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TREES OUTSIDE FORESTS OF MANIPUR VALLEY DISTRICTS OF MANIPUR STATE WITH SPECIAL REFERENCE TO EXOTIC TREES

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ABSTRACT
Exotic trees are species that have native in one place, but has been moved to a new geographic location due to human interference. Present investigation is aimed at gathering information of useful exotic tree species occurring in Manipur Valley, which have been ignored so far. Investigations of the remote areas, where village dwellers are resided for data collection, identification and documentation of the trees were a difficult task. Collection and conservation of exotic trees used by local people with special reference to wild relatives of cultivated plants have been incorporated. This will ultimately give the information of the use of plant which have not been given much attention by earlier workers. A total of 71 exotic tree species under 23 families were observed, among them, Fabaceae (21), Myrtaceae (7), Lythraceae (5) and Annonaceae (3) families were dominant. Some of the trees which are naturally available even in Indian subcontinent, were not available in Manipur, people brought to Manipur State and ultimately, has rich exotic trees which ultimately, changes its natural vegetation.

Key words: Exotic trees, Natural vegetation, Manipur Valley, Manipur, India.

INTRODUCTION

The word ‘Exotic’ means in Greek language ‘Exotikos’= foreign; as a term meaning comes from a distant foreign country (Soanes, 2001). Exotic plants or animals are the introduced one by the human activity, either deliberately or by an accident from a place to a new area for the purpose of food crops, medicine, oil seeds, timber, fibers and ornamentation (Jogdand and Dhabe, 2015). Exotic plants are becoming Invasive or Alien in the new area may be unfamiliar or unacceptable or outlandish (Soanes, 2001). However, some find suitable climate and are escaped from cultivation, ultimately naturalizing in the new habitats. It is worth to be mentioned that, a few of them even turnout to troublesome and aggressive plants (Naik, 1966, 1970, 1971, 1973, 1977, 1979, 1998). In order to check the age of the endemic trees of north eastern India a dendroclimatological study was performed by Balraju and Tripathi (2023) and reported that the oldest tree ring chronology of *Abies densa* of 490 years (1504 to 1994) from Yumthang of Sikkim. Whereas, the youngest chronology of *Toona ciliata* of 35 years (1984 to 2018) was from Chandel district of Manipur. So, it is necessary to know the age of the tree, whether, it is endemic or exotic tree, so as to record the trees are living natural archives and their growth is largely impacted by various climatic and non-climatic events occurring in the surrounding environments (Balraju and Tripathi, 2023).

In India, Trees Outside Forests (TOF) are the trees, developing external to the public authority Recorded

Forest Area (RFA). TOF comprise a heterogeneous and locally very different natural resource, also referred to as tree resource outside the forest (TROF). TOF are characterized by FAO as "trees ashore not characterized as timber land or other lush land". Thus, TOF are characterized according to the two other tree assets and these three classes ought to in this way be talked about at a scene level Attum and Mahmoud (2012). TROF, is an exceptionally assorted and locally unique normal sustainable asset. TOF happen in normal and in developed scenes and serve than various environmental and monetary capacities Boffa (2000).

The tree species that grows naturally in the country or in the region where the conditions are favorable for their growth is known as indigenous species. On the other hand, exoticspecies have several definitions, some researchers defineexotic species as trees growing in an area different to their natural habitat or species growing in area where they do not naturally occur (Zobel and Talbert, 1984). Others use the “exotic” term as a reference to species that are not only able to survive but also able to reproduce outside their habitats where they evolved or spread naturally (United States Environmental Protection Agency, 2003). The term “Exotic” is also used as synonymous of introduced, foreign, invasive, non-native, naturalized, immigrant, non-indigenous species, but, some differences among those terms could be found. The difference between the terms exotic species and invasive species is that, exotic species is associated with a benefit, while invasive is relate to species that have been introduced and become a pest in its new location. Alien species have been moved by humans to areas outside of their native ranges and they often become pests inthe areas into which they are introduced.

Afforestation of forest by using indigenous species is the mostcommon practice in forestry. Mostly, the indigenous species are favorable to the natural condition, where, they are growing for a longer period of time. These are less susceptible to pest and diseases in the local climate. These indigenous species are more valuable for its timber value and firewood production. As the origin of species are well known, the cultivation and cultural practices of trees are also known by the local people. Thus, it helps the people to manage the forest stand which enhance the forest produce. The Indigenous species does not harm local flora and fauna thus, facilitates conservation measures. The wild animals are adapted well to the vegetation, so, that the habitat destruction is reduced. The seed collection, storage and treatment also have no problem. Some indigenous species commonly used for agroforestry purpose are *Tectona grandis, Acacia species, Bombax ceiba, Bahunia* species. Some indigenous species are also used for the reclamation of mining area and wasteland. These are *Acacia catechu, Acacia auriculiformis, Acacia mangium, Albizia lebbek* and *Casuarina equisetifolia* used for deforestation purpose. The multipurpose tree species are *Albizia lebbek, Azadirachta indica, Artocarpus heterophyllus* and *Prosopis cineraria* are used for fodder and living fence, shade and nurse tree and for avenue purpose. Some species often grown for industrial uses are: *Pinus* spp, *Tectona grandis,* and *Terminalia* spp. (for sawn timber); *Dipterocarpus* species and *Tectona grandis* (for plywood and veneer); *Acacia* spp, *Leucaena* spp, *Pinus* spp (for pulpwood).

Exotic forestry refers the use of exotic plant and tree for various forestry application. This is inevitable where indigenous species fail to produce the desired quality and quantity of the forest produces. They can sometimes be very competitive and invasive in nature. An invasive exotic plant is a naturalized exotic plant that is expanding its range into natural areas and disturbs naturally occurring native plant communities. The merits and demerits of both types of species have to be considered before selecting trees for planting on farmlands. Khan *et al.* (1999). studied the growth of exotic species on farmland of Punjab and according to them the most commonly planted indigenous tree species on irrigated farmlands of Punjab are *Dalbergia sissoo, Bombax ceiba, Melia azedrach* and *Albizzia procera*, whereas, the common exotic species are *Populus deltoides* and *Eucalyptus camaldulensis*. The exotic species have a faster growth rate then the native species. It has been concluded from different studies that indigenous trees have better resistance to diseases and pathogens as compared to exotic species while the exotic tree species have faster growth in comparison to the indigenous species as they are very compatible to the site where introduced. A comparative study on the volume produced was done by Muhammad *et al.* (2004). conducted on the native species and exotic one at Chichawatni irrigated plantation from 1989 to 2000. According to them, the overall performance is much better in native species than the exotic. Two of the indigenous species (*A. procera* and *B. ceiba*) were suitable for planting on farmlands particularly due to their importance for providing light quality timber and also fuel wood.

Although the growth of *D. sissoo* and *M. azedarach* was slower than other species but the importance of these two indigenous species for providing good quality timber increases the feasibility. Planting of *E. camaldulensis* on waterlogged and saline soils is also beneficial for biological amelioration of the land to make it suitable for cultivation of agricultural crops. Exotic plantations are more profitable than native tree plantations in terms of timber and also for short term basis (Sangha and Jalota, 2005). However, for longer

term the total benefits from native plantations are far more than the exotic species, where the value of intangible and tangible products and services increases over time. A study by Kumari and Choudhary (2016). was carried out to assess the threat of natural forests in Betla National Park (BNP), Palamu in Jharkhand State.

The exotic species like *Eeucalyptus* species, *Poplar* and *Prosopis juliflora* are mostly used for the agroforestry purpose. These tree are also grown in commercial purpose for their high market value. *Eucalyptus* and *Poplar* are mostly cultivated for paper and pulp production. These species are more dominant in comparison to the native species, as they easily acclimatized to the environment. Wheat and poplar, poplar and turmeric based agroforestry system are mostly practiced in India. Khanduri *et al*. (2017). studied the forest invasive species introduced in village forest in Tehri Garhwal area, Western Himalaya. Data were collected through extensive field survey and quadrat method. High invasion was recorded in the shrub and herb layer of the forest. In tree strata native species are dominant. A highest value of ecological indices was evaluated in *Pinus roxburghii* dominated site as compared to the *Quercus leucotrichophora* dominated site.

Exotic tree species canhave the potential to take intensive pressure, which can reduce the burden of natural forest. Besides agroforestry the exotic tree species are used in energy plantation, avenue plantation, industrial plantation and wasteland plantation.These exotic tree species are also useful for afforestation of opencast coal mines and also used for reclamation of saline and alkaline soil. The exotic tree species can also be used in agroforestry, commercial plantation, road side plantation,reclamation of saline and alkaline soil and also used for the afforestation purpose. (Dutta and Agrawal, 2003). As the exotic species have faster rate of growth as compared to indigenous species so the production and yield is much more in exotic species as compared to the later (Hafeez,1986). Thus, exotics have very high potential in every aspect of forestry.

MATERIAL AND METHODS

The research program involved extensive ethnobotanical studies, survey and collection of exotic plants in different localities from valley districts of Manipur State (Imphal west, Imphal east, Bishnupur, Thoubal and Kakching) Fig. 1. During the fieldwork methods of exotic plant collection of Sonawane and Fatima (2017), Panigrahi (2020), Kumari and Choudhary (2016), Devi and Singh (2022), Kleinn and Morales (2005), Pasiecznik, *et al.*(2004), Maniknandan and Prabhu (2012) and Jogdand and Dhabe (2015) were followed. Voucher specimens of each plant were collected and numbered by following standard methods (Jain and Rao, 1976). Plants specimens were identified with the help of keys to the families, genera and species provided in reputed floras like Cooke (1967), Singh *et al.* (2001), Pradhan and Singh (1999), etc. Balapure, *et al.* (1987), Hopkins, (1901), Karnick, (1975), Macdonell and Keith, (1912), Sagreiya, (2005), Shastri, Tulsidas, (1966) and Varma (2015).

Fig.1: Map of Manipur showing study sites, the five valley districts (Imphal west, Imphal east, Bishnupur, Thoubal and Kakching) in the centre.

RESULTS AND DISCUSSION

Indian tree species introduced to other country

The exotic tree species like *Neem*, which is a native to north-eastern India, is a fast-growing evergreen tree thathas been introduced and established throughout Australia's tropics and subtropics. *Neem* is used to produce insecticide, and is planted across northern Australia for this reason. However, in dense stands, it could have adverse effects on native plants and animals.

Native to tropical and subtropical Asia, bamboo is a tall, woody grass that grows in dense stands. Bamboo was introduced to Australia as an ornamental plant, and today is often used to create shelter belts or for erosion control. Bamboo species have spread into many parts of South East Queensland and northern New South Wales. Where they have broken containment and become invasive, running bamboos have become a problem for landowners and managers of natural areas. Nothing will grow under bamboo, and it crowds out native and other desirable species.

In Manipur State because of the climatic and environment factors, some exotic trees were introduced, however, even some of the trees which are naturally available in Indian subcontinent were not available in Manipur, because, of the isolated area which is bounded by various ranges of mountains. Now a days, many exotic tree species coming in because of many factors. Now, Manipur State has rich exotic trees which ultimately, changes its natural vegetation.

Table 1: Exotic trees of Manipur State along with the native place from where it reached Manipur, India

Sl No	Name of the tree	Local name	Family	Native place
1. 1	*Acacia auriculiformis* A. Cunn. ex Benth.	Auri	Fabaceae	Australia, Philippines, Indonesia, and Papua New Guinea.
2.	*Acacia farnesiana* (L.) Willd.	Sweet acacia	Fabaceae	Tropical America, from Brazil and Peru to Mexico and the southern USA,
3.	*Acacia mangium* Willd.	Black wattle	Fabaceae	Papua, Western Irian Jaya and the Maluku islands in Indonesia, Papua New Guinea and north-eastern Queensland in Australia.
4.	*Acacia nilotica* (L.) Del	Gum arabic tree	Fabaceae	Africa, the Middle East and the Indian subcontinent.
5.	*Albizia amara* (Roxb.) Boiv	Bitter albizia	Fabaceae	Botswana, Eritrea, Ethiopia, India, Kenya, South Africa, Sri Lanka, Sudan, Tanzania, Zambia, Zimbabwe Indonesia
6.	*Albizia lebbeck* (L.) Benth	Siris	Fabaceae	Indian subcontinent and Myanmar.
7.	Albizia procera (Roxb.) Benth.	White siris	Fabaceae	Southern Asia from India to southern China, Indonesia, Philippines and northern Australia.
8.	*Annona glabra* L.	Pond apple	Annonaceae	Florida in the United States, the Caribbean, Central and South America, and West Africa.
9.	*Annona muricata* L.	Soursop	Annonaceae	General Caribbean region and South America
10.	*Annona squamosa* L.	Sugar apple	Annonaceae	Caribbean, Central America & Northeastern S. America
11.	*Araucaria heterophylla* (Salisb.) Franco	Norfolk Island pine/Norfolk pine	Araucariaceae	Norfolk Island (east of Australia)
12.	*Azadirachta indica* A. Juss.	Neem tree, Neem	Meliaceae	Indian subcontinent; South and Southeast Asia, including Pakistan, Sri Lanka, Thailand, Malaysia, and Indonesia.
13.	*Bauhinia acuminata* L.	Orchid tree, Chingthrao	Fabaceae	Tropical southeastern Asia.
14.	*Bauhinia purpurea* L.	Orchid tree, Chingthrao	Fabaceae	Indian subcontinent and Myanmar
15.	Bauhinia racemosa Lam.	Orchid tree, Chingthrao	Fabaceae	Tropical Southeast Asia.
16.	*Bauhinia tomentosa* Lam.	Orchid tree, Chingthrao	Fabaceae	India, Sri Lanka, and parts of tropical and Southern Africa from

				Ethiopia southwards to KwaZulu-Natal in South Africa
17.	*Bauhinia variegata* L.	Orchid tree, Chingthrao	Fabaceae	the sub-Himalayan tract and outer hills and valleys from the river Indus in Pakistan eastwards to Assam and Myanmar
18.	*Bombax ceiba* L.	Red cotton tree, Tera	Malvaceae	Southern and eastern Asia and northern Australia.
19.	*Butea monosperma* L.	Flame of the forest	Fabaceae	Tropical and sub-tropical parts of South Asia and Southeast Asia.
20.	*Callistemon citrinus* (Curtis) Skeels	Bottlebrush	Myrtaceae	Australia
21.	*Callistemon polandii* Baile	Bottlebrush	Myrtaceae	Far northern Queensland in Australia
22.	*Canella winterana* (L.) Gaertn.	Pepper chinnamon	Canellaceae	Florida and tropical America
23.	*Cinamomum verum* Presl.	Ceylon cinnamon	Lauraceae	Sri Lanka, Malabar Coast of India, and Myanmar
24.	*Crateva adansonii* (Buch.-Ham,) Jacobs.	Loyumba-lei	Capparaceae	Africa
25.	*Dalbergia sissoo* Roxb.	Sissoo	Fabaceae	Indian subcontinent and southern Iran
26.	*Delonix elata* (L.) Gamble.	Gul mohur	Fabaceae	Sudan to Tanzania, S. Arabian Peninsula
27.	*Delonix regia* (Boj. ex Hook.) Raf.	Gul mohur	Fabaceae	Madagascar
28.	*Dillenia indica* L.	Gul mohur	Dilleniaceae	Southeastern Asia, India, Bangladesh and Sri Lanka, China (Yunnan),Vietnam,Thailand, Malaysia and Indonesia
29.	*Erythrina variegata* L.	Coral tree, Kurao	Fabaceae	Africa, Indian, Australia,Islands of Indian Ocean and the western Pacific Ocean east to Fiji
30.	*Erythrina variegata* L.var. *alba* L.	Coral tree, Kurao	Fabaceae	Africa, Indian, Australia,Islands of Indian Ocean and the western Pacific Ocean east to Fiji
31.	*Eucalyptus citriodora* Hook.	Eucalyptus, Nasik	Myrtaceae	Australia
32.	*Eucalyptus cladocalyx* F. Muell.	Eucalyptus, Nasik	Myrtaceae	South-eastern Australia
33.	*Eucalyptus globulus* Labill.	Eucalyptus, Nasik	Myrtaceae	South-eastern Australia
34.	*Eucalyptus rummeryi* Maiden.	Eucalyptus, Nasik	Myrtaceae	Northern New South Wales
35.	*Eucalyptus tereticornis* Sm.	Eucalyptus, Nasik	Myrtaceae	Eastern Australia and southern New Guinea
36.	*Ficus arnottiana* (Miq.) Miq.	Indian rock fig, Khonang	Moraceae	Indian Subcontinent, Andaman Islands, Thailand
37.	*Ficus benghalensis* L.	Banayan	Moraceae	Indian subcontinent
38.	*Ficus carica* L.	Common fig, Khonang	Moraceae	Southwest Asia and the eastern Mediterranean
39.	*Ficus hispida* L.	Opposite leaf fig, Asi-heibong	Moraceae	Asia-southern China, Indian subcontinent, Myanmar, Thailand, Laos, Vietnam, Malaysia, Indonesia, to New Guinea and Australia
40.	*Ficus microcarpa* L.	Curtain fig, Khonang	Moraceae	Tropical Asia, southern China, Taiwan, islands of the Western Pacific and Australia
41.	*Ficus racemosa* L.	Cluster fig/Red river fig	Moraceae	Australia and tropical Asia
42.	*Ficus religiosa* L.	Sacred fig, Sana khonang	Moraceae	Southeast Asia, southwest China, India and the Himalayan foothills
43.	*Grevillea robusta* A. Cunn. ex R.Br.	Silk oak, Koubilia	Proteaceae	Eastern coastal Australia
44.	*Huberantha cerasoides* (Roxb.) Chaowasku	Cherry ashok	Annonaceae	Indian Subcontinent to China (S. Yunnan to S. Guangdong) Indo-China
45.	*Ipomoea cairica* (L.) Sweet	Garwel, Lamkhop-chei	Convolvulaceae	Tropical Africa, and from the eastern Mediterranean through Asia to Taiwan
46.	*Jatropha gossipifolia* L.	Cotton-leaf physicut,	Euphorbiaceae	South America

47.	*Kigelia africana* (Lam.) Benth.	Sausage-tree, U-khongdrum	Bignoniaceae	Africa
48.	*Lagerstromia floribunda* Jack.	Pride of India	Lythraceae	Tropical region of Southeast Asia
49.	*Lagerstromia reginae* Roxb.	Pride of India	Lythraceae	China
50.	*Lagerstromia speciosa* (L.) Pers.	Pride of India	Lythraceae	Tropical southern Asia
51.	*Lagerstromia thorelli* Gagnepin.	Pride of India	Lythraceae	Indian subcontinent, southeast Asia, northern Australia, and parts of Oceania
52.	*Lantana camara* L.	Common Lantana, Nongbal-lei	Verbanaceae	America and Africa
53.	*Lawsonia inermis* L.	Henna tree, Henna	Lythraceae	Northern Africa, Asia and northern Australia
54.	*Magnolia grandiflora* L.	Bull bay, U-thambal	Magnoliaceae	Coastal plain of the Gulf/South Atlantic states
55.	*Magnilia liliiflora* (L.) Desr.	Red magnolia, U-thambal	Magnoliaceae	China
56.	*Melia azedarach* L.	Chinaberry tree, Seijrak	Meliaceae	Southeast Asia and northern Australia
57.	*Michelia champaca* L.			From India, southwestern China, Indochina to Malesia (Sumatra, Malay Peninsula, Java, Lesser Sunda Islands)
58.	*Moringa oleifera* Lam.	Drumstick, Narasing	Moringaceae	Northwestern India
59.	*Murrya koenigii* L.	Curry tree,	Rutaceae	Asia
60.	Peltophorum pterocarpum (DC,) K. Heyne	Yellow flametree	Fabaceae	Tropical southeast Asia, northern Australasia, Sri Lanka, Indonesia, Malaysia, Papua New Guinea, Philippines, Thailand and Vietnam
61.	*Phyllanthus emblica* L.	Indian gooseberryMyrobalan/Amla/Heikru	Phyllanthaceae	India
62.	*Pongamia pinnata* (L.) Pierre.	Indin beech	Fabaceae	Asia and Australia
63.	*Santalum album* L.	Indian sandalwood, Chandan	Santalaceae	Tropical belt of the peninsular India, eastern Indonesia and northern Australia
64.	*Saraca asoka* (Roxb.) Willd.	Asoka	Fabaceae	South India, Sri Lanka, Orissa, and Assam
65.	*Spathodea campanulata* P. Beauv.	African tulip tree, Ee-pambi	Bignoniaceae	Tropical dry forests of Africa
66.	*Tecoma stans* (L.) Juss. ex Kunth	Yellow trumpet bush	Bignoniaceae	America
67.	*Terminalia arjuna* (Roxb.) Wight & Arn.	Arjun, Mayokpha	Combretaceae	India
68.	*Terminalia catappa* L.	Indian almond	Combretaceae	Asia, Australia, the Pacific, Madagascar and Seychelles
69.	*Theobroma cacao* L.			Tropical South and Central America
70.	*Thespesia populnea* (L.) Sol. Ex Correa	Indian tulip tree	Malvaceae	Old World tropics
71.	*Ziziphus mauritiana* Lamk.	Bor	Rhamnaceae	South Asia and East Africa

Table 1 shows the exotic trees of Manipur State along with the native place from where it reached Manipur, India. A total of 71 exotic tree species under 23 families were observed, among them, Fabaceae (21), Myrtaceae (7), Lythraceae (5) and Annonaceae (3) families were dominant (Fig. 2). The trees were entered to Manipur State because of various factors like, for their useful reasons, prominent figures, shape, size and ornamental structures, etc. For instance, *Azadirachta indica* A. Juss., *Terminalia arjuna* (Roxb.) Wight & Arn., *Saraca asoka* (Roxb.) Willd., *Moringa oleifera* Lam., *Ficus racemosa* L., *Ficus benghalensis* L., *Lagerstromia thorelli* Gagnepin. and *Phyllanthus emblica* L. are the majority of the exotic trees of Indian subcontinent, however, coming in Manipur because of the above mentioned factors.

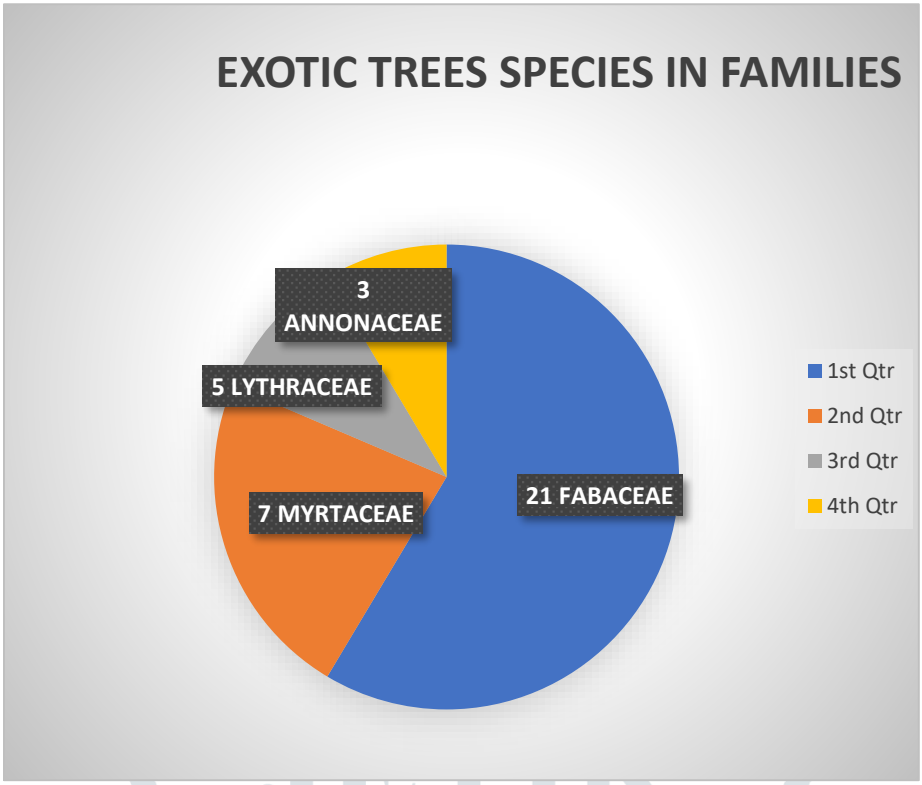

Fig. 2: Number of dominant exotic tree species in Families (Fabaceae (21), Myrtaceae (7), Lythraceae (5) and Annonaceae (3) families were dominant).

Purpose of exotic tree introduction in India

The ever-expanding human population requires an enormous amount of wood, which in turn, puts intense pressure on the existing forest wealth of India. The production potential of trees for wood generation is restricted to about 0.7 cubic meter/hectare/year in the country as compared to the world average of 2.1 cubic meter/hectare/year. This results in a huge gap between demand and supply.

As per the National Forestry Action Program, India's timber requirement in 2006 stood at 82 million cubic meter whereas, the domestic availability was just 27 million cubic meter. Moreover, in the past 10 years, the money spent on import of wood has jumped from US $1 billion in 2001 to more than US $ 5 billion in 2011. Expansion of farm areas is not possible as land is a limited resource. However, enhancing the efficiency of farms by planting and integrating fast-growing trees under farm forestry and agroforestry is a reasonable and realistic alternative to meet the increasing demand for wood. Planting fast-growing trees outside the forest in the form of farm-forestry or agroforestry is the only way to meet the goal as required by the National Forest Policy, 1988 to increase forest tree cover to 33 per cent from the present 24.01 per cent. (http://www.fao.org/3/af338e/af338e06. htm). Short-rotation tree species having faster growth, multiple uses and wider adaptability were deemed desirable for agroforestry/farm forestry plantations.

The exotic species are used as an alternative in many places where local indigenous forests cannot produce the quantity and quality of forest products required and its growth rates is much higher than native species; therefore, they produce more wood per unit of area and time. In the tropics, exotic species could grow 5 to 10 times more wood than native species. Many of the exotic species used in forestry plantations can grow in sites with limited edaphological conditions (as pH, nutrient availability, moist content, texture, etc) with better yield than indigenous species. Exotic species usually can adapt to different environmental conditions; nevertheless, is important to test the exotics in the zone where it is needed prior deciding a large-scale plantation establishment. With features as fast growing and wider adaptation, exotic species could be used as source of different type of products and so reduce the pressure over native species (which in general growth less and slower). The yield is higher in exotic trees and augment improved return from a land. Wood is of uniform quality and desirability is obtained. The rotation period is less as compared to the native one. Suitability of the species for involvement as well as biology and reproduction is well known. Exotic trees are not likely to be effected by their enemy such as pest and disease and many exotic perform well in the introduced country. Moreover, some exotic tree species were introduced to contribute to the success of farm forestry plantations programs.

Farmers in India may need to be careful in integrating exotic trees into their agroforestry farms. Besides

from looking at market prices, farmers should also consider the trees capability to be efficient and effective suppliers of food, fodder and fuel wood. More importantly, they should also check how the tree of choice complements the other crops, including its maintenance requirements. The introduction of the exotic species, depends on the factors like edaphic, climatic, forest types and environmental condition should also be taken into consideration. The exotics also have some specific role towards the soil and water conservation. Tree species introduced in India There are a number of tree species introduced to India which are fast growing in nature and have the potential to meet the need of local people. The tree species like *Populus*, *Eucalyptus*, *Prosopis* are mainly used in agroforestry purpose. The most successful agroforestry practice in India is wheat (*Triticum astivum*) with poplar (*Populus deltoides*, turmeric (*Curcuma domestica*) with poplar (*Populus deltoides*) etc., (Chander, 1998).

Table 2: List of some common exotic tree and their impacts on climate and environment

SL NO	SCIENTIFIC NAME, LOCAL, FAMILY	NATIVE COUNTRY	USES	NEGETIVE IMPACT	REPORT
1.	*Populus deltoides* W.Bartram ex Marshall F.Salicaceae	U.S.A.	Adsorption of carbon dioxide, production of oxygen, conservation of soil and water,	It is very much susceptible to lighting and it capture fire easily.	(Chander, 1998)
2.	*Eucalyptus tereticornis* F. Myrtaceae	Australia	Leaf in photosynthesis to temperatures that relate to thermal regime	Water demand with other species, incidence of allelopathy.	(Yan, 2012)
3.	*Prosopis juliflora* F.Papilionaceae	South America	They are capable of transferring fertile land into dense thickets of impenetrabletree stands	More water consumption can lower the ground water table. Seed pods are poisonous to livestock	(Pasiecznik *et al*. 2004)
4.	*Araucaria heterophylla* F.Araucariaceae	Norfok Island, Pacific Ocean	Tolerance to salt and wind so ideal for planting in coastal zone.	Canker and needle blight are observed.	(Panigrahi, 2020)
5.	*Cryptomeria japonica* (L.f.) D.Don F.Cupressaceae	Japan	Tree withstands to stagnant water condition and grows well in moist soil.	Toxic to human and other animal.	(Panigrahi, 2020)
6.	*Taxodium distichum* (L.) Rich. F.Cupressaceae	Southeast ern United States	Gives structural support and stabilization. Can grow in flood prone area.	Brown pocket rot is very common. It attacks and destroy sapwood of another tree. Cypress flea beetle, leaf roller infestation is common.	(Panigrahi, 2020)
7.	*Acacia mellifera* (Vahl) Bosc F.Papilionaceae	Ethiopia	Trees are important particularly in arid andsemi-arid areas for regulating microclimate, improving conditions for survival of associated plant and animal species	It is invasive and cover large area offarmland.	(Attum & Mahmoud, 2012)
8.	*Jatropha curcas* Euphorbiaceae	Central American	Use of jatropha biodiesel reduce the global warming potential and the non-renewable energy demand as compared to fossils diesel.	The jatropha bioenergy is not climate friendlybecause it disturbs the greenhouse gas balance and increase the acidification, eutrophicationand water depletion.	(Panigrahi, 2020)

Table 2 shows a list of some common exotic tree species eight in number and their impacts on climate and environment change, the problem is because of the prevailing situation facing after introducing the exotic trees in India, the same thing is facing in Manipur State also. These trees were introduced from many places like America, Ethiopia, Japan, Australia, etc. *Jatropha curcas*, *Taxodium distichum* (L.) Rich., *Cryptomeria japonica* (L.f.) D.Don, *Araucaria heterophylla*, (Panigrahi, 2020), *Acacia mellifera* (Vahl) Bosc (Attum and Mahmoud, 2012), *Prosopisjuliflora* (Pasiecznik *et al*. 2004), *Eucalyptus tereticornis* (Yan, 2012) and *Populus deltoides* W.Bartram ex Marshall(Chander, 1998).

Problems due to exotic tree species

The plantation of exotic species should be selected carefully, after introduction to a site if the provenances and seed sources of the exotic species are not appropriate, the plantation could result in a disaster.

Therefore, it is important to test the species in the area where it is to be grown before it is planted at commercial scale. The delayed failure, in some cases creates a problem during afforestation in later stage. In some case, The introduced species are performed at substandard level. Sometimes growth may become unsatisfactory. The exotic trees are considered ecologically less valuable than indigenous species. The use of exotic species could be associated with new pests and diseases and affect native species e.g. pink disease *eucalyptus grandis*. Therefore, it implies new or stricter disease and pest controls. The exotic may bring new insect and pest to be introduced at the region. Experimentationwith exotic is time consuming and may not serve the purpose of immediate needs.

The use of exotic species has many opponents, not only ecologists but also politicians, who are against the use or modification of natural forests and their biodiversity. Some ecologists point out that "once established, some exotic species have the ability to displace or replace native plant and animal species, disrupt nutrient and fire cycles, and cause changes in the pattern of plant succession" (Lovich, 2003). The exotic may have physiological distribution and problem of need production. e.g. *Araucaria bidwill*, in spite of their faster rate of growth in many areas these are not producing the viable seed. Due to this reason large scale propagation is not possible.

Previously in India they promoted wide-scale plantations of exotic *Eucalyptus tereticornis* mainly for the short-term visible gains from timber because of its straight bole (the trunk of a tree), fast growth rate, high productivity per unit area, and minimal requirement for post-plantation care. However, the meritand demerit of this tree is a very controversial from the viewpoint of scientific community, private growers, and the public. One reason for this is that our current accounting system considers only the economic gains from wood and fails to consider the cost of lost ecological services when comparing exotic vs. native trees. Instead, we compared the total value of exotic *E. tereticornis* plantations in comparison with native *Dalbergiasissoo* plantations.

Exotic plantations are more profitable than native tree plantations only over the short-term basis and in terms of timber, which is at the cost of many ecological services (Sangha and Jalota, 2005). However, the long term the total benefits from native plantations are far greater, where, the value of intangible and tangible products andservices increases over time, and adds to the continuum of services and sustainability of a system. Invasive exotic plant species (IEPS) threaten the environment, reduce biodiversity, replace economically important plant species and increase the investment in agriculture and silviculture practices, prevail vegetation dynamics and alter nutrient cycling (Richardson and Higgins 1998). They can promotehazards like forest fire.

Plant invasions dramatically affect the distribution, abundance and reproduction of many nativespecies (Sala, 1999). IEPS intrusion is severe in edges of forests, agricultural land and wet lands. However, all ecosystems that are susceptible to invasion and effected with a higher level of human interventions (e.g. forestry, agriculture, wetland and rangelands) are likely to pose greater susceptibility. Introducing an exotic species canresult in undesirable side effects. One possible problem is that the species will adapt so well to its new environment that it will become a weed and take over crops that are important to farmers' livelihood. For example, *Prosopis juliflora*, native to Central America and the West Indies, was introduced to India as a fodder and fuel wood tree. It grows so well in its new environment that it inhibits the germination and growth of other plants that are more valuable to the farmer. Invasive plants that have usually beenbrought in as exotics, but are so well adapted to their surroundings that they spread uncontrollably, pushing out indigenous plants, and consuming precious resources at the same time.

Strategies to overcome the problem

The successful growth of exotic tree species depends on selection of the most appropriate species. To perform well the, farmers or forest personals must have a clear idea of purpose to grow exotic trees and the tree crops match the needs of their particular farming system and local agro-ecological conditions. People grow trees for different purposes: to obtain timber, fuel-wood, fodder, or food; to conserve the soil or a combination of these and also be grown in different land use systems, such as alley cropping, home gardens, farm woodlots, or industrial plantations. These different purposes and growing systems determine thecriteria that farmers must consider when selecting which species to grow. People needs to understand about exotic species, their impact, and management of it. The balance of nature by introducing non-native species into any region is also ensuring the focus on ecosystem.

The over exploitation of forests leads to damage the environment and biodiversity. If the process continues there will be no forests left by 2050. The condition of forest-basedindustries is also not healthy in India. Therefore, promoting large-scale farm forestry/agroforestry plantations is essential. The National Forest Policy (1988) directed the wood-based industrial units to meet their future raw material requirements by

developing partnerships with farmers. Some progressive industrial units have promoted farm forestry/agroforestry plantations through the supply ofplanting stocks, technical extension services and buy-back arrangements with varying degrees of success.

CONCLUSION

In Manipur the natural vegetation of the endemic trees are affected, because, of the introducing of exotic trees, thereby, changing the environment (Sala, 1999). These exotic trees have the potential to take intensive pressure and can mitigate the timber demand of huge population. From various study it is concluded that, the exotic trees can give more outcomes per unit area as compared to the indigenous species as the rate of growth is faster in exotic trees, so, they withstand in the new environment(Jogdand and Dhabe, 2015). But, the indigenous species has better resistance to disease and pest as compared to the exotic. Theexotic tree species have various advantages in agroforestry and commercial plantation, apart from these advantages,there are various negative impacts of exotic trees *viz*., allelopathy, liable to attack by pests and disease, use of excess water and effect on soil and invasive nature. These risks can be reduced by taking some precautions before introduction of an exotic species (Jogdand and Dhabe, 2015). Introducing material through proper evaluation before mass plantation, keeping wide genetic base, etc., must be taken into consideration at the time of selection. However, the long term the total benefits from native plantations are far greater, where, the value of intangible and tangible products andservices increases over time, and adds to the continuum of services and sustainability of a system.

When introducing an exotic tree species, it is important to determine whether the soil, rainfall, and other requirements of the species match the conditions of the planting site. If the suitability of the species in the introduced area are not known indigenous species as well aslocal species should be considered first. Exotic species are those found in botanic gardens, on farms, in parks or along road sides have survived easily in local agro-ecological conditions. Exotic plantations are more profitable than native tree plantations only over the short-term basis and in terms of timber, which is at the cost of many ecological services (Sangha and Jalota, 2005).

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