulative effect is reported to cause dementia.	0.2	31 of 3025, 1964	-
Boron (as B), Mg/L	1	-	5	29 of 3025, 1964	-

Source: Bureau of Indian Standards (IS 10500: 1991, Revised August 1995) Indian Standard: Drinking water specification. UDC 628.1.033.

Note: Atomic absorption spectrophotometric method may be used.

APPENDIX A-14.3

Ambient Standards in Respect of Noise

Area Code	*Category of Area/Zone*	*Limits in dB(A) Leq**	
		Daytime	*Nighttime*
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

Source: CPCB (1998) Polluction Control Acts, Rules and Notifications issued there under. Volume-1 p.313.

Notes :

1. Daytime shall mean from 6.00 a.m. to 09.00 p.m.
2. Night time shall mean from 09.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 metres around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the Component Authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is related to human hearing.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of human ear.

Leq : It is an energy mean of the noise level over a specified period.