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REVIEW ARTICLE

Comparative Review Study on the Forest and Biodiversity Management practices between India and Germany

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ABSTRACT

The review study aims to identify several chains of socio-political events in the forest and wildlife management sectors in India and Germany, which interfered and affected its natural biodiversity during the 19th century. It also deals with the understanding of formulation of laws as an effort to reduce the impact of exploitation of native forests and biodiversity in the respective countries.

The comparative study of forest management of India and Germany dates back to more than hundred years when Sir Dietrich Brandis, a German forester, who is now recognized as the Father of Tropical Forestry was appointed as the forest administrator of India by the British Government. The study explores the critical issues in the forest and biodiversity management sectors that were identified more than a century ago and are still prevalent in many parts of the countries which resulted in severe loss of natural biodiversity. The importance of conservation and restoration along with the formulation of forest and biodiversity laws under several circumstances are also highlighted in the study.

1) INTRODUCTION

The influence of systematic forestry in India dates back to centuries when Sir Dietrich Brandis, a German forester was appointed as the Superintendent of the Forests in India by the British Company [1]. He practiced systematic forestry management for the sustainable production of timber across the country [1]. The study aims to compare the formulation of different socio-political events and management policies between the two countries - India and Germany. The main objectives of the study are : (i) to understand the policies and management plans of forest management between Germany and India, (ii) to evaluate the influence and consequences of the effect of formulation of these laws in India, due to the British Government, (iii) to evaluate the extent of the damage caused in the Wildlife and Forestry sectors in the respective countries due to the implementation of these laws and finally (iii) to understand the prevalence of these ancient management laws to the present-day formulation of forestry management policies in India.

2) GERMAN FORESTRY

The Federal Republic of Germany is a federal state consisting 31% of forest cover [2]. In 18th century, a massive loss of forest in several parts of Germany was observed [3]. There was intense pressure on the country to replant its forests so to

avoid the situation of timber famine [3]. Originally forests of Germany consisted of mixed vegetation, including species of family Fagaceae (beech, oak), Onagraceae (Willow herbs), Dipsacaceae, Erigeron (daisy family), Caryophyllaceae and so on [4]. Later on, the major concern of the country was to regain back its timber wood economy by practicing systematic plantation of so called profitable trees like Pine (*Pinus sp.*), Spruce (*Picea sp.*), Birch (*Betula sp.*), Willow (*Salix sp.*), Aspen (*Populus sp.*) and Oak (*Quercus sp.*), among others [3]. This practice resulted in the transformation of the forest patterns and change in the biodiversity of the forests.

Consequences for the introduction of Invasive and Exotic species

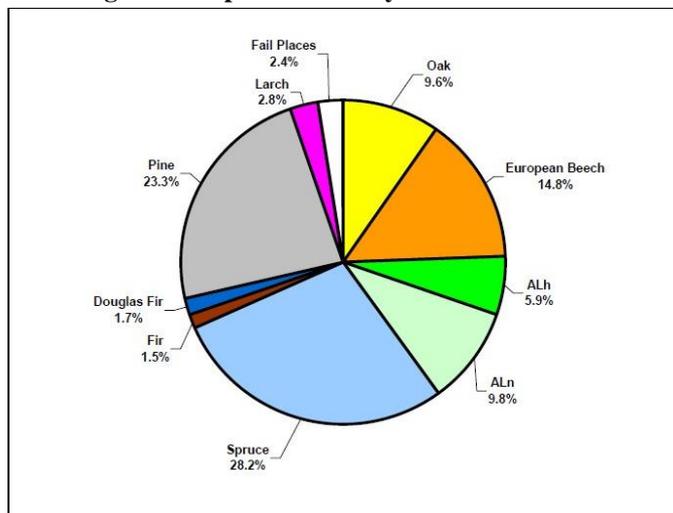
Several alien and invasive species were introduced during the period. One such species is *Prunus serotina* also referred to as Wild Black Cherry or Rum Cherry, commonly found in Eastern United States, known for its valuable timber quality [5]. The species was first introduced in Europe in 16th century and was recorded in Germany in 1685 [5]. Later it was considered as an undesirable and invasive species in Germany and often regarded as “forest pest” that interfered with growth and regeneration of the natural forests [5]. The systematic forestry of Germany in the late 18th century practiced monoculture, which involved plantation of one particular

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species of same age group in a definite area [3]. There were often cases of replacing beech forests with pine and spruce plantations for better timber yield [3]. During the 19th century, timber used as fuel wood was completely replaced by coal, and timber harvested from plantations was entirely used as industrial timbers [3]. This practice was eventually successful to bring back the forest cover in Germany within a century [3].

Fig 1: Tree species diversity of German Forest



ALh : Other Deciduous wood with long rotation period; ALn : Other Deciduous wood with low rotation period. **Source: Roering (2004)**

Movements against Systematic Forestry in Germany

There were certain movements in the late 19th century, such as Dauerwald movement which focused in restoring the original mixed vegetation of the forests of Germany instead of encouraging monoculture plantation practices [6]. Due to the systematic plantation, soil compaction, acidification and several complex diseases such as Waldsterben caused by severe air pollution was observed during this period [6]. In the mid-19th century, scientists like Rossmassler of Tharant [3] and Johann Christian Karl Gayer [7], were the first to criticize the concept of systematic forestry. Professor A. Moeller, a forest mycologist was the first to introduce the Dauerwald movement [6]. Dauerwald, a German word meaning permanent or perpetual forest deals with the principle of considering forest as “complex, dynamic organisms, that can express their inherent vigor and production only if all parts are healthy” [6]. The Dauerwald movement was against clear felling, crop rotation, limited regeneration periods and particular pattern of silviculture [6]. The movement was supported and used as propaganda by the Nazi Party. By 1934, the Party mandated the Dauerwald policy in all forests of Germany [8]. The Nature Protection Law was also implemented in 1935, which dealt with several issues of land use patterns and effects of urbanization [8]. The Volkische movement, which referred to the romantic focus on folklore and the preservation of the original forest often referred to as naturally grown community was also one of the major movements that was against the systematic forestry practices of Germany [8]. However, within few years of the Nazi rule, the Dauerwald movement lost its importance in many parts of the country due to the increasing demand of industrial timber for military preparations [6]. Post-World War II, in 1950, the Dauerwald policy was revived with slight modifications of

selective cutting principles by an organization known as Working Group for Nature friendly Forest Management (ANW) in Central Europe by Swiss forester Walter Ammon [6]. During the 1970s, in several mountainous areas of southwest Germany, reintroduction of Beech (*Fagus sylvatica*) was informally practiced [6]. By 1980, there were very few “wild lands” (unmanaged forests) left in Germany [6]. The German citizens took part in several nature rallies with themes like “Save the forests” and “Back to Nature” to protest against the poor management of forests and loss of native species across the country [6]. Several major events followed during the period, which eventually managed to change the clear-felling forestry trend in Germany. In 1987, clear cutting of forests was finally terminated by the German state of Saarland along with other states and several countries in Europe mandated the Dauerwald policy for public forests [6]. Meanwhile in 1989, The Association of European Foresters Practicing Management, of Slovenia formulated an initiative known as “Pro-silva” to encourage and promote Dauerwald principles [6]. With the increasing support from different countries, Europe affirms a strong commitment to sustainable development in international agreements at Rio Earth Summit 1992 [6]. The contemporary forest management techniques improvised the original Dauerwald policies with application of chemicals as per the modern requirement and low impact solutions to logging were encouraged and promoted [6]. The reintroduction of original flora and fauna were considered as the necessary conditions for restoration and conservation of degraded forest and biodiversity [6]. The ownership structure of the German forestry consists of 3.7% of State Federation forests (Bunds), 47.3% State forest (Bundeslaender), 19.5% Communal forest and 29.6% Private forest [2]. According to the Federal Forest Act, as described in Article 1 of the German Federal Forest Law 1975:

- i) To conserve forests due to their economic benefits (productive function) and their importance for the environment and recreation of the population (protective and recreational functions), to expand them, wherever possible, and ensure their proper management on sustainable basis, whilst promoting the forestry sector and reconciling public interests and the concerns of forest owners.
- ii) to promote forestry and
- iii) to bring about a balance between the interests of general public and the interest of the forest owners [2].

The accessibility of forests by the citizens is described in Article 14 of German Federal Forest Act which involves spatial reach, motivational scope of recreational purpose, temporal bounds, ambit of ancillary rights (right to ride horseback, bicycle, remove natural objects), any restriction of public access, and varying duties of the recreational users [9]. Some of the other important forest act involves: Act on Forest Propagation Material 2003, which regulates the concession of the parent material (the trees, from which forest propagation material is harvested), the certification, and marking of the propagation material for trade, and the control of the involved companies [2], Forest Damage Compensation Act 1969 regulates the compensation of damages as a result of special natural phenomenon in forestry, it provides the opportunity i) to restrict the regular loggings (Article 1), ii) to restrict the timber import (Article 2), iii) to take different measures to

reduce the tax burden (Article 3-8) [2], Timber Promotion Fund Act 1998, regulated the foundation, legal form, the tasks, the organization and the financing of the Timber Promotion Fund [2], Act on Classification Scales of Raw Timber 1969 is the legal fundament for an ordinance (ordinance on classification scales for Raw Timber, 1971), which regulated the generation, the marking, the denomination, the measurement, and the quantity calculation of raw timber in accordance with the regulation of the European Union [2]. One of the most important sector of forest industries and largest consumer of raw timber is the saw industry [2]. According to 2002 data, more than 550,000 employees worked for the industry [2].

Table 1: Fellings of Germany in 2002

Species	Felling in 1000 m ³
Oak, Red oak	1,562
European Beech, other deciduous wood	7,641
Spruce, Fir, Douglas Fir	23,976
Pine, Larch	9,201
Total	42,380

source: Roering (2004)

Modern Day Forestry approaches in Germany

The recent conservation practices of Germany focus on the alteration of the tree layer composition of several deciduous forests [10]. The introduction of the closely native European beech (*Fagus sylvatica*), which is considered as a “competitive ecosystem engineer”, helps to control the secondary tree species, which in turn can alter the expected herb-layer diversity, productivity and composition of the forest [10]. Thus, the traditional systematic methods of forest management may not be prevalent in all parts of Germany, but for maintaining the ecological balance, many foresters believe in “close to nature forestry management” [10].

Management of Wildlife in Germany

Wildlife species in Germany consists of Red foxes (*Vulpes vulpes*), Badgers (*Meles meles*) Eurasian lynx (*Lynx lynx*), Red deer (*Cervus elaphus*), Roe deer (*Capreolus capreolus*), Fallow deer (*Dama dama*), Bighorn sheep (*Ovis orientalis musimon*), Moose (*Alces alces*), Wild boar (*Sus scrofa*), European Hare (*Lepus europaeus*) among others [11][12][13][14]. Due to habitat fragmentation and different dimensions of human dominated landscapes, several wildlife populations are managed in the country. Game hunting is considered as one of the major control measures of the wildlife population [15]. However, during the period 1100 to 1400, the sole purpose of hunting was considered to be a widely accepted sport throughout Germany [15]. Several vulnerable species like Auerochs (*Bos primigenus*) and Wild horses (*Equus gmelini*) were hunted to extinction [15]. In 2001, the German wildlife information system known as WILD (Wildtier-Informationen system der Lander Duetschlands) was established to perform a long-term monitoring program documenting occurrence, number and development of game populations throughout Germany [11]. The German Wildlife information system is considered as a sustainable measure to track the population of game animals. The population size is estimated by standardized counting methods in the respective reference areas. For example, in 2006, the distribution of Badgers in Germany was surveyed

with the help of nationwide questionnaire [16] and the population survey of the European Hare during 2002 to 2005 was conducted by spotlight strip census method in the specific reference areas [11].

Reintroduction of certain species is considered as significant conservation measures in the country [17]. Eurasian Lynx, one of the few members of the carnivore communities of Germany was reintroduced after its disappearance of about 100 years from the German forests [17]. The reintroduction programs include the study of habitats, spatial basis of habitat modeling, possibility of survival of viable population of the species and to estimate the demographic viewpoint to predict the extinction probability [17].

However, in national parks like Eifel National Park in Schleiden, instead of reintroduction of species, the park managers believe in making the forest suitable for the wildlife, like Wolves (*Canis lupus*) to return back (Personal observation). The concept can be considered as one of the important ideologies of the biodiversity management of Germany.

3) INDIAN FORESTRY

The history of the onset of Forest laws in India

The forestry in British India can be explained with the help of a chain of events that took place during the period. Certain political scenarios were responsible for the formulation of the Forest laws in India. The Oak forests of England were in the verge of depletion in 1805, followed by the countries’ enquiry for permanent dependence on teak timber from India was carried on [1]. The enquiry resulted in immediate appointment of forest committee, with charge to enquire about the forests as well as the status of proprietary rights of these forests [1]. The result was a General Proclamation, declaring the royalty rights of teak forests as vested in the Company, followed by prohibition of all unauthorized felling of such trees [1]. On 10th November 1806, Captain Watson was appointed as the first conservator of Forests in India [1]. He established timber monopoly throughout Malabar and Travancore [1]. The timber monopoly largely deprived the proprietors and timber merchants across India, thus there were protests all over the country, which further abolished the Conservatorship in 1823 [1]. Deforestation was “religiously” practiced in large scales all over the country. There were concerns regarding the increasing destruction of the forests and several favored plantation programs in different parts of India [1]. In 1831, the Indian Navy Board recommended the re-establishment of Conservatorship [1]. The perspective of deforestation, climate change and aridification impacting the human health of India was supported by Surgeon Dr. Alexander Gibson in Bombay Presidency and Asst. Surgeon Edward Balfour in Madras by 1839 [1]. In 1847, the Bombay Presidency appointed Dr. Gibson as the first regular Conservator of Forests followed by in 1865 Dr. Cleghorn was appointed as the Conservator of Madras Presidency [1]. From Dr. Gibson’s reports, soil erosion in hills, silting of rivers, creeks on harbors and coast were the consequences of deforestation [1].

In 1852, the Province of Pegu (Bago) in Burma (modern Myanmar) was under the rule of the British [1]. One of the important events of Indian forestry was in 1855 when Lord Dalhousie issued the Charter of Indian forests, outlining the forest conservancy of whole India [1].

Dietrich Brandis: The New Era of Systematic Forestry in India

In January 1856, Dietrich Brandis was appointed as the Superintendent of the Pegu forests in Burma (modern Myanmar) [1]. Brandis was a famous German forester and one of the admirers of the systematic forestry of Germany [3]. He introduced several measures for protection and improvement of the forests including the method of Linear valuation survey, which involves survey across line, road, ridges, streams, where the tree species are counted and classified according to their girth and ticked off on small pieces of bamboo, split into ten pieces [1]. Different pieces were carved for different classes of trees [1]. Brandis also introduced systematic management of teak trees, which were of highest importance then, according to different classes, as per the girth of the trees [1]. The first category involved the trees of 6 feet and above in girth, the second category involved the trees of 4 feet 6 inches to 6 feet in girth, the third category involved, trees of 3 feet to 4 feet 6 inches in girth, and the fourth category involves trees under 3 feet in girth [1]. He proposed the principle that “in any forest to be worked out, as many first-class trees as would be replaced during the year by the growing stock of second-class trees, could and should be felled in that period” [1]. From his observation, he constituted the following data [1]:

Girth in feet	Age in years source: Forestry in British India (1990)
3 feet	18
4 feet 6 inches	39
6 feet	62

According to Brandis, “ twenty fourth of first class trees in each forest might annually be felled and assumed that as the number of fourth class trees had been found largely to exceed those in other classes, the forests would gradually improve under the proposed system of working and become richer in teak than they were before in 1856” [1]. The method was widely accepted and also mitigated conflicts with private enterprises by encouraging them to use the forest [1].

In 1862, Brandis was appointed by the Government of India for conducting special duty in organizing forest administration in different provinces [1]. The Indian Forest Act 1865 was the first attempt to forest legislation to extend their control over the forests and resulted due to the increasing demand of timber and the significance of forests as a source of revenue [1]. There were huge demands of timber for construction of railways across the country [1]. According to the Indian National Forest Policy 1894, i) the sole object to which the management of forests is to be directed is to promote the general welfare of the country, ii) the maintenance of adequate forests is dictated primarily for the preservation of the climate and physical conditions of the country and secondly to fulfill the needs of the people [1].

In the 19th century, there were increase in conflicts with the forest authorities and the locals, the citizens were against the forest policy of fire protection [1]. The local people were not allowed to use the forest resources, but the rights were reserved for the Company, who largely exploited it for commercial purposes [1].

Later the Indian Forest Act, 1927 was passed under the British Government to safeguard and protect the interests of the forests [1]. The act also made provisions for the conservation

of forests [1]. Further in 1980 after the independence from the British Rule the Forest Act was re-established for the conservation and welfare of the forests of India. As a large number of the population of India depends on forest resources for their survival, the Forest Rights Act 2006 was passed which deals with the rights of the forest dwellers to utilize the resources.

Wildlife Management in India

India is one of the most diverse countries of the world and has ten biogeographic realms, and is one of the world’s 17-mega diversity countries that together support two-thirds of the world’s biological resources [18]. According to the Ministry of Environment, Forest and Climate Change data of 2003, 33% of the country’s 49,219 plant species are endemic to India. Although it covers just 2.4% of the world’s area, India accounts for 7.3% of the world’s terrestrial vertebrate species with 89,451 faunal species [18]. There are several charismatic species, including 40% of the world’s tigers, and most of the world’s Asian elephants [18]. Tigers and elephants are considered as ‘umbrella species’ in India, whose protection is thought to conserve other species and their habitats [18]. But unfortunately, the overall conservative estimates suggest that 20% of Indian mammals face imminent extinction, and many have disappeared from over 90% of their historic range [18].

Background of the formulation of Wildlife laws and policies in India

During 1850s to 1920s, the British promoted widespread hunting of game animals in India, and they also set aside more than 600,000 km² of land as government forests [18]. As the sectors of agricultural frontiers, construction of the railways, and establishment of plantations were promoted across the country, the majority of the wildlife species survived only in these government forests [18]. The hunting reserves and government forests were the first foundations of protected areas in India [18]. After independence, the first successful legislation to protect Indian wildlife was enacted in 1972 – the Wildlife (Protection) Act of India [18]. The primary strategies for the formulation of this Act by the Government of India were: (i) the protection of endangered species to enable them to stage a recovery in their population sizes and (ii) the protection of habitats with minimum possible interference by man so that the organisms (including the large number of unknown and undocumented species) can live in conditions as close to their natural state as possible [19].

This act banned hunting, and ‘commercial’ exploitation of wildlife and timber [18]. During the period between 1970 - 1990, national parks and sanctuaries were set up in different parts of India and thus within a time period of 30 years, the land under nature protection grew from less than 1% to greater than 4% of the total area of the country [18].

4) CONCLUSION

The effect of British colonization in India resulted in several influence of the European management policies and frameworks in various sectors across the country. There is a very close link between the forest management practices in India and Germany, as Sir Dietrich Brandis was appointed as the Superintendent of Indian forests in the 19th century under the British rule. Systematic forestry was practiced for the first

time in India during this period. Although Brandis was the first to introduce seriousness, thoroughness and professionalism into the Indian forestry administration system, the knowledge on tropical forests were limited during the 19th Century in the German forestry approaches [3]. Also, the traditional indigenous knowledge of forest management in India was not considered in the management policies [3]. Besides, the geography and climatic conditions of India differ to a large extent from that of the European countries like Germany or Great Britain, hence the forest types along with the natural flora and fauna found in these areas also differ to a considerable extent. Nevertheless, Brandis established the first forestry school in Dehradun, India, to promote the scientific approaches of forest management [3].

As, the forests were degraded and monoculture for timber production was widely practiced across the country, wildlife habitats were also affected, resulting in extinction of several species from India. Game and hunting were introduced by the British as part of sport for the Royal guests and Princes. Hence, it is often argued that the establishment of protected nature reserves were necessarily an exclusion strategy of the British against the common people of India, thus several conflict situations were reported during this period [20]. Thus, post-independence, when the British left, until the formulation of the Wildlife (Protection) Act 1972, the commoners had direct access to the game reserves and hence a huge loss of biodiversity was witnessed.

Moreover, it can be stated that the Forest Protection and Conservation Acts or policies were primarily formulated for the commercialization of forest resources by the British [21]. The consequences of which affected the diverse forest habitats and tribal settlements in the country [21]. In this context, it is evident to state that the constant demand for high amount of forest revenues interfered with Brandis' approach to carry out significant forestry measures for better management of forests in British India [21].

However, the present situation in India is entirely different in the sector of forestry and wildlife management. Several projects for the promotion of endangered species are promoted and valued. Systematic forestry management practices are not followed for managing national parks and sanctuaries. The introduction of exotic and invasive species like *Eucalyptus (Eucalyptus globulus)*, for the greater yield of timber production is still a threat to the natural ecosystem [22].

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REFERENCES

- 1) Ribbentrop, B. 1989. Forestry in British India. Indus Publishing Company, New Delhi.
- 2) Roering, H.W. 2004. Study on Forestry in Germany. Institute for Economics. Federal Research Centre for Forestry and Forest Products, Hamburg, Germany.
- 3) Saldanha, I.M. 1996. Colonialism and professionalism: A German forester in India. *Environment and History*, 2(2), 195-219.
- 4) Bleeker, W., Schmitz, U. and Ristow, M. 2007. Interspecific hybridisation between alien and native plant species in Germany and its consequences for native biodiversity. *Biological Conservation*, 137(2), 248-253.
- 5) Starfinger, U. 1997. Introduction and naturalization of *Prunus serotina* in Central Europe. *Plant Invasions: Studies from North America and Europe*, 161-171. Backhuys Publishers, Leiden, The Netherlands.
- 6) Schabel, H.G. and Palmer, S.L. 1999. The Dauerwald: Its role in the restoration of natural forests. *Journal of Forestry*, 97(11), 20-25.
- 7) ProSilva Ireland.
- 8) Eggert, K. 2013. An Unexpected Pair: The Nazis and the Environment. Senior Capstone Theses, Paper 9, 1-31.
- 9) Lundmark, T. 1995. The Recreational Entrance Right in Germany. *North European Environmental Law* 1995.
- 10) Mölder, A., Streit, M. and Schmidt, W. 2014. When beech strikes back: How strict nature conservation reduces herb-layer diversity and productivity in Central European deciduous forests. *Forest Ecology and Management*, 319, 51-61.
- 11) Strauß, E., Grauer, A., Bartel, M., Klein, R., Wenzelides, L., Greiser, G., Muchin, A., Nösel, H. and Winter, A. 2008. The German wildlife information system: population densities and development of European Hare (*Lepus europaeus* PALLAS) during 2002–2005 in Germany. *European Journal of Wildlife Research*, 54(1), 142-147.
- 12) Wolfe, M.L. and Berg, F.C.V. 1988. Deer and Forestry in Germany: Half a Century After Aldo Leopold. *Journal of Forestry* 86(5), 25-36.
- 13) Heinze, E., Boch, S., Fischer, M., Hessenmöller, D., Klenk, B., Müller, J., Prati, D., Schulze, E.D., Seele, C., Socher, S. and Halle, S. 2011. Habitat use of large ungulates in northeastern Germany in relation to forest management. *Forest Ecology and Management*, 261(2), 288-296.
- 14) Ray, R.R., Seibold, H. and Heurich, M. 2014. Invertebrates outcompete vertebrate facultative scavengers in simulated lynx kills in the Bavarian Forest National Park, Germany. *Animal Biodiversity and Conservation*, 37(1), 77-88.
- 15) Schabel, H.G. 2001. Deer and Dauerwald in Germany: any progress? *Wildlife Society Bulletin*, 29(3), 888-898.
- 16) Keuling, O., Greiser, G., Grauer, A., Strauß, E., Bartel-Steinbach, M., Klein, R., Wenzelides, L. and Winter, A., 2011. The German wildlife information system (WILD): population densities and den use of red foxes (*Vulpes vulpes*) and badgers (*Meles meles*) during 2003–2007 in Germany. *European Journal of Wildlife Research*, 57(1), 95-105.
- 17) Kramer-Schadt, S., Revilla, E. and Wiegand, T. 2005. Lynx reintroductions in fragmented landscapes of Germany: Projects with a future or misunderstood wildlife conservation? *Biological Conservation*, 125(2), 169-182.
- 18) Karanth, K.K., Kramer, R.A., Qian, S.S. and Christensen Jr, N.L. 2008. Examining conservation attitudes, perspectives, and challenges in India. *Biological Conservation*, 141(9), 2357-2367.

- 19) Mohanraj, P. and Veenakumari, K. 1996. Nomenclature, classification and the basis of the Schedules in the Indian Wildlife (Protection) Act, 1972. *Current Science*, 70(6), 428-432.
- 20) Saberwal, V.K. 2001. *People, parks, and wildlife: Towards coexistence* (Vol. 14). Orient Longman Private Limited, New Delhi.
- 21) Saravanan, V. 2008. Economic exploitation of forest resources in south India during the pre-Forest Act colonial era, 1793-1882. *International Forestry Review*, 10(1), 65-73.
- 22) Sita, G.L. 1993. Micropropagation of Eucalyptus. (In *Micropropagation of Woody Plants, Forestry Sciences* (Vol 41) (pp.263-280), Springer, Dordrecht).