Eco-hydrology and Chemical Pollution of Western Ghats

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Eco-hydrology

Eco-hydrology is a new integrative science that involves finding solutions to issues surrounding water, people, and the environment. One of the fundamental concepts involved in eco-hydrology is that the timing and availability of freshwater is intimately linked to ecosystem processes, and the goods and services provided by fresh waters to societies. This means that emphasis is placed on the hydrological cycle and its effects on ecological processes and human well-being.

Limnology

Limnology is the science that deals with the physical, chemical and biological properties and features of fresh waters. A professional who studies fresh water systems is a limnologist.

Lotic System: The lotic environment is consisting of all inland waters in which entire water body continually flows in a definite direction. etc. rivers streams.

Lentic system: The lentic environment has been including all inland waters in which water has been not continually flowing in a definite direction. Standing waters

Western Ghats

The Western Ghats hill range extends along the **west coast of India, covering an area of 160,000** square kilometers. The presence of these hills creates major precipitation gradients that strongly influence regional climate, hydrology and the distribution of vegetation types and endemic plants.

Biodiversity

Although the total area is less than **6 percent** of the land area of India, the Western Ghats contains more than **30 percent of all plant, fish, fauna, bird, and mammal species** found in India. The region also has a spectacular assemblage of large mammals and is home to several nationally significant wildlife sanctuaries, tiger reserves, and national parks. A total of **58 protected areas consisting of 14 National Parks and 44 Wildlife Sanctuaries** fall within its

boundaries. The total area covered by these protected areas is 13,595 sq km representing 9.06 percent of the Western Ghats . It is one of two biogeographic zones (the other being the Andaman and Nicobar Islands) with the highest level of coverage by protected areas in India. The Western Ghats contains numerous medicinal plants and important genetic resources such as the wild relatives of grains (rice, barley, Eleucine coracana), fruits (mango, garcinias, banana, jackfruit), and spices (black pepper, cinnamon, cardamom, and nutmeg). Biodiversity in the Western Ghats is threatened by a variety of human pressures. Only one third of the area is under natural vegetation.. Three hundred and forty species of vertebrates (**36% of all vertebrate species**) are endemic to the Western Ghats. Amongst **amphibians**, 94 of the 121 species (**78%**) known till date from the ecoregion are endemic.

Rainfall

On account of its mountainous topography and heavy rainfall (between **2000 and 8000 millimeters** of annual rainfall within a short span of 3-4 months), the Western Ghats performs important hydrological and watershed functions. The soils and waters of this region sustain the livelihoods of millions of people.

Pesticides

Estimates suggest that around **4,00,000 ha is under tea cultivation** in India. While Assam and West Bengal top the list amongst the Indian states, in the Western Ghats, Kerala, Tamil Nadu and Karnataka are the primary cultivators of tea; together they cultivate 73,669 ha amounting to **18% of the country's tea gardens**. In the Western Ghats, tea grows between elevations of 300 and 2300 m ASL and within rainfall regimes of 90–750 cm per annum, coinciding with the biodiversity-rich rainforests and the endemic montane *shola*-grassland ecosystems.Since tea grows best in the humid, biodiversity-rich parts of the world, it has attracted a large number of pests. The literature states that over **300 species of arthropods, 58 species of fungi and 130 species of plants infest tea cultivation in India alone, necessitating the continuous application of heavy doses of pesticides.** And, despite the international markets' concern on the human health hazards posed by the toxic residues in tea, not less than 30 different pesticides are used.

Pesticides commonly used on tea

Organochlorine compounds

Dicofol , Endosulfan

Organophosphorous compounds

Ethion , Quinalphos , Chlorpyrifos

Synthetic pyrethroids

Deltamethrin

Weedicides

Paraquat , Glyphosate

Fungicides

Copper oxychloride

Recent studies have shown that insecticides such as DDT, dieldrin and malathion affect the immune systems, and the herbicide atrazine, at such small doses as 0.1 parts per billion, causes reversal of sex in amphibians. Ironically however, the permitted residue of atrazine in processed tea is 0.1 parts per million32 – 1000 timeshigher than what is safe for an amphibian! While atrazine, DDT and dieldrin are not among the pesticides recommended for tea, malathion is occasionally used to control green fly, a sucking pest of minor importance in tea. Breakdown of immune systems in amphibians can make them vulnerable to diseases.

What happens to the pesticides used in tea cultivation?

The heavy rainfall (450 cm per year) might just wash most pesticides from exposed surfaces. The chemicals will contaminate aquatic system. Water is life and is necessary for all ecosystems. The chemically contaminated water may poison the ecosystem. Many of the rivers are originating from western ghats and chemically contaminated water pose serious threats living systems. Let us look into the rivers originating from western ghats.

Western Ghats rivers

Krishna rises in the Western Ghats, at an altitude of 1,336 metres near Mahabaleshwar in Maharashtra, flows from west to east for a length of about 1,400 km, through Maharashtra, Karnataka and Andhra Pradesh. The Krishna has a drainage area of about 2.59 lakh sq km. Together with its tributaries, it flows for about 704 km length in the State.

Ghataprabha The Ghataprabha river rises in the Western Ghats, at an altitude of S84 metres and tlows eastwards for a length of 283 km before joining the Krishna. The river debouches by 53 metres at Gokak Falls in Belgaum Dt. The total catchment area of the river and its tributaries accounts for 8,829 sq.km in Maharashtra and Karna,taka States.

Malaprabha also rises in Western Ghats at an altitude of 792 metres in Belgaum Dt. The river flows first in easterly and then in north-easterly directions and joins the Krishna at Kudalasangama, about 304 km from its source. The principal tributaries are the Bennihalla, Hirehalla and the Tas Nadi. The total catchment area of the Malaprabha and its tributaries is 11,549 sq km., wholly in Karnataka.

Bhima river also rises in Western Ghats, at an altitude of about 945 metres and flows south-east wards through Maharashtra and Karnataka. It flows for 861 km before joining the Krishna near Kudlu in Raichur taluk. The latter 298 km of the Bhima's course is in the State. It has a drainage area of 70,614 sq km out of which 18,315 sq km lies in Karnataka.

Tungabhadra formed north of Shimoga at an elevation of about 610metres by the union of twin rivers, the Tunga and the Bhadra, which rise together in the Western Ghats at an elevation of about 1,198 metres. The Varada and the Hagari are its important tributaries. It has a drainage area of 71,417 sq.km out of which 57,671 sq.km lies in the State. It flows for a distance of 293 km. in the State.

Cauvery has its origin in the Western Ghats in Kodagu Dt. It flows for a length of 320 km in the State. The river flows generally in a south-east direction. The Chunchanakatte Falls (about 20 m) and the Shivasumdra Falls (about 100 m) exist in the State.

Hemavat rises in the Western Ghats at an elevation of about 1,219 metres and joins the river Cauvery near Krishnarajasagar. The drainage area is about 5,410 sq.km and the approximate length of the river is 245 km.

Kabini The river Kabini has a total course of about 230 km and a catchment area of about 7,040 sq.km. It joins the Cauvery river at Tirumakudal Narasipur.

Godavari basin Godavari basin has a drainage area of 4,405 sq.km. Only a small part of Godavari basin lies in the State. The river Manjra is the major tributary of the Godavari and it flows for about 155 km in the State.

Pennar and Palar basins The North Pennar, South Pennar and the Palar rivers drain about 13,610 sq.km in the State.

The Mahe river, also called the Mayyazhi puzha, originates from the forests on the western slopes of the Wayanad hills which from part of the Western Ghats. The length of the river is about 54 kms. and it flows through an area of 394 sq. kms.

The Murad river, also known as the Kuttiady river, takes its origin from the Narikota ranges on the western slops of the Wayanad hills, a part of Western Ghats. This river has a length of 74 kms. and along with its tributaries it flows through an area of 583 sq. kms. The Onipuzha, the Thottilpalam puzha, the Kadiyangad puzha, the Vamathil puzha and the Madapalli puzha are the major tributaries of Murad river. It passes through Oorakuchi, Kuttiady, Tiruvallur, Muyipoth, Maniyur and Karuvancheri.

The Korapuzha formed by the confluence of two streams called Punnurpuzha and Agalapuzha, this river and its main tributaries are tidal in their lower reaches. The Agalapuzha is more or less a backwater, while the Punnurpuzha originates from Arikkankunnu. The Agalapuzha forms a part of the important. West Coast Inland Navigation System. The total length of the river is 40 kms. with a drainage area of 624 sq. kms.

The Kallai river has its origin from Cherukulathur village and is connected to the Chaliyar on the south by a man-made canal.. The length of the river is 22 kms. and it has a drainage area of 96 sq. kms. Though small in size, the Kallai is one of the most important rivers in the entire State from the commercial point of view. Kallai, a main centre of timber trade, is situated on its banks.

The Chaliyar, known in the lower reaches as the Beypore river, this is one of the major rivers of the State. The lower reaches form part of the West Coast Inland Navigation system. It originates from the Ilambalari hills in Gudalur taluk of Nilagiri district in Tamil Nadu. The Chalipuzha, the Punnapuzha, the Pandiyar, the Karimpuzha, the Vadapurampuzha, the Iringipuzha and the Iruthilpuzha are its important tributaries. As an inter-state river, this has a total drainage area of 2923 sq. kms, of which 2535 sq. kms. lie in Kerala and the rest, 388 sq. kms. in Tamil Nadu. With a length of 169 kms., the Chaliyar river flows through Nilambur, Mambad, Edavanna, Areacode, Vazhakkad in Malappuram district and Feroke in Kozhikode district before it joins the Arabian Sea near Beypore.

The Kadalundi river is formed by the confluence of its two main tributaries, the Olipuzha and the Veliyar. The Olipuzha takes its origin from the Cherakkombhanmala and the Veliyar from the forests of Erattakombanmala. The total length of this river is 130 kms, with a drainage area of 1099 sq.kms. The river flows towards the Chaliyar and joins the Arabian Sea at about 5 kms. south of the Chaliyar river mouth. The Pooraparamba river, a small stream, is also included in this basin, as its lengh is only 8 kms. with a drainage area of 23 sq. kms. The total

drainage area of the basin is thus 1122 sq.kms. The Kadalundi river, also known by the names, Karimpuzha and Oravanpurampuzha, is important from the navigation point of view.

The Tamiraparani. originates from the peak of the Periya Pothigai hills of the Western Ghats above Papanasam in the Ambasamudram taluk. The great river like the Cauvery, but unlike most of the other Indian rivers, is fed by both the monsoons - the south west and the north-eastern and is seen in full spate twice a year if the monsoons do not fail. The Tirunelveli Sthalapurana associates the origin of the river with sage Agasthiyar

The Pachaiyar The river Pachaiyar rises on the eastern slope of Western ghats about 11 km. north west of Kalakadu at an altitude of 1000 m. above MSL. It flows eastward upto Padmaneri village from where it changes its course towards north east. It is a tributary of Tamiraparani and makes its confluence with the river in the village Tharuvai. The total length of the river from its source to its confluence with the Tamiraparani is about 32 km.

The Korayar is a tributary to the Tamiraparani. It originates in the eastern slopes of Western ghats, flows in the northern direction and empties into the main river Tamiraparani near Vellanguli village in Ambasamudram taluk after crossing the Kannadian channel through and outlet

The Chittar. The river takes its origin in the eastern slopes of the Western Ghats in the Courtalam hills, called Tirikoodam in literature, at an altitude of 1750m. above MSL. From its origin, the river climbs down for about six km. turns north and flows for about 16 km. before turning towards the east. Its total length is about 80 km. It joins the river Tamiraparani near Sivalapperi village of Tirunelveli Taluk.. The river Chittar makes many patches of, Tenkasi Taluk fertile.

Aluthakanniar It is a major tributary to the Chittar river. Arising in the eastern slopes of the western Ghats, it flows 10km. towards north east before joining its main river (Chithar) near Kadapagothi village of Tenkasi taluk.

Aintharuviar is one of the tributaries of the river Chittar. It takes its origin from the eastern slopes of Eastern ghats and Joins the Chittar river near Gajamajorpuram village. The river in its course causes a waterfall, popularly known as Aintharuvi. There are two anaicuts across the river and they are Aintharuvi anaicut and Ilanji anaicut.

Jambunathi It is a tributary of the Ramanathi. Like all the rivers of the district, it also originates from the eastern slopes of the Western ghats. The river confluences with the Ramanathi near Mokkadagam village. The only anaicut built across this river is Subramaniathevar anaicut.

Ramanathi Originating in the eastern slopes of Western ghats at an altitude of 1720m. above MSL in the north western corner of Ambasamudram taluk, the Ramanathi flows down the hills for about six km. in the thickly wooded forest and reaches the plain in Melakadayam village from where it runs about eight km. and receives its tributary Jambunathi.

Gadananathi The Gadananathi or Karunaiyar, like the other rivers of the district, has its origin in the eastern slopes of Western ghats at an altitude of about 1700 m. in Ambasamudram taluk. It is a major tributary of the Tamiraparani. The river after flowing about 8km., receives the Pampar and on it course, two other rivulets, Kallar and Iluppaiyar, all these tributaries, join it at Sivasailam village. After the confluence, the river flows about 10km. and merges with the Ramanathi in Kila Ambur village. **Hanumanathi** It is a tributary of the Chittar river. It rises at an altitute of 1650m. above Courtalam in Tenkasi taluk, traverses in the slopes about 10km. receives Karuppanathi, its tributary, then it flows and merges with Chittar near Surandai village.

Karuppanathi Arising adjacent to the Hanumanathi to the north of it at the same altitude, it constitutes the major tributary of the river Hanumanathi. The Karuppanathi flows in the slopes for about 9km. reaches the plains in the village Visavankulam where Vembunathi, contributes its waters to the Karuppanathi as a tributary. Then it runs for 18km. and joins the Hanumanathi below Urmelalagian anaicut built across the river Karuppanathi.

Gundar The river Gundar originates at Mundankoil mottai above Courtalam. Mottaiyar and few streams contribute to its water and it flows in Sengottai and Tenkasi taluks for 20 km. and combines with the Hariharanathi. The combined river runs for about 8 km. and joins its main river the Chittar.

Mottaiyar Mottaiyar is a tributary of the Gundar. An anaicut called Mottai anaicut has been built across the river.

Manimuthar The river Manimuthar is a major tributary of the Tamiraparani. It arises from the dense forest a top Senkutheri in Ambasamudram taluk at the height of about 1300 m. from MSL. The tributaries of the Manimuthar are the Keezha Manimuthar (lower or eastern Manimuthar) and the Varattar. The river runs from its source for a distance of 9 km. and confluences with the Tamiraparani near Kallidaikurichi. In its 9km. course, it makes minor cataracts.

Nambiyar The Nambiyar river is the water source to the Nanguneri taluk. It takes its origin in the western slopes of the Western ghats - 8 km. west of Thirukurungudi village at an altitude of 1500 m. above MSL. It runs eastwards and turns south east and confluences in the Gulf of Mannar at Tiruvambalapuram village. It's course of 45km. is restricted entirely to Nanguneri taluk. The river has two tributaries, the Parattaiyar and the Thamaraiyar. The first tributary is a stream from Mahendragiri hills and the second tributary originates from the combination of two hill streams, Mombaiyar and Kodumudiyar. These tributaries join Nambiyar at the foot of the Mahendragiri hills

Vadamalaiyaru Two rivulets, Virisidai-idiyaru and Kadaiyaru in the eastern slopes of the Western ghats above Sankarankoil taluk, combine and flow as Vadamalaiyaru which runs in the taluk and empties into the big tank of Malaiyadikurichi.

Kottamalaiyaru This river also originates at an altitude of 1700 m. above M.S.L. in the Western ghats above Sankarankoil taluk. It merges with the small tank of Durgapuram.Apart

from the above rivers, there are some more rivers also orginates in this district Kothaiyaru, Rajasingiyaru and Mundhal Odai.

Paiaru (368 km): starts in eastern ghatt (near coimbatore), runs through North Arcot, Chingleput Dts terminates into Bay of Bengal (near caturangapattinam)

Thenpannai (400 km) : starts in eastern ghatts, runs through Salem, South Arcot districts and terminates into Bay of Bengal (near Cuddalore)

Vellaru (215 km): starts at cErvarAyan hills (Salem), runs through Trichi, south arcot districts and terminates into Bay of Bengal (near paRangippEttai)

Kaviri (760 km): starts in western ghatts, runs through Salem, Coimbatore, Trichi, Tanjore dts and terminates in Bay of Bengal; tributaries/branches: bhavani, neyyal, amaravathi, kollitam

Vaigai (190 km) starts in western ghatts, runs through Madurai, Ramanathapuram Dts and terminates in Palks Straights; tributaries/branches: varahanathi, cuRuLiyAru, veththilai

Thamiraparuni (32 km): starts in western ghatts, runs through Tirunelveli Dt and terminates near mann Arkudi; tributaries/branches: ciRRAru, maNimuththARu

Kerala is a land rich in water resources**. There are 41 rivers flowing westwards and three flowing eastwards**.Periyar is the longest river of Kerala and Bharathapuzha, which originates from Tamilnadu is the longest among rivers that flow through Kerala. Poorapparambu and Kalnadu are the shortest rivers. Another important river is Chaliyar. Kanjhirappuzha,Pannappuzha,Karimbuzha, Vadapurampuzha together form the Chaliyar river. This originates from the Ilambaleri hills in Tamil Nadu. The holy river Pamba is the third longest river. It originates from Peerumedu near Sabarimala. Three rivers that flow towards the east are tributaries of the river Kaveri. Among these Pambar and Bhavani flow into Tamilnadu while Kabani into Karnataka.

Bharathapuzha Bharathapuzha alias Nila originates from Aanamala mountains in Tamil Nadu. Flows through Pollachi in Coimbatore District, Chittoor, Palakkad, Ottappalam and Ponnani in Kerala. Gayatrippuzha, Kannadippuzha, Kalppathippuzha, Thoothappuzha are its main tributaries. Within Kerala the river measures a length of 209 Km. Its total length is 374 Km. Originating from the Sahyadri and flowing through 11 taluks Bharathappuzha covers an area of 6186 sq. kilometers. During the monsoons the river is seen in its full width and is indeed navigable. Else most of the area remains a vast expanse of land.

Periyar The longest river in Kerala. Originates from Sivagirimala. Numerous rivulets join to form the Periyar River. It runs through Devikulam, Thodupuzha, Moovattupuzha, Kunnathunadu and Paravur Taluk and at Aluva takes two different directions. While one flows into the Chalakkudipuzha the other joins the Vembanadu Lake at Varapuzha. It measures a length of 244 kilometers and an area of 5398 sq.km.

Nilgiri Biosphere Reserve

The Nilgiri Biosphere Reserve (NBR) is the first biosphere reserve set up in India under the Indian National Man and Biosphere Programme. The NBR is spread over three south Indian states; Tamilnadu, Kerala and Karnataka and hence under the joint jurisdiction of the three state's forest departments. It embraces a complex of Protected Areas and reserved forests including Rajive Gandhi National Park (Nagarhole) and Bandipur (Karnataka), Wynaad, the slopes of Nilambur, Silent Valley and Siruvani Hills (Kerala) and Dr J Jayalalitha Wildlife Sanctuary (Mudumalai), Nilgiris and Mukurti (Tamihradu). Of these Bandipur, Nagarhole and Silent Valley are National Parks. Mudumaai, Wynaad and Mukurti are Wildlife Sanctuaries. Bandipur is a Tiger Reserve and also the single largest Protected Area (874.0 km2) within the NBR

CHEMICAL POLLUTION IN THE NBR

Industrial development in the towns located in and around the NBR

NBR is spread over eight districts, namely Nilgiris, Coimbatore and Erode in Tamilnadu, Palakkad, Malappuram and Wynaad in Kerala, and Coorg and Mysore in Kamataka. Of all the eight districts, Coimbatore and Nilgiris have respectively the maximum industrial and agricultural development. The major industries which have an impact on the local economy and environment are described below.

There are seven major industries in the Nilgiris district. In addition there are 175 tea and several other small scale industries. **A chemical factory located at Sandinella producing gelatine** for the manufacture of capsules has a daily effluent output of 4300 kilo litres. The treated effluent immediately joins the Pykara flume channel joining the **River Pykara**. A defence establishment at a cost of Rs 33 13 lakhs is located at **Aravangadu** producing chemical propellants. This has an effluent output of 2000 kilo litres per day. The treated effluent is released into a nearby nallah and it joins the **River Coonoor** after running downhill about 10 to 12 km. The biggest industry in the Nilgiris district is a photo film anufacturing unit located at Ooty. A variety of chemicals, such as silver nitrate, potassium bromide, soda ash, methylene chloride and a few acids are used. Roughly 1200 kilo litres of effluent is generated every day and released after treatment into Sandinella division wier down stream, finally joining the **River Moyar.**

An industry which produces various kinds of needles (including surgical) and other knitting accessories is located at Keti near Ellanelli. The factory's daily effluent discharge is roughly 107 kilo litres. It joins a nearby stream and finally **the River Coonoor**. Solid waste of about 850 kg per day is also generated by this factory. An instant tea manufacturing factory at Cherambadi releases nearly **120 kilo litres** of effluent and the treated effluent joins the **River Choladi**. It is worth mentioning that an industry at Masinagudi in the Dr J Jayalalitha Wildlife Sanctuary which was expected to release effluent containing cyanide was prevented through court orders. The major industries in Erode district are situated in three taluks namely, Gopichettypalayam, Sathyamangalam and Bhavani which are closer to the Western Ghats. There are five major industries in this Satyamangalam taluk. A **paper factory situated on the bank of the River Bhavani** near Bhavani Sagar dam releases 1300 kilo litres of effluent. Approximately 600 kilo litres of the effluent is reported to be used for irrigation and the rest recycled. A **sugar factory at Satyamangalam located on the bank of the River Bhavani** releases effluent of 800 kilo litres per day and it is reported to be used for irrigation after treatment in the factory's own land. A co-operative milk chilling plant located at Sathyamangalam with a capacity of 30000 litres per day discharges about 20 kilolitres of

effluent every day. A textile processing unit at Akkaraikodiveri is a major industry in Gopi taluk. This **uses caustic soda, sodium silicate, soda ash, sodium hypochloride and a considerable quantity. of dyes**. The daily effluent discharge is about 300 kilo litres. The factory draws water from the River Bhavani and the treated effluent is reported to be used for irrigation in the factory's own land of six acres. The number of major industries in this Bhavani taluk is four. **A sugar factory releases around 1750 kilo litres of effluent daily**. It is said to be used for irrigation after treatment. Adjacent to the sugar factory, a distillery unit is also located, **The distillery's effluent, about 1200 kilo litres per day**, is reported to be used for irrigation. The boiler unit of **Tamilnadu News Print and Paper Ltd, discharges daily 350 kilo litres of effluent.** A **chemical industry in Periapuliyar discharges 800 kilo litres** of effluent every day. Although all the major industries in Erode district are reported to have effluent treatment plants and the water is reused after treatment or for irrigation, certain quantity of **factory effluents joins the River Bhavani and Cauvery and contaminate the river water.** Apart from the major industries there are about **60, 400 and 60 small scale dyeing and bleaching units** in and around Bhavani, Erode and Chennimalai respectively. The small scale units let out their effluent as it is without any treatment into the nearby nallahs and finally they find their way into either Bhavani or Cauveri. In Erode there are more than 85 tanneries. A rough estimate of the untreated effluent from these units, puts the figure as **2000 kilo litres per day**. The Tamil Nadu Pollution Control Board has taken earnest steps to set up common treatment plants for these textile bleaching and tannery wastes in Bhavani, Chennirnali and Erode. In Coimbatore district, there are 5 taluks namely Coimbatore, Avinashi, Mettuppalayam, Tirupur and Pollachi. Of the five talks, Coimbatore and Mettuppalayam are the taluks located closer to the Western Ghats and part of them fall within the NBR. Hence industrial development in these two taluks alone is discussed. A rayon yam factory situated on the bank of the River Bhavani is one of the major industries in Mettuppalayam taluk. The factory releases more than **40000 kilo litres of effluent after treatment into the River Bhavani**. A textile processing unit releases around **1600 kilo litres** of effluent daily and the effluent joins the River Bhavani. Mettuppalayam has one of the few wattle industries extracting vegetable tanning agent. The wattle extract is mainly used in tanning of leather which is not as harmful as chrome tanning. In the village Jadayampalayam, an industrial hamlet, there are a few dyeing and bleaching industries releasing effluents in the range of 40 to 800 kilo litres per day. Further, there are around 6 similar units proposed to be established in the same locality **Coimbatore taluk** The city with **175 spinning mills, 40 medium and more than 100 small scale mills** isone of the biggest textile centres of India. The other major industrial sector is foundry. There are 700 of them at present in the city. They emit fumes with sulphur dioxide and carbon monoxide and create air pollution. The other industry which creates considerable air pollution is the cement factory located at Madukkarai. The installation of electrostatic precipitator at the chimney is a good sign towards mitigating the level of air pollution. Dam is reportedly due to the lime stone quarrying in the foot hills of the Western Ghats in the main catchment area of the dam. Unlike Mettupalayam, in Coimbatore taluk there are only a few industries which generate large quantities of effluents. They are mainly small scale dyeing industries which release between 20 and 45 kilo litres of effluent into the nearby nallahs. Further there are a few lead refineries creating some lead pollution. Of the four taluks of Palakkad district, only two taluks namely, Palakkad and Mannaarkkaad are close to NBR. On the whole there are 25 large scale industries in this district and around 5000 small scale industries of various nature. The major industries are in and around Palakkad and in the

Walayar-Kanjikkode industrial belt. There are a few flour mills in Walayar and the effluent from these factories cause organic pollution. In addition companies manufacturing fertilizers, chemicals, pesticides and tread rubber located in between Walayar and Kanjikkode are also of concern. The cement industry located in Walayar causes air pollution and the limestone quarrying in the foot hills of Western Ghats which is the main catchment area of the River Malampuzha causes siltation. The co-operative sugar factory at Menonpara discharges effluents into the River Korayar and a paper mill located in Meenkara pollutes the River Gayathri**. Malappuram District** There are four taluks in the district namely, Manjeri, Perintalmanna, Tirur and Ponnani. Of the four taluks Perintalmanna and Manjeri are closer to the forest ranges. There are about 10 large and medium scale industries and notable among them are the chemical factory and the Wood Complex at Nilambur. **Wynaad District** There are no large scale industries in this district. However two medium scale units. viz., one edible oil company and one rubber industry are present. Two small scale electroplating units are present in Sultan Battery. Further, more than 500 small scale industries which fall under various categories such as brick works, tyre retreading units, granite crushing units, sandal and eucalyptus oil extraction units are thriving in this district. **Mysore District** Of the 11 taluks of Mysore only three, namely Chamrajnagar, Gundlupet and Heggdadevankote come within or close to NBR boundary. Chamrajnagar has 1000 small scale units and a couple of medium scale spinning mills. In Gundlupet, the number of small scale units is around 750.**Kodagu District** Of the three taluks of Kodagu district only part of Virarajendrapet tahtk falls under NBR. There are around 1500 small scale industries in this district of which 250-300 are in Virarajendrapet taluk. On the whole the district has not seen any major industrial development. Coffee cultivation is the back bone of the district's economy. Coffee plantation in Coorg district is to the extent of 286 ha and the production is around 700 tonnes per year. There are about 50 to 60 coffee pulping units, 25 hulling units and almost the same number of curing units in this district. The **wastes from these units are released into the nearby streams and finally they find their way into the River Cauvery and cause organic pollution. Of all the River systems present in the NBR, the River Bhavani, one of the major tributaries of the River Cuavery is highly contaminated**. The water at several places is deep black in colour and rich in organic wastes due to the huge quantity of effluent let into the river at several points along the course of the river. The water quality is very poor with biological oxygen demand (BOD) and chemical oxygen demand (COD) several hundred times more than the tolerable limits. The levels of sulphates, nitrates, chlorides are also reported to be much higher than permitted. There are instances of fish mortality due to the high contamination levels and according to the local fishermen the fish catch has gone down over a period of time in the river. The masonry in Bhavani Sagar dam is also reported to be corroding due to the chemical pollution. (This however, requires verification).

Pesticide contamination in NBR

The indiscriminate use of pesticides and fertilizers in agriculture to enhance the production, also contaminates the ecosystem to a great extent. The biocidal properties of pesticides used are not only restricted to the target organisms but they also seriously interfere with the biological balance in soil, air and water. Hence a circle of poison or what is referred to as the 'pesticide treadmill' is created within the system. As the effect of pesticides on the environment is insidious barring the instances of poisoning, it is being overlooked. While this being the national scenario, the situation in and around the NBR is not very different. Enormous quantity

of chemical pesticides is used to control the pest in all the crops. The major crops in this region are cotton, tobacco, tea, coffee, vegetables, fruits, millet and paddy. For example, in the Nilgiris district pesticides to the tune of around **600 metric tonnes in the form of granules and powder and around 28,000 litres in the form of liquids are used per year**. It is important to note that all the pesticides used and also the industrial effluents released in this hill district ultimately find their way into the plains. The pesticide consumption in Coimbatore district which has extensive area under cotton cultivation is also huge. From the above discussion it is quite evident that around NBR industrial and agricultural pollution is quite striking. An unchecked progress in these lines of development will insulate NBR totally affecting the free flow of biodiversity, especially the riverine in the near future.

Health impacts of water pollution

It is a well-known fact that clean water is absolutely essential for healthy living. Many areas of groundwater and surface water are now contaminated with heavy metals, POPs (persistent organic pollutants), and nutrients that have an adverse affect on health. Water-borne diseases and water-caused health problems are mostly due to inadequate and incompetent management of water resources. Safe water for all can only be assured when access, sustainability, and equity can be guaranteed. Ground water can be contaminated through various sources.

Diseases

Water-borne diseases are infectious diseases spread primarily through contaminated water. Though these diseases are spread either directly or through flies or filth, water is the chief medium for spread of these diseases and hence they are termed as water-borne diseases.

Most intestinal (enteric) diseases are infectious and are transmitted through faecal waste. Pathogens – which include virus, bacteria, protozoa, and parasitic worms – are disease-producing agents found in the faeces of infected persons. These diseases are more prevalent in areas with poor sanitary conditions. These pathogens travel through water sources and interfuses directly through persons handling food and water. Since these diseases are highly infectious, extreme care and hygiene should be maintained by people looking after an infected patient. Hepatitis, cholera, dysentery, and typhoid are the more common water-borne diseases that affect large populations in the tropical regions.A large number of chemicals that either exist naturally in the land or are added due to human activity dissolve in the water, thereby contaminating it and leading to various diseases.

Pesticides. The organophosphates and the carbonates present in pesticides affect and damage the nervous system and can cause cancer. Some of the pesticides contain carcinogens that exceed recommended levels. They contain chlorides that cause reproductive and endocrinal damage.

Lead. Lead is hazardous to health as it accumulates in the body and affects the central nervous system. Children and pregnant women are most at risk.

Fluoride. Excess fluorides can cause yellowing of the teeth and damage to the spinal cord and other crippling diseases.

Nitrates. Drinking water that gets contaminated with nitrates can prove fatal especially to infants that drink formula milk as it restricts the amount of oxygen that reaches the brain causing the 'blue baby' syndrome. It is also linked to digestive tract cancers. It causes algae to bloom resulting in eutrophication in surface water.

Petrochemicals. Benzene and other petrochemicals can cause cancer even at low exposure levels.

Chlorinated solvents. These are linked to reproduction disorders and to some cancers.

Arsenic. Arsenic poisoning through water can cause liver and nervous system damage, vascular diseases and also skin cancer.

Other heavy metals. –Heavy metals cause damage to the nervous system and the kidney, and other metabolic disruptions.

Salts. It makes the fresh water unusable for drinking and irrigation purposes.

Exposure to polluted water can cause diarrhoea, skin irritation, respiratory problems, and other diseases, depending on the pollutant that is in the water body. Stagnant water and other untreated water provide a habitat for the mosquito and a host of other parasites and insects that cause a large number of diseases especially in the tropical regions. Among these, malaria is undoubtedly the most widely distributed and causes most damage to human health. .

Let me conclude my paper with the following observations

The ecosystem of Western ghats has to be protected which is directly or indirectly related to the Life of people of south India.

The anthropogenic activities in western ghats

1.Deforestation

The recharging of ground water system affected adversely due to Deforestation. The trees are helping water to penetrate deep into the ground. In the absence of dense forests water will flow through surfaces. With the decrease of Forest Cover, Climate and biodiversity will be affacted. The forests have a decisive role in reducing temperature.

2.River diversion.

Diverting river from the source disrupting the natural flow will affect ecology of the region. Aral sea is an historic lesson.

"Environmental Catastrophe" of Aral Sea

- The Aral Sea Basin is situated between 55°00' E and 78°20' E and between 33°45' N and 51°45' N.

- The Aral Sea Basin has a total area of 2.7 million km^2 and it is shared by seven countries: Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan and the Islamic Republic of Iran.
- The Aral Sea was once the world's fourth largest inland sea. Problems began in the 1960s and 1970s with the diversion of the inflowing Amu Dar'ya and Syr Dar'ya rivers in order to grow cotton on arid land in what was then Soviet Central Asia. Ninety-four water reservoirs and 24,000 km of channels were constructed on these two rivers to support the irrigation of 7 million ha of agricultural land.
- In 1963, the surface of the Aral Sea measured 66,100 km^2, with an average depth of 16 metres and a maximum depth of 68 metres. The salt content was 1%. By 1987, 27,000 km^2 of former lake bottom had become dry land. About 60% of the Aral Sea's volume had been lost, its depth had declined by 14 metres, and its salt concentration had doubled. By the 1990s it was receiving less than one-tenth of its previous flow—and sometimes no water at all.
- Today, the sea is reduced by 75 % of its 66,100 km^2 size and has split into two. At the current rate of decline, the Aral Sea could disappear completely by 2020.
- At present, about 200,000 tonnes of salt and sand are carried by the wind from the Aral Sea region every day, and dumped within a 300 km radius. The salt pollution is decreasing the area available for agriculture, destroying pastures, and creating a shortage of forage for livestock. The livestock population has become so low in the region that the government has issued a decree to reduce their slaughter for food.
- The consequences for health have been just as bad. People in Qyzlorda in Kazakhstan, Dashhowuz in Turkmenistan and Karakalpakstan in Uzbekistan receive water contaminated with fertilizers and chemicals, unsuitable for human consumption or agriculture.
- Drinking water in the region contains four times more salt per litre than the limit recommended by the World Health Organization (WHO).
- Tuberculosis has reached epidemic proportions. In some towns there are an estimated 400 cases out of a population of 100,000.
- Infant mortality rates have reached 100 per 1,000 live births in some regions—higher than the average for South Asia. Some 70% of the 1.1 million people in Karakalpakstan suffer from chronic maladies—respiratory illnesses, typhoid fever, hepatitis and oesophageal cancers.
- The independence of the Central Asian states has failed to stem the crisis. In fact, their lack of cooperation has sustained a steady deterioration in indicators of livelihoods, health and well-being. Cotton yields have fallen by a fifth since the early 1990s, but the overuse of water continues. The loss of four-fifths of all fish species has ruined the once vibrant fishing industry in downstream provinces. Whereas in 1959 the Aral Sea's fisheries produced almost 50,000 tonnes of fish, by 1994 the annual catch was only 5,000 tonnes.
- Through a joint project with the World Bank initiated in 2001, Kazakhstan has built the Kok-Aral Dam and a series of dykes and canals to rehabilitate water levels in the northern (and eventually southern) parts of the Aral Sea. The project is already yielding benefits: the northern sea's area has expanded by a third, and water levels have risen from about 29 metres to about 40 metres. If progress continues, prospects for rehabilitating fishing communities and restoring sustainability are promising. If other basin countries also get involved, the scope for basin-wide rehabilitation would increase greatly.

3. **Persistent Organic Polutants (POP)**

The organo chlorine pesticides used/ being using in high ranges and other places at last reaches downstream without decomposing. The half life of Organo chlorine pesticides are very high. (The half life of DDT in water is 150years. The organo chloro pesticides enter food chain through aquatic organisms and is becoming the root cause fatal disesases like Cancer. These chemicals were introduced in the 1940s, and many of their uses have been restricted by the U.S. EPA because of their persistence in the environment. Although many of these chemicals are no longer widely used in the United States, other countries continue to use them. Organochlorine pesticides can enter the environment from direct application and runoff, disposal of contaminated wastes into landfills, emissions from waste incinerators, and releases from manufacturing plants that produce these chemicals. Some organochlorine pesticides

are volatile or can adhere to soil or particles in the air. In aquatic systems, organochlorine pesticides are adsorbed onto sediments in water that can then bioaccumulate in fish and other marine mammals. Because these chemicals are soluble in fat, they are found at higher concentrations in fatty foods. In the general population, the diet is the main source of exposure to organochlorine pesticides, primarily through the ingestion of fatty foods (such as milk, dairy products, and fish). Minor sources of exposure for the general population include contaminated drinking water and air. Infants can be exposed to these chemicals through breast milk and the fetus can be exposed in utero via the placenta.

Minamata: environmental contamination with methyl mercury

In Minamata, Japan, inorganic mercury was used in the industrial production of acetaldehyde. It was discharged into the nearby bay as waste water and was ingested by organisms in the bottom sediments. Fish and other creatures in the sea were soon contaminated and eventually residents of this area who consumed the fish suffered from MeHg (methyl mercury) intoxication, later known as the Minamata disease. The disease was first detected in 1956 but the mercury emissions continued until 1968. But even after the emission of mercury stopped, the bottom sediment of the polluted water contained high levels of this mercury.

Various measures were taken to deal with this disease. Environmental pollution control, which included cessation of the mercury process; industrial effluent control, environmental restoration of the bay; and restrictions on the intake of fish from the bay. This apart research and investigative activities were promoted assiduously, and compensation and help was offered by the Japanese Government to all those affected by the disease.

The Minamata disease proved a turning point, towards progress in environment protection measures. This experience clearly showed that health and environment considerations must be integrated into the process

Who is an environmentalist?

Two doctors were walking along the bank of a river when they saw a man drowning. One of them jumped into the water, pulled him out, and administered first-aid. By the time the doctor was done with him, there came another, followed by yet another. The doctor now decided to set up a clinic at that spot.

The second doctor decided to go upstream and find out what was pushing people into the river. He was an environmentalist: –rather than going in for symptomatic treatment, he wanted to tackle the problem at source. This is what is needed today.

Anthropogenic activities in Western Ghats is affecting the life of the people and all the living system adversely. Discourage all anthropogenic activities in Western ghats. That is the duty of an Environmentalist.

I conclude by quoting the great sage-poet Thiruvalluvar, "***Without truth there is no humanity, without water there is no existence***".