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## **DECLARATION**

I hereby declare that, the present field work report entitled, “ENVIROMENTAL DEGRADATION OF THE NAINITAL LAKE” submitted to Department of Geography, Government College for Girls, Sector-14, Gurugram (Haryana) in partial fulfilment of the requirement for the award of Bachelor’s Degree in Geography (Hons) is a record of original research field work done by me under the guidance of Mrs Sarita Devi, Department of Geography.

**Dated: 20th November 2022**

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SUPERVISED BY  
Mrs. SARITA DEVI

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## **ACKNOWLEDGEMENT**

*I would like to express my sincere gratitude to our college( Govt. College for Girls Sector-14, Gurugram,( Haryana) **Principal Ramesh Kumar Garg** for allowing the students of our class to go for a field trip to Nainital Uttarakhand for the fulfilment of our Practical (Field Work).*

*I would like to thank our **Asso. Prof. Dr. Rajesh Kumari** who made prior arrangements for the trip which allowed us to work easily on our practical work and our **course coordinator Mrs. Sarita Devi** for accompanying us to the field trip besides she provided us with proper guidance, moral support and proper understanding of each aspect involved in the field work and helped us to tackle the problems we faced throughout the course of our field work as well as give us full guidance at the time of report writing .*

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*Lastly, I would also like to thank the staff of the hotel where we resided during our visit to Nainital who helped us in getting acquainted with the places in Nainital and also helped us during our field work.*

**NAME:**

**CLASS:**

# **“ENVIRONMENTAL DEGRADATION OF THE NAINITAL LAKE”, UTTARAKHAND**

*A FIELD REPORT SUBMITTED TO THE  
DEPARTMENT OF GEOGRAPHY  
PRACTICAL*

*IN THE PARTIAL FULFILMENT FOR THE  
REQUIREMENT OF THE  
DEGREE OF BACHLORS OF ARTS  
IN GEOGRAPHY*



*SUPERVISED BY:*

*Mrs. Sarita Devi*

*SUBMITTED BY:*

*NAME:*

*ROLL NO:*



## **Introduction**

Before having a clear idea of what is physical and social economic survey it is necessary to understand the meaning of field survey.

Field survey is defined as a documentation of analysis of phenomena, processes based on theories and observation made by researchers in the field. Its purpose is to describe and observe person, place or event, to analysis the observation data, to identify the research problem underpinning.

The department of geography of Government College of Girls Sec 14 Gurugram has organised an educational tour for completing the fieldwork of third year honours students as per G U Curriculum. The destination was Jim Corbett and Nainital. The tour was organised by our teachers Dr. Rajesh Kumari and Mrs. Sarita Devi from 3 oct 2022 to 07 oct 2022. There were thirty students and three faculty members in the team.

We started our journey from our college on 3 oct 2022.

On 4th oct, After reaching at Jim Corbett we stayed at a well decorated resort after that we started heading towards a Village “ Sunderkhaal” in Jim Corbett. We observed there a variety of flora and fauna, We also observed certain problems that people inhabiting there were suffering from. There after we headed towards Jim Corbett Museum.

Next Day early morning, we did jungle safari thereafter we worked on long and cross profile on a rivulet called Dabka.

Next Day that is 5 Oct 2022, we went towards Nainital. On the way we saw the Kosi barrage thereafter reaching the Nainital we saw various lake like Khurpatal, Sariyatal, Mallital, Bhimtal etc.

We observed some unstable slopes on the way. We enjoyed boating at Nainital lake. But the lake seemed to be degrading as the water quality was not good, heavy tourist inflow and various construction activity was also noticed there. Next day that is 07 oct 2022 we headed towards our college.

This excursion helped us to understand the struggle of the hilly people and we could understand the various factors attributing to the degradation of the Nainital lake.

### **Objective:**

The Development of area depends on physical and social setting of an area. Keeping it in mind following objectives are undertaken for the field study.

- 1) To know about the Ecosystem and biodiversity of the Nainital lake.
- 2) To understand the geological formation of the Nainital lake.
- 3) To understand the hydrology and biodiversity of the Nainital Lake.
- 4) To Identify various anthropogenic activities affecting ecosystem of the lake.
- 5) To analyse the water quality of the lake.
- 6) To observe and identify the reasons of degradation of lake

### **Study Area:**

Nainital is a town and headquarter of Nainital district of Kumaon division, Uttarakhand India.

Nainital is in deep Kumaon foothills of the outer Himalayas and is located at a distance of 285 km from the state capital Dehradun. It is situated at an altitude of 1938 metres above the sea level the town is set in a valley. It is an eye shape lake approximately 2 miles in circumference and surrounded by mountains of which the highest are Naina peak on the north Deopath on the West and Ayarpath on the South. The town of Nainital covers a total area of 11.73 square km and is located at 29.38 degree north and 79.45 degree east at an average elevation of 2084 metres above the sea level. Geographically the district is divided into 2 zones: a) North of Naini lake is Mallital/Krol, b) Foothills is Tallital or Bhabar.





**Pic.-1 "DEVBHUMI" literally 'Land of the God'**



**Pic.-2 Clouds touching the roof of Mountains. Photo taken during field work on 6-10-2022 at 7:03 PM**



**Pic.-3 The Sivalik Hills, also known as the Shivalik Hills and Churia Hills, are a mountain range of the outer Himalayas that stretches over about 2,400 km (1,500 mi) from the Indus River eastwards close to**

**the Brahmaputra River, spanning the northern parts of Indian Continent. Photo taken during field work on 6-10-2022 at 12:47 PM.**

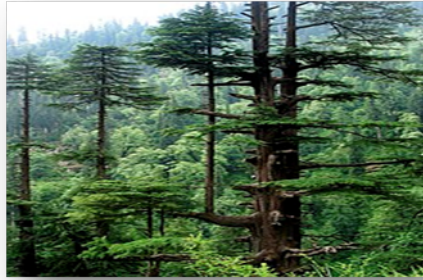
- **Geology:** The town is located in the catchment area of the Nainital lake which has highly folded and fragile rocks. it is characterised by distinct rock types of varied geological ages, structural trend and geomorphic features like Ayarpath is composed of dolomite and Barapathar is composed of black shales with Marls etc.
- **Flora and Fauna:** Areas around Nainital is rich in natural vegetation which includes Sal, Teak, Deodar, Pine, Banj , Oak etc. Fauna includes deer, tiger, elephant, lion etc. Birds species includes : Golden Throated barbet, Crescent serpent eagle, Merops orientalic etc.



**Pic.-4 Flora and Fauna at Nainital**



**Pic.-5 Flora and Fauna at Nainital**



- Hydrology: a) The main river flowing through the district is “ Kosi” It is originated from Koshimool near Kausani . Main Rivulets include Dabka, Gaula,Baur, and Bhakra. Important dam located here is Kosi Barrage. b) Some of the bigger lakes in Nainital includes; Bhimtal, Sattal, Khurpatal, Nainilake, Lokhamtal etc.



**Pic.-6 Nainital Lake, also known as Naini Lake, is a natural freshwater body, situated amidst the town of Nainital in Kumaon, Uttarakhand, India. It is tectonic in origin and is kidney shaped or crescent shaped and has an outfall at the southeastern end. Photo taken on 6-10-2022 at 12:24 PM.**







**Pic.-7 Huge ammount of fishes found at the Nani Lake**





**Pic.-8 Picture during Nainital visit on 6-10-2022 at 11:09AM**



**Pic.-9 Picture of Nani Lake during Boating on 6-10-2022 at 2:21 PM. Agriculture pattern across Khurpatal Lake.**

- **ABOUT NAINITAL LAKE** : Nainital lake is also known as naini lake. It is a natural fresh water body situated amidst the town of Nainital. It is an eye shaped lake. It is the 3rd largest lake in Uttarakhand and is 2 miles approx. in circumference. It is located at an average elevation of about 1938 metre above sea level . It is approx. 27 m deep lake. The width and length of the lake is 0.45 km and 1.43 km respectively . The lake

is fringed by string of 7 hills: Ayarpatta, Deopatta, Handi-Bandi, Chena peak, Alma , laria kanta and sher ka danda.

➤ Historical background:

The origin of this lake has been described by 3 theories:

- 1) As per Indian Mythology, Goddess Sati's eyes fell out of her charred body here, hence the name Nain-tal refers to the eye shaped lake.
- 2) According to another legend, this lake was named after 3 sages ( Tri-Rishi- Sarovar).
- 3) As per the historical records, a business man( Mr. P Barron) came across this lake. In his hunting expedition during 1839 and he decided to build a European colony on its shores.

➤ Climate: According to Koeppen-Geiger climate classification system as the towns climate is influenced by the elevation. The town is a bit dry during winter and very wet during summer due to South Asian monsoon system. The lowest precipitation total updates in November with total 7.9 millimetres while the highest precipitation total occurs in July with the total 725 millimetres like most places in temperate region. Nainital has relatively cool summer, the hottest month is July with the temperature ranging from 16.4 degrees Celsius to 23.5 degrees Celsius while the coldest month is January with the temperature ranging from 1.7 degrees Celsius to 10.7 degrees Celsius the highest temperature ever recorded in Nainital was 30 degrees Celsius recorded on 16 June 1972 while the lowest temperature was 5.6 degrees Celsius reported on 10 January 1953. The winter season in Nainital commences by mid November and last still mid March. Frost and mist are former features in the month of December and January occasionally bit spread rainfall also occurs due to western disturbance with snow occurring on peaks higher than 2000 metres. the

winter rainfall is sometimes associated with cyclonic activities. The weather during the post monsoon is characterised by bright skies. it is in fact a transition between the summer and the winters and with reduced rainfall the monthly temperature records a progressive decline till mid-January.

➤ Flora and fauna:

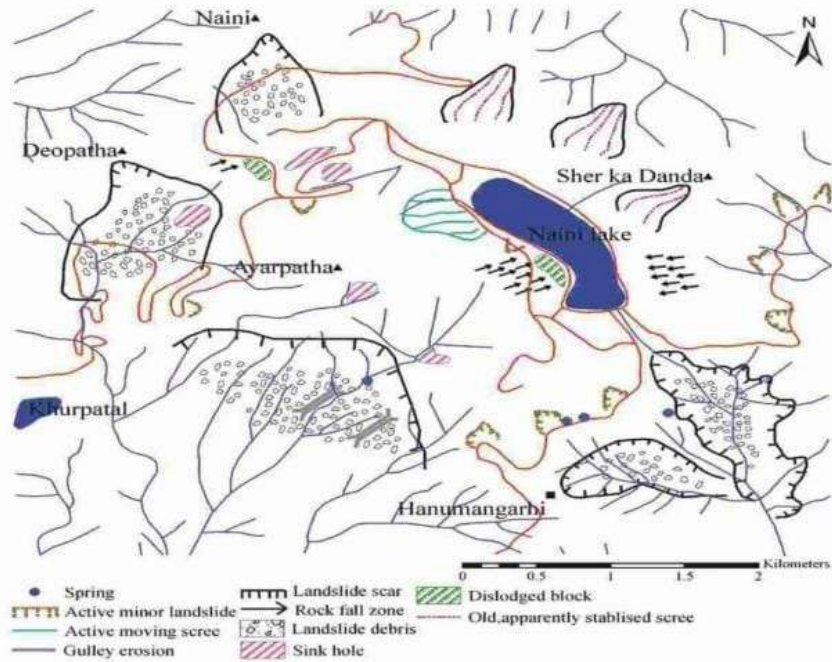
Flora around Naini lake includes Pine, Oak, Deodar, Surai etc. and Aquatic macrophytic vegetation includes Potamogeton pectinatus; Potamogeton crispus; Potamogeton Hydropipper.

Important fauna species in the lake includes: Species of Mahaseer fish(Trot), Species of Hill trout, Imported fish breed ( Mirror Carp & Mosquito fish).

➤ Geology:

Naini lake is seismically active lake or of tectonic origin. It is located near the border of the “Sub-Himalayan Zone”, restricted to a narrow belt of 5 km to the north of Krol. The Krol group of rock like slate, dolomite, limestones etc is the dominant geological formation of the lake’s surroundings. The lake catchment has highly folded and faulted rocks. The slopes around the lake are highly vulnerable to landslides, mass movements due to various geological and anthropogenic factors.





➤ Hydrology:

The lake receives inflow from the surrounding catchment basin comprising of hill slopes and springs. It outfalls in the south eastern end. The water quality of the lake is reported to be alkaline in nature and is home to various species of fish like Mahaseer, Hill trout, Mirror carp etc. The open drains feeding the lake introduce toxic substances from the catchment of the lake. BOD of the lake has increased over the past few years.



**Research Problem:**

Nainital is the most important water body in terms of environmental and tourist attraction. It is also recipient of storm water for large catchments. In comparison to other Kumaon lakes, the Nainital lake is subjected to the greatest man-made manipulation and the area experiences the extreme of climate too. Declining water level of the lake had also caused a concern among environmentalist who consider overuse of the lake for water supply purposes during summer a major factor, apart from deficit rainfall, for water levels coming down in the lake. In the recent years, due to unplanned construction, Encroachment and degradation of recharge zones, deficit in winter rainfall and receding monsoon early caused the rapid decline in water level about 20 ft. It is topic of concern among the local people, environmental agencies, government authorities and ecologist. Concrete construction causing very low infiltration of rain water which enhances siltation, dumping debris in Sukhatal lake, which is major aquifer recharge area for Nainital lake, causing the lake to shrink from its 2 hectare area. According to the recent study, the water quality of the Naini lake has been steadily deteriorating and is highly polluted due to the addition of exogenous wastes. As a result of being a popular tourist destination, there has been an increase of more than 37% human and tourist population in the catchment area of the lake. Also, high siltation resulting in reduction of lake depth, the depth of lake has reduced from its original depth of 29 m in 1871 to only 13 m in 2017.

***Following are the major reasons for the environmental degradation of the Nainital lake:***

- 1) Natural Causes: The problem of landslide subsidence in Nainital particularly in the periphery of the lake is due to a combination of several causes like geological movements, structure, lithology, water sewage, soil cover, vegetation cover, weather, and climate change. landslide and Soil erosion from the adjoining hill cause heavy silt deposition in the lake. To prevent such landslides and soil erosion, adequate

protective measures are required because they not only damage mountains slopes and lives but also decreases the growing life of the lake. Due to landslides on the surrounding hills the source of water filling the lake are blocked.



- 2) Anthropogenic Causes: Heavy tourist inflow has contributed to the degradation as well. An important part of solid waste and plastic generated due to the increasing number of tourists in the city makes its way into the lake through drain or indiscriminate litter. These not only pollute the lake water but also reduce the beautification of the lake. Nainital lake also polluted due to urbanization and tourism activities. Discharge of untreated waste water, disposal of solid waste and silt deposition are the major factors that cause pollution of the lake. growth of urban population and inadequate sewer system lead to the problem of overflowing of sewage in stormwater drains ultimately discharging into Nainital lake .
- Another important cause is encroachment and illegal construction: It has reduced the catchment area as houses and hotels have come up in areas surrounding the lake unfortunately due to unlimited population and mushrooming growth of hotels in

Nainital. The lake has been suffering from various problems including pollution as a result of the accelerated rate of man's cultural activities in the catchment area of the lake, the lake has become eutrophic and polluted.



### **Research Methodology:**

The bedrock of data analysis and interpretation is formed by the **collection of data**. 'Data' is basically unorganized statistical facts and figures collected for some specific purposes, such as analysis. There can be different *sources* of data, such as statistical and non-statistical sources.

Also, there are different *methods of data collection*, depending on the type of data. There are two main types of data: primary and secondary. Understanding the difference between the two is important in deciding which method of data collection to use. Tremendous amounts of statistical analyses are carried out continuously in countries for publication purposes or even for policy framing.

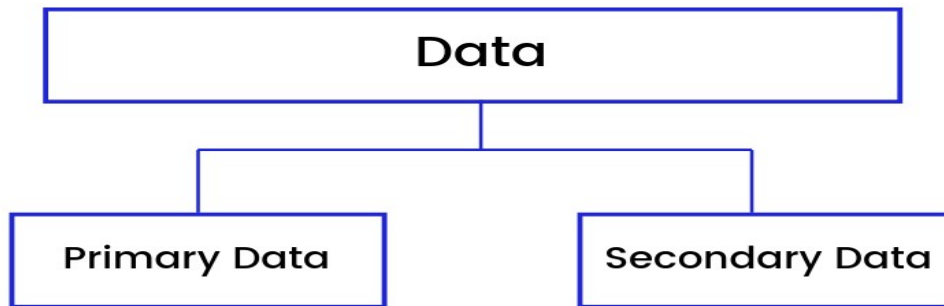
The data collection of our survey was **primary** type data..



## Sources of Data

There are two sources of data in Statistics. **Statistical sources** refer to data that are collected for some official purposes and include censuses and officially conducted surveys. **Non-statistical sources** refer to the data that are collected for other administrative purposes or for the private sector.

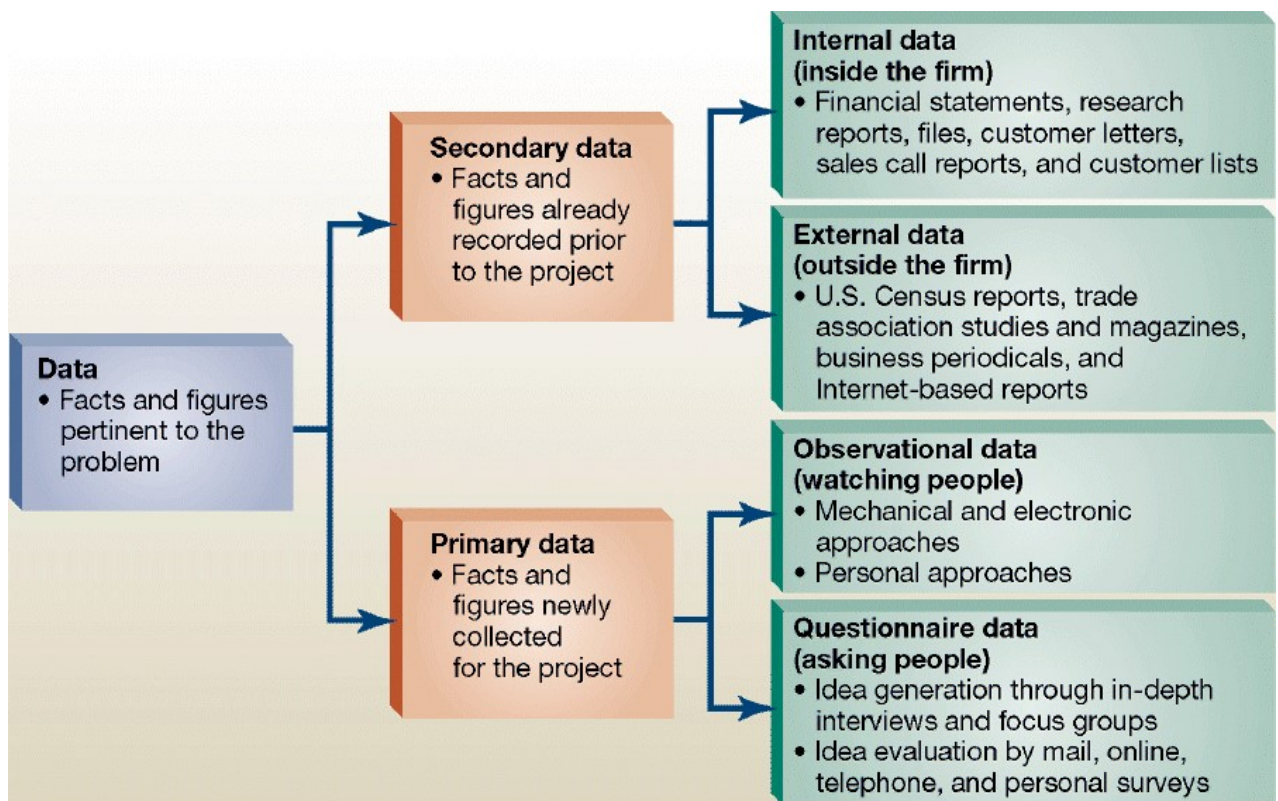




Examples:  
 1. Interviewing people within your organization  
 2. Observing a moderated discussion amongst people you choose to collect data

Examples:  
 1. Google Analytics report on your website's traffic  
 2. Information you collect from census and electoral statistics

**atlan**



## Result and Discussion

The Nainital lake is a large water body with 2 basins Mallital and Tallital. The physico-chemical profile of the Nainital lake has been studied. The quality of the lake water depends largely on catchment characteristics, geology of the area and the inputs of human activities.

Following information's are collected from the field survey conducted on 6th October 2022 in Nainital:

- 1) **Morphometric changes of Nainital lake:** the mean depth of Nainital has gradually decreased over the past few years registering a decrease in area below 25 metre surfaces of the lake. the reduction in the depth of the lake is mainly due to deposition of sediments in the basin. Accordingly, the volume of the lake has considerably reduced in the last 85 years.

The data showing the changes in the depth of the lake from 1895 to 1979 is given below.



Year	Depth (m)			% Reduction from 1895 to 1979
	1895	1969	1979	
Maximum depth(m)	27.45	26.95	25.70	1.75 (6.38)
Mean depth(m)	21.43	20.64	18.55	2.88 (13.44)

Fig: Changes in the depth of the lake from 1895 to 1979

- 2) **Water quality index :** The dissolved oxygen and biological oxygen demand are the indicative parameters showing the health of the waterbody. It indicates the amount of biologically oxidisable organic matter present that can be used to determine the rates at which degradation occurs.

in the studies reported by Gupta 1990, the average BOD in the Nainital lake is around 20 mg per litre. The maximum value was recorded as 40 mg per litre and minimum 13 mg per litre these higher values of BOD indicate of organic pollutants including the algal mass.

Summer months depicted high value of BOD in the Nainital lake while the monsoon period recorded relatively low values of BOD. the poor quality of the lake water can be attributed to the release of certain toxic gases during different periods of the year. Release of the toxic gases was recorded throughout the year.

- 1) NH<sub>3</sub> occurred throughout the year relatively higher in winter months.
- 2) H<sub>2</sub>S was recorded throughout the year.
- 3) Release of methane gas particularly during winter months. Consequently, toxic substances such as NH<sub>3</sub>, H<sub>2</sub>S etc. are produced and the fish kill occurs .

**Table.2. Characteristics of the water flowing through the metro poledrains, Nainital Lake**

S. No	Parameters	Range
1	PH	7.5 – 8.2
2	Alkalinity (mg/l)	185 – 390
3	Hardness mg/l	> 300
4	T.D.S. mg/l	300 – 610
5	D.O. mg/l	2.5 – 8.0
6	B.O.D. mg/l	22 – 58
7	Phosphate mg/l	0.23 – 0.396
8	NO <sub>3</sub> - N mg/l	0.6 – 2.15
9	NH <sub>3</sub> - N mg/l	0.06 – 1.2
10	NO <sub>2</sub> - N mg/l	0.02 – 1.2

- 4) Eutrophication : eutrophication of the Nainital lake has increased manifold during the subsequent 2 decades. At present the lake water has become almost opaque. The release of NO<sub>3</sub>-N has increased by 1.6 times, BOD by 2 times and PO<sub>4</sub>-P has risen by 13.6 times. Though the sewer connection has improved considerably but bathroom and kitchen waste water still finds its way into the lake throughout the drains.



- 5) Water borne diseases: lake is prone to various water born diseases because of the degrading quality of the water. A clear impact of this should get reflected in the health status of the people in Nainital data based on cases admitted to the hospital indicate that infective diarrhoea, dehydration and vomiting constitute the major diseases.

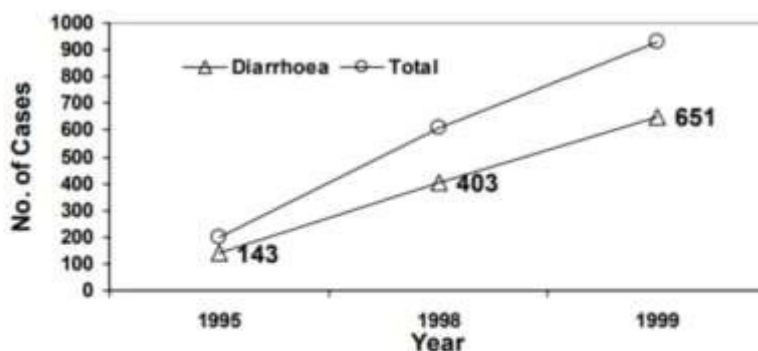


Fig. 2.16 Trend of water-borne diseases (individuals admitted to the district hospital of Nainital during 1996-98)

### Summary and conclusions

Based on the information and data it can be concluded that the problems associated with lake are due to anthropogenic intervention. The data collected shows evidence that lake system is under stress. The Nainital lake receives waste from the surrounding areas run off from catchments and residues of construction activities through small and large drains.

The lake water have many uses such as provision of drinking water, recreation and aesthetics, assimilation of waste, fisheries and aquaculture.

**Recommendations:** following are the recommendations to conserve and restore the Nainital lake.

- 1) Proper treatment of sewage in the city and specifically around the lake.
- 2) improve sanitation around the lake.
- 3) Reduce generation of debris by suitable control on construction and slope modification.
- 4) In view of the reducing depth of the lake, the sediment removal process from the periphery of the lake should be carried out regularly at an interval of 3 to 5 years.
- 5) Planning of trees and protecting the natural vegetation of the lake catchment will improve recharge and reduce sediment yield into lake.
- 6) Limnological measures such as bottom aeration, siphoning of hypolimnetic water, biomanipulation and limited sediment removal from the deltas of the drains which lead to the lake.
- 7) Public awareness and public participation programmes.

- To improve the quality of the lake water, the measures are being taken by the government of Uttarakhand which includes the control of external inputs. When external supply of nutrients will be successfully cut off, the lake eutrophication may be reduced. sediments may be removed from the areas where pollutants have accumulated debris the catchment has settled and inflows streams are depositing their silt load.
- the Supreme Court of India in its judgment of 1995 gave the following recommendation which have also been addressed in the restoration measures:
  - 1) sewage water must be prevented at any cost from entering the lake.
  - 2) Building materials are not allowed to be heaped on the drains to prevent siltation of the lake.
  - 3) The offence of illegal felling of trees is required to be made cognizable.
  - 4) Multistorey group housing and commercial complexes have to be banned in the town area of Nainital.
  - 5) Vehicular traffic around the lake has to be reduced .

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**Source:** During Field Work, 5th October, 2022



***Different Type of Vegetable at Sunderkhal Village***

