

Operational Power Plants Based Impacts on Biodiversity to Assess Ecosystem Degradation in UP (India)

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Abstract

Large number of thermal power plants in UP (India) has changes air composition, water quality and environmental conditions that consequently affected biodiversity, wildlife and migration of birds in the region. Biodiversity is a measure of the health of ecosystems and is influencing due to climate change. Location-specific approaches may be less useful for protecting migratory species. National Action Plan on Climate Change (NAPCC) must address properly the issue of power generation, renewable energy and energy efficiency. Future energy infrastructure investment decisions, expected to total over 20 trillion dollars between 2005 and 2030, will have long-term impact on green house gases (GHGs) emissions because of the long lifetimes of energy plants and other infrastructure capital stock. The widespread diffusion of low-carbon technologies may take many decades, even if early investments are made attractive. Initial estimates show that returning global energy-related CO₂ emissions to 2005 levels by 2030 would require a large shift in the pattern of investment. Increasing public awareness is one of the most important ways to conserve biodiversity. This can be accomplished through educational programs, incentive programs, and volunteer monitoring programs. Various organizations and conferences that research biodiversity and associated conservation strategies help to identify areas of future research, analyze current trends in biodiversity conservation and management.

Keywords: Power plant; air quality; biodiversity; conservation.

1. Introduction

Power plants are necessary for the increasing demand of power/ electricity but operations of these plants have changed air and water quality. The electricity sector in India had an installed capacity of 232.164 GW as on 2013, and non-renewable power plants constitute 87.55% of the installed capacity, and renewable power plants constitute the remaining 12.45% of total installed capacity [1-2]. India generated 855 BU (855 000 MU i.e. 855 TWh) [3] electricity during 2011–12 fiscal. In terms of fuel, coal-fired plants account for 57% of India's installed electricity capacity, compared to South Africa's 92%; China's 77%; and Australia's 76%. After coal, renewable hydropower accounts for 19%, renewable energy for 12% and natural gas for about 9% [4-5]. Total per capita consumption of power in India is 778 kWh [6]. The International Energy Agency estimates India will add between 600 GW to 1200 GW of additional new power generation capacity before 2050 [7]. Indian coal is of low calorific value and high ash content. On average, Indian coal has a Gross Calorific Value (GCV) of about 4500 Kcal/kg, whereas the quality elsewhere in the world is much better; for example, in Australia, the GCV is 6500 Kcal/kg approximately [8]. The high ash content in India's coal affects the thermal power plant's potential emissions. Therefore, India's Ministry of Environment & Forests has mandated the use of beneficiated coals whose ash content has been reduced to 34% (or lower) in power plants in urban, ecologically sensitive and other critically polluted areas, and ecologically sensitive areas. The Ministry of Environment and Forests has published a technical guidance manual to help project proposers and to prevent environmental pollution in India from thermal power plants as this sector has many environmental issues [9-12]. The installed capacity of Thermal Power in India, as of 31 October 2012, was 140206.18 MW which is 66.99 [13] of total installed capacity.

Uttar Pradesh (India) has large number of thermal power plants. Lack of clean and reliable energy sources such as electricity is, in part, causing about 80 crore (800 million) people in India to continue using traditional biomass energy sources – namely fuelwood, agricultural waste and livestock dung – for cooking and other domestic needs [14]. Traditional fuel combustion is the primary source of indoor air pollution in India, causes between 300,000 to 400,000 deaths per year and other chronic health issues. India's coal-fired, oil-fired and natural gas-fired thermal power plants are inefficient and offer significant potential for greenhouse gas (CO₂) emission reduction through better technology. Compared to the average emissions from coal-fired, oil-fired and natural gas-fired thermal power plants in European Union (EU-27) countries, India's thermal power plants emit 50% to 120% more CO₂ per kWh produced [15].

2. Climate Change Impacts

Plants and animals are sensitive to fluctuations in temperature and climate. In the past, climate has varied considerably within short time scales. Evidence from fossils and paleobiological studies have indicated that these periods of rapid climate change have been associated with mass extinction events. We are currently in a period of high climatic variability. Operation of power plants have changed climatic conditions and

speeding up the rate of global warming. This is a direct result of the increase in production of greenhouse gases, such as CO₂ (carbon dioxide), CH₄ (methane) and oxides of nitrogen due to the burning of fossil fuels. Moreover, incomplete combustion from vehicles and release of anthropogenic chemicals called chlorofluorocarbons (CFCs) into the atmosphere has degraded the stratospheric ozone layer around the Earth, which shields the planet from harmful ultraviolet radiation. Increasing water temperatures will radically alter the ecology of freshwater ecosystems and wetlands, leading to increased phytoplankton, changes in distribution of invertebrate and fish species and the loss of coldwater species (like lake trout) altogether. Studies on the effects of global warming point to two major facts: the speed of change is much more accelerated than in the past, which may pose a serious threat to slow-growing communities which cannot respond quickly, and which may shrink the range of plants that need cooler environments. Secondly, global warming may increase the frequency of climatic disturbances such as fires, disease, insects, storms, etc.

3. Threats for Biodiversity

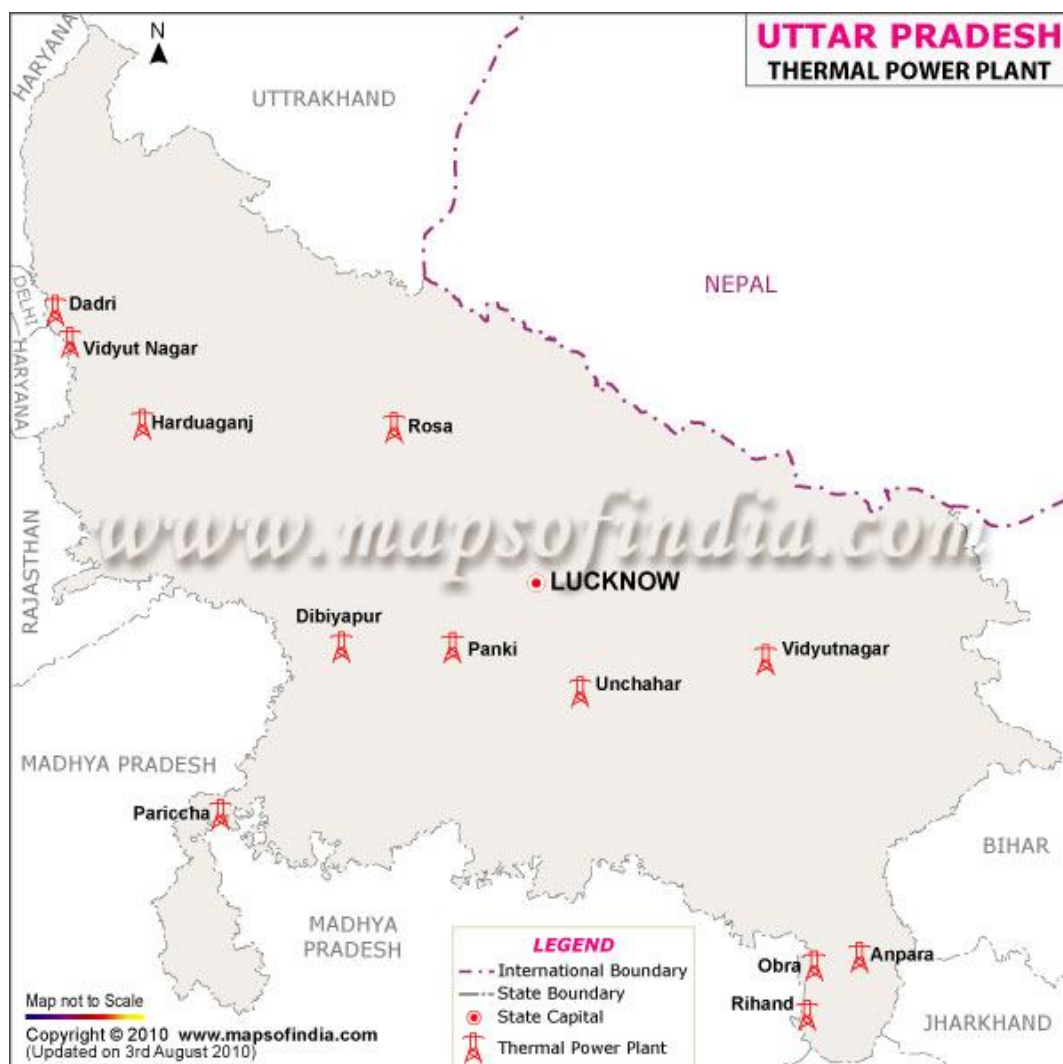
Biodiversity is sum of all the different species of animals, plants, fungi, and microbial organisms living on Earth and the variety of habitats in which they live. Each species is adapted to its unique niche in the environment, from the peaks of mountains to the depths of deep-sea hydrothermal vents, and from polar ice caps to tropical rain forests. Humans have long depended on biodiversity resources for food, medicines, and materials as well as for recreational and commercial purposes such as fishing and tourism. Aquatic organisms also rely upon the great diversity of aquatic habitats and resources for food, materials, and breeding grounds. Factors including overexploitation of species, the introduction of exotic species, pollution from urban, industrial, and agricultural areas, as well as habitat loss and alteration through damming and water diversion all contribute to the declining levels of aquatic biodiversity in both freshwater and marine environments. As a result, valuable aquatic resources are becoming increasingly susceptible to both natural and artificial environmental changes. Thus, conservation strategies to protect and conserve aquatic life are necessary to maintain the balance of nature and support the availability of resources for future generations. Air and water pollution, sedimentation and erosion, and climate change also pose threats to aquatic biodiversity [16-17].

Thermal power plants' spatial locations at different locations in Uttar Pradesh (India) have affected biodiversity and migration path of birds in the State of UP. Figure exhibits locations for major thermal power plants and important forms of pollutants includes: (i) poisonous pollutants: agrochemicals, metals, acids and phenol cause mortality, if present in a high concentration and affect the reproductive functionality of fish [18-19]; (ii) suspended solids: it affects the respiratory processes and secretion of protective mucus making the fish susceptible to infection of various pathogens; (iii) sewage and organic pollutants: they cause deoxygenation due to eutrophication causing mortality in fishes; (iv) thermal pollution: it cause increase in ambient temperature and reduce dissolved oxygen concentration leading to death of some

sensitive species. These factors affect the aquatic biodiversity directly or indirectly. Excessive mortality of organisms due to any of these factors may lead to two types of effects: (a) extinction of the species / populations (b) reduction of population size.

4. Biodiversity Conservation Approach

India has about 27% of earth's bird species along with 1.2 Billion people in just over 3 million km². Aquatic conservation strategies support sustainable development by protecting biological resources in ways that will preserve habitats and ecosystems. In order for biodiversity conservation to be effective, management measures must be broad based. Central Pollution Control Board (CPCB) is executing a nation-wide programme of ambient air quality monitoring known as National Air Quality Monitoring Programme (NAMP). CPCB through its air quality monitoring programme on various pollution control activities and there is continuous monitoring of Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Respirable Suspended Particulate Matter (RSPM) and Suspended Particulate Matter (SPM) etc. in many areas in the country to determine status and trends of ambient air quality, ascertain whether the prescribed ambient air quality standards are violated, identify non-attainment cities, to obtain the knowledge and understanding necessary for developing preventive and corrective measures; to understand the natural cleansing process undergoing in the environment through pollution dilution, dispersion, wind based movement, dry deposition, precipitation and chemical transformation of pollutants generated for pollution control strategies. The quality of data is of critical importance. In order to ensure the quality of data, regular calibration, servicing and repair of the field device is must; and for that CPCB has initiated the project entitled "Calibration and Evaluation of Ambient Air Quality Monitoring Stations in India". Aquatic areas that have been damaged or suffered habitat loss or degradation can be restored with reasonable efforts. Bioregional management is a total ecosystem strategy, which regulates factors affecting aquatic biodiversity by balancing conservation, economic, and social needs within an area. This consists of both small-scale biosphere reserves and larger reserves. Watershed management is an important approach towards aquatic diversity conservation. Rivers and streams, regardless of their condition, often go unprotected since they often pass through more than one political jurisdiction, making it difficult to enforce conservation and management of resources. However, in recent years, the protection of lakes and small portions of watersheds organized by local watershed groups has helped this situation. Plantation of trees in the catchment area of water body prevent soil erosion and subsequently reduce the problem of siltation in water body resulting in better survival of aquatic organisms. Regulatory measures must be taken on wastewater discharge in the water body to conserve biological diversity.



Source: www.mapsofindia.com

Fig. 1: Spatial locations of various thermal power plants in UP (India)

Table 1: Different power plants with their installed capacities (MW) in UP (India).

Power Station	Location	District	Installed Capacity(MW)
Obra Thermal Power Station	Obra	Sonebhadra	1322
Anpara Thermal Power Station	Anpara	Sonebhadra	1630
Panki Thermal Power Station	Panki	Kanpur	210
Parichha Thermal Power Station	Parichha	Jhansi	640
Harduaganj Thermal Power Station	Harduaganj	Aligarh	220
Singrauli Super Thermal Power Station	Shaktinagar	Sonebhadra	2000

Rihand TPP	Rihand Nagar	Sonebhadra	2000
National Capital TPP	Vidyutnagar	Gautam Budh Nagar	1820
Feroz Gandhi Unchahar TPP	Unchahar	Raebareli	1050
Tanda TPP	Vidyutnagar	Ambedkar Nagar	440
Rosa Thermal Power Plant	Rosa	Shahjahanpur	600

5. Conclusions

Biodiversity management strategies through creation of partnership by involving governmental, commercial organizations, navy and military, NGOs, local populations and general public are important. More effective legislation, including biodiversity aspects into all relevant laws, designation of legislation support of biodiversity conservation must be part for sustainability. Scientific approach for formalization of decision-making procedure, looking for biodiversity indicators, cadastre of biodiversity, development of monitoring etc are addition support system for biodiversity conservation strategies. Ecosystem models have applications in a wide variety of disciplines, such as natural resource management, eco-toxicology and environmental health, agriculture, biodiversity and wildlife conservation. The climate change affects biological processes such as metabolism, nutrient requirements and biochemical activities quickly react to them. The behavioural response like migration and geographic distribution of birds are changed. Reproductive physiology and breeding behaviour of animals are directly affected by photoperiods, temperature and precipitation. Changes in atmospheric CO₂ and methane can affect plant species and indirectly animal species. The entire food web is affected and becomes imbalanced. There is need to explore uses of bio-energy & bio-fuels and imposition of ban on coal-based industries with immediate effect. Use of clean energies like solar and wind power for running industries and household lights must be encouraged through subsidies by Government. Capture of CO₂ from air through speedy forest development programs. Both ex-situ and in-situ conservation strategies for biodiversity must be incorporated in planning by Government.

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