Plant Archives Vol. 21, No. 2, 2021 pp. 795-803 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2021.v21.no2.121

INDIGENOUS TREE SPECIES SUITABLE FOR "TELANGANA KU HARITHA HARAM": A MASSIVE PLANTATION PROGRAMME IN INDIA

E. N. Murthy[1*], **S. Rama Rao**[2], **A.Vijaya Bhasker Reddy**,[2] Raju Bolla,[4] **N. Sai Vaishnavi**[3] **and N. Venu Madhav**[1]
[1]Department of Botany, Satavahana University, Karimnagar-505 001
[2] Department of Botany, Nizam College, Osmania University, Hyderabad-500 007
[3]Dr. BRKR Govt Ayurvedic Medical College, Hyerabad-500 038
[4] IGNOU Regional Centre, Hyderabad-500 001
[*]E-mail: murthyensnbc@gmail.com; Mobile: +91-9440642632

(Date of Receiving : 06-07-2021; Date of Acceptance : 09-09-2021)

ABSTRACT

Government of Telangana has launched a massive plantation programme in order to enahnce the forest cover of the state up to prescribed 33%. In this connection various departments are actively involved in massive plantation programme. It is a prestigeous flagship programme carved out by the Government of Telangana state, India. Fragmented and encroached forest lands, barrend lands, hillocks, assigned urban and rural areas are prioritized for the plantation. Targets are set to achieve desired number of saplings to plant including indigenous and exotic tree species based on the availaibility at the public and private nursaries. Organizations are eager to ahieve the plantation-targets by planting fastgrowing, ornamental and other exotic tree species without studying the ecological impact caused to the ecosystem. Monitoring of long term impact of the exotic tree species is also simply ignored. Keeping inview of ths background an effort was made to explore the suitable indigenous tree species for Telangana Ku Haritha Haaram programme. Traditional and conventional planting methods existed in the ancient Indian culture are also discussed in detail.

Keywords: Impact of exotic trees, Indigenous trees species,

INTRODUCTION

It is becoming a world wide phenomenon that rapid urbanization (Concrete Jungle) and industrialization, vegetation cover is contributing to the rapid detioriation of vegetation cover. Time has come to recognise the importance of the trees in maintenance of ecological sustenance in particular ecosystems. Keeping in view of the importance of the vegetation cover particularly tree cover, National Forest Policy of India underscores a minimum 33% of the total geographical area under forest or tree cover to maintain environmental stability and ecological balance that are vital for sustenance of all life-forms, human, animal and plants even outside the notified forest areas. Recognizing the importance of the tree cover Government of Telangana launched the massive plantation programme as its flagship programme titled as "Telangana Ku Haritha Haaram (means green garland to Telangana) (here after abbreviated as TKHH)" to increase the existing 24 % tree cover to 33% of the total geographical area of the state (Anonymous 2021).

Trees play vital role in ecological restoration, retaining surface moisture, checking top soil erosion, enhancing ground water table, ground soil health, hosting soil microorganisms etc.

The main aim is not only achive stipulated forest cover but also conserve the degraded forest ecosytems to protect watershed with integrated social forest methods by involving institutional initiation of various government and non governmental organisations. Areas are identified in disturbed and fragmented forest areas, gap areas formed after harvesting of *Eucalyptus* plantations, Over burden cites of Open-cast coal mining, outside forested areas and barren hills for block and massive plantation including road side areas, canal banks, tank bunds, rural and urban parks, religious places, housing board colonies, schools, universities, river banks, bunds of reservoirs, dam cites of Kaleswaram lift irrigation project, premises of educational and government institutions for avenue plantation (Figure 1). A multistrategic approach is adopted to rejuvenate the degraded forest ecosytems affected under mining cites etc. It is need of the hour to ensure the protection of existing forests from anthropogenic activities like smuggling, illegal logging, encroachments, forest fires etc. to improve the forest cover upto desired level. Various governmetn departments like,

Panchayat Raj, Municipal Corporations, Forest Department, Horticuture, Sericulture, Hyderabad Urban Development Authority (HUDA) are actively involved to take part in the massive plantation programme.

People from all spheres viz., Government agencies, officers, prominent citizens, and public representatives will participate in the programme. The field functionaries of various line Departments have undertaken identification of sites for planting and prepared village Action Plans. The Village Action Plans will be consolidated at Mandal level and finally at the District level to form District Action Plan. At State level, two committees; the State Level Coordination and Monitoring Committee, and the State Level Steering Committee oversee the progress of the TKHH programme (Anonymous 2021). In recent times, government has initiated the rural parks named Palle Prakrithi Vanams and urban parks named Pattana Prakrithi Vanams inadition to these, nursaries to raise the tree saplings at very village and town levels are maintained to long term continuation of this massive planation programme.

Inorder to achieve the targets set under this programme, government and non government agencies take part in the massive plantation programme of **"**Telangana *Ku Haritha Haaram* (TKHH)" are actively involved in plantation of saplings beloning to various tree species irrespective their nativity like indigenous or exotic. Targets are set to achieve desired number of saplings to plant including indigenous and exotic tree species based on the availaibility in the public and private nursaries. Organizations are eager to ahieve the plantation-targets by planting fastgrowing, ornamental and other exotic tree species without knowing the damage to the ecosystem caused by them. Long term impact of the exotic tree species is not taken into consideration. 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**.** They can promote hazards like forest fires. Plant invasions dramatically affect the distribution, abundance and reproduction of many native species (Aarif Ali Gattoo, 2013; Almeilla and Freitas, 2001**;** Kumari and Choudhary 2016**,** Lovich Jeff. 2003**,** Richardson and Higgins 1999, Muhammad *et al*., 2004, Sala *et al*., 1999; Sonia Panigrahi, 2020, United States Environmental Protection Agency, 2003) Keepving in view of this background an effort was made to explore the suitable indigenous tree species for TKHH programme. Traditional and conventional planting methods existed in the ancient Indian culture are also discussed in detail. Review and retrospection of methodolgy, procedures and targets achieved in TKHH programme was not discussed here. Main aim of this paper is to suggest suitable indigenous tree species for TKHH programme and other traditional ways to promote tree cover.

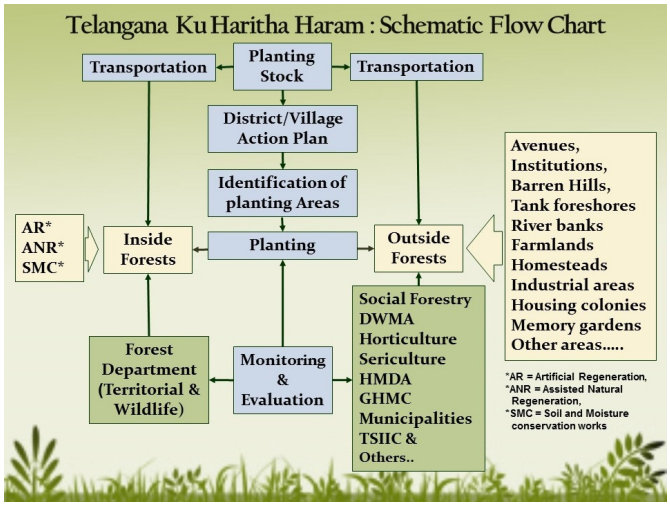

Fig. 1 : Schematic flow chart for plantation programme of Telangana *ku Haritha Haram* (accessed from http://harithaharam.telangana.gov.in)

MATERIAL AND METHODS

A detail exploration was made by referring state and local floras available. Random field surveys were conducted at field level to observe the observations on status of the plantations. A detailed list of indigenous tree species was prepared by referring the botanical literature and floristic reports of India in general and Telangana in particular. Tree species are presented in a tabulated form envisaging their botanical name, family name along with their local telugu name. In addition, traditional plantation patterns like *Nakshatra vanam* and *Raasi vanam* are encouraged with their botanical components. Importance of other plantation strategies like urban parks, rejuvination of natural forest vegetation, trees for biofencing, shade giving trees, flowering trees, fruit yielding trees, wind resistant trees, trees for avenue plantation and *Tamarind* groves are also discussed in detail. Detailed field works were conducted along with the detailed literature survey was takenup (Anonymous, 1992; Brandis, 1906; Khan, 1953; Patridge, 1911; Prasanna *et al*., 2012; Pullaiah, 1999; Rao 1986; Rao, 2012; Reddy *et al*., 2000; Reddy, 2008; Reddy & Reddy 2016; Shrikant & Sharvari 2010; Sayeeduddin, 1935**-**36, 1938, 1941, 1954) to find out the important indigenous tree species suitable for Telngana *ku Haritha Haram*.

RESULTS

A total 104 indigenous tree species suitable for plantation in Telangana *ku Haritha Haram* programme were enumerated. All the tree species were presented in a tabulated form. Table includes the Botanical name of each tree species including their families with their native telugu names along with their importance to plant for block plantation, avenue plantation, flowering, fruiting and medicinal importance.

Table 1 : Indigenous tree species suitable for "Telangana *ku Haritha Haram*"

S. No.	Botanical name	Family	Vernacular name	Significance
1	*Acacia catechu* (Roxb.) Willd.	Mimosaceae	*Kachu*	B, M
2	*Acacia nilotica* (L.) Willd. **ex Del.**	Mimosaceae	*Nallathumma*	S, B
3	*Aegle marmelos* (L.) Correa	Rutaceae	*Maaredu*	S,B,M
4	*Ailanthus excelsa* Roxb.	Ailanthaceae	*Peddamaanu*	S,B,M
5	*Alangium salvifolium* (L.f.) Wang**.**	Alangiaceae	*Ooduga*	B, M
6	*Albizia amara* **(Roxb.)** Boiv**.**	Mimosaceae	*Naarlingi, Chigara*	S, A
7	*Albizia odoratissima* (L.f.) Benth	Mimosaceae	*Chinduga*	S, A
8	*Albizia procera* (Roxb.) Benth.	Mimosaceae	*Tellachinduga*	S, A
9	*Alibizia lebbeck* **(L.)** Benth.	Mimosaceae	*Diresana*	S, A
10	*Alstonia macrophylla* G. Don	Apocynaceae	*Pedda adakula paala*	S, A
11	*Alstonia scholaris* **(L.)** R. Br.	Apocynaceae	*Edakula paala*	S,A, M
12	*Annona muricata* L.	Annonaceae	*Seethaphalamu*	FR, B
13	*Annona reticulata* L.	Annonaceae	*Laxamana phalamu*	FR,B
14	*Annona squmosa* L.	Annonaceae	*Ramaphalamu*	FR, B
15	*Anogeissus latifolia* Bedd.	Combretaceae	*Chirumaanu*	B, M
16	*Atalantia racemosa* Wight & Arn.	Rutaceae	*Adavinimma*	FR, B
17	*Azadirachta indica* A.Juss	Meliaceae	*Vepa*	S, M
18	*Balanites roxburghii* Planch	Balanitaceae	*Gaara*	B, M
19	*Barringtonia acu**t**angula* (L.) Gaertn	Barringtoniaceae	*Kanapa/Ganapa*	B, M
20	*Bauhinia purpuria* L.	Fabaceae	*Devakaanchanamu*	A, FL
21	*Bauhinia racemosa* Lam.	Fabaceae	*Aari*	A, FL
22	*Bauhinia variegat**a*** L.	Fabaceae	*Devakanchanamu*	A, FL
23	*Bombax ceiba* L.	Bombacaceae	*Booruga*	A, FL
24	*Boswallia serrata* **Roxb. ex** Colebr.	Burseraceae	*Andugu*	B, M
25	*Bridelia retusa* **(L.) Spreng.**	Euphorbiaceae	*Koramaddi*	B, M
26	*Buchnania axillaries* (Desr.) Rama**m**.	Anacardiaceae	*Pedda morli*	B, M
27	*Buchnania lanzan* Spren**g.**	Anacardiaceae	*Chinna morli*	B, M
28	*Butea monosperma* **(Lam.)**Taub.	Fabaceae	*Moduga*	B, M
29	*Calophyllum inophyllu**m*** L.	Guttiferae	*Ponna*	A, FL
30	*Careya arborea* Roxb.	Lecythidaceae	*Buda dhdarmi*	A, FL
31	*Cassia fistula* L.	Caesalpiniaceae	*Rela*	A, FL
32	*Ceiba pentandra* (L.) Gaert**.**	Bombacaceae	*Tella burooga*	A, FL
33	*Chloroxylon swirtenia* DC.	Flindersiaceae	*Billudu, Billa*	B, M
34	*Chukrasia tabularis* A. Juss	Meliaceae	*Erra pongadi*	A, F
35	*Cochlospermum religiosum* **(L.)**Alston	Cochlospermaceae	*Konda gogu*	A, F
36	*Cordia dichotoma* Forst. **& Forst.f**	Cordiaceae	*Iriki, Nakkera*	B, M
37	*Cordia wallichii* Don**.**	Cordiaceae	*Pedda nakkera,*	A, FL
38	*Crateva mag**n**a* (Lour.) DC.	Capparidaceae	*Ulimidi, Usika maanu*	A, FL
39	*Dalbergia latifolia* Roxb.	Fabaceae	*Jitregu, Pachairugudu*	B, M
40	*Dalbergia paniculata* Roxb.	Fabaceae	*Pachari, Jettigu*	B, M
41	*Delonix **e**lata* **(L.)** Gamble	Caesalpiniaceae	*Tellaturayi*	A, FL
42	*Desmodium oojeinense* **(Roxb.)** Ohashi	Fabaceae	*Vandanamu, Darugu*	B, M
43	*Diospyros melanoxylon* Roxb.	Ebenaceae	*Thuniki, Tendu*	B, M
44	*Dolichandrone falcata* **(Wall. ex. DC.)**Seem.	Bignoniaceae	*Neeti voddi*	A, FL
45	*Eriolaena hookeriana* Wight & Arn.	Sterculiaceae	*Naara bothuki*	B, M
46	*Erythrina variegata* L.	Fabaceae	*Baaditha*	A, FL
47	*Ficus amplissima* Sm.	Moraceae	*Konda juvvi*	B, M
48	*Ficus arnottiana* Miq.	Moraceae	*Konda raavi*	B, M
49	*Ficus benghalensis* L.	Moraceae	*Marri*	B, M
50	*Ficus mollis* Vahl.	Moraceae	*Kaali juvvi*	B, M
51	*Ficus racemosa* L.	Moraceae	*Medi*	A, FL
52	*Ficus religiosa* L.	Moraceae	*Raavi*	A, FL

53	*Ficus virens* Aiton	Moraceae	*Juvvi*	B, M
54	*Firmiana colorata* (Roxb.) R.Br.	Sterculiaceae	*Karaka*	B, M
55	*Garuga pinnata* Roxb.	Burseraceae	*Garugu*	B, M
56	*Givotia moluccana* (L.) Sreem.	Euphorbiaceae	*Poliki, Konda poliki*	B, M
57	*Gmelina arborea* Roxb.	Verbenaceae	*Gummadi teku*	B, M
58	*Grewia tiliifolia* Vahl.	Tiliaceae	*Thada*	A, FL
59	*Gyrocarpus americanus* Jacq.	Hernandiaceae	*Kommari poliki*	B, M
60	*Haldinia cordifolia* (J.D.Jacks.) Ridsdale	Rutaceae	*Pasupu ganapa, bandari*	B, M
61	*Hardwickia binata* Roxb.	Caesalpiniaceae	*Narayepi, Ippa*	A, FL
62	*Hibiscus tiliaceus* L.	Malvaceae	*Neeru patti*	A, FL
63	*Holarrhena pubescens* (Buch.-Ham.) Wall. ex G.Don	Apocynaceae	*Kodise, Ankudu*	A, FL
64	*Holoptelea integrifolia* **(Roxb.)** Planch.	Ulmaceae	*Nemali naara*	A, FL
65	*Hymenodictyon orixense* (Roxb.) Mabb.	Rubiaceae	*Chedippa*	B, M
66	*Ixora pavetta* Andrews	Rubiaceae	*Palaponna*	B, M
67	*Lagerstroemia parviflora* Roxb.	Lythraceae	*Chennangi*	A, FL
68	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	*Voddi*	B, M
69	*Limonia acidissima* L.	Rutaceae	*Velaga*	A, FL
70	*Madhuca latifolia* Macbr.	Sapotaceae	*Chinnaku vippa*	B, M
71	*Madhuca longifolia* (**f.Koeng.)**Macbride	Sapotaceae	*Vippa*	B, M
72	*Manilkara hexandra* (Roxb.) Dubard	Sapotaceae	*Paala*	B, M
73	*Melia az**edi**a**rch* L.	Meliaceae	*Thuraka vepa*	A, FL
74	*Melia dubia* Cav.	Meliaceae	*Malabaaru vepa*	A, FL
75	*Mitragyna parviflora* **(Roxb.)** Korth.	Rubiaceae	*Batta ganapa*	B, M
76	*Morinda citrifolia* L.	Rubiaceae	*Thogaru*	B, M
77	*Morinda pubescens* Sm.	Rubiaceae	*Thogaru maddi*	B, M
78	*Nyctanthes arbor-tristis* L.	Nyctanthaceae	*Paarijathamu*	A, FL
79	*Phyllanthus emblica* L.	Euphorbiaceae	*Usiri*	A, FL
80	*Pithecelobium dulce* (Roxb.) Benth.	Euphorbiaceae	*Seema chintha*	A, FL
81	*Pongamia pinnata* **(L.)** Pierre**.**	Fabaceae	*Kaanuga*	A, FL
82	*Premna mollissima* Roth	Lamiaceae	*Nelli kura*	A, FL
83	*Prosopis cineraria* (L.) Druce	Mimosaceae	*Jammi chettu*	B, M
84	*Pterocarpus marsupium* Roxb.	Fabaceae	*Vegisa*	B, M
85	*Putranjiva roxburghii* Wall.	Putranjivaceae	*Tella poliki*	A, FL
86	*Radermachera xylocarpa* **(Roxb.)** Schum.	Bignoniaceae	*Naaguru,*	A, FL
87	*Rhus mysorensis* Don**.**	Anacardiaceae	*Seeha sundari*	B, M
88	*Sapindus trifolia**tus*** L.	Sapindaceae	*Kunkudu*	B, M
89	*Semecarpus anacardium* L.f.	Anacardiaceae	*Nalla Jeedi*	B, M
90	*Soymida febrifuga* **(Roxb.)** Juss.	Meliaceae	*Somida*	B, M
91	*Sterculia **foetida*** **L**.	Sterculiaceae	*Jangli Baadam*	A, FL
92	*Sterculia urens* Roxb.	Sterculiaceae	*Tapsi*	B, M
93	*Streblus asper* Lour.	Moraceae	*Barreknka*	B, M
94	*Strychnox nux-vomica* L.	Loganiaceae	*Visha mushti*	B, M
95	*Strychnox potatorum* L.f.	Loganiaceae	*Chilla ginja*	B, M
96	*Tamarindus indica* L.	Rubiaceae	*Chintha*	A, FL
97	*Tectona grandis* L.f.	Verbenaceae	*Teku*	B, M
98	*Teminalia tomentosa* (Roxb. ex DC.) Wight & Arn.	Combretaceae	*Nalla maddi*	A, FL
99	*Terminalia arjuna* Roxb. ex DC.	Combretaceae	*Thella maddi*	A, FL
100	*Term**i**nalia bellirica* (Gaertn.) Roxb.	Combretaceae	*Thaani*	A, FL
101	*Thespe**s**ia populn**ea*** **(L.)Soland ex. Correa.**	Malvaceae	*Ganga raavi*	A, FL
102	*Trema orientalis* **(L.)** Blume	Ulmaceae	*Boggu chettu*	A, FL
103	*Walsura trifol**i**ata* **(Juss.)**Harms	Meliaceae	*Vaalsuri*	A, FL
104	*Wrightia tinctoria* **(Roxb.)** R.Br.	Apocynaceae	*Paala kodisa*	B, M

A=Avenue; B=Block plantation; FL=Flowering; FR=Fruiting; M=Medicinal; S=Shade

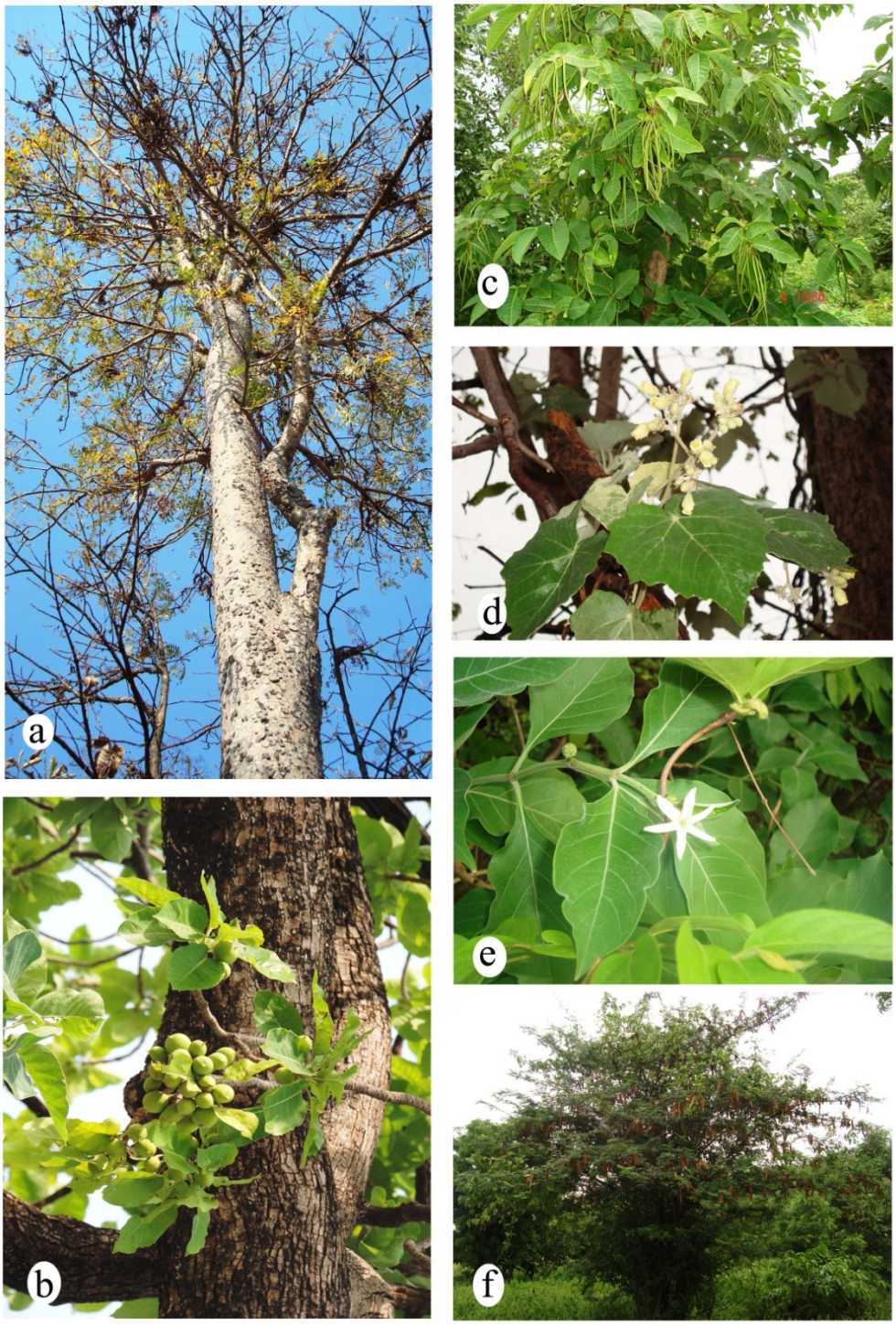

Fig. 2 : Indigenous tree species; a. *Lannea coromandelica*; b. *Madhuca longifolia*; c. *Holarrhena pubescens*; d. *Givotia moluccana*; e. *Morinda pubescens*; f. *Albizia amara*.

Shade giving trees

Alstonia scholaris, Artocarpus heterophyllus, Barringtonia acutangula, Dalbergia sissoo, Ficus benghalensis, Ficus elastica, Ficus microcarpa, Ficus virens, Madhuca longifolia, Mangifera indica, Manilkara hexandra, Sapindus emarginatus, Schleichera oleosa, Sterculia foetida, Swietenia mahogani, Syzygium cumuni.

Wind resistant tree

Acacia nilotica, Azardichta indica, Casuarina equisetifolia, Polyalthia longifolia, Tamarindus indica, Terminalia catappa, Ziziphs mauritiana.

Colourful Trees

Albizia lebeck, Bauhinia purpurea, Bombax ceiba, Butea monosperma, Cassia fistula, Cochlospermum religiousm, Erythrina variegata, Nycanthus arbor-trisits, Senna surattensis

Bird attracting trees

Bauhinia purpurea, Bombax ceiba, Butea monosperma, Erythrina variegata, Ficus benghalensis, Schrebera swietenioides

Fragrant trees

Alangium salvifolum, Albizia lebeck, Alstonia scholaris, Barringtonia acutangula, Bauhinia purpurea, Calophyllum inophyllum, Cananga odorata, Crateva magna, Dolichandron falcata, Gardenia latifolia, Gardenia resinifera, Madhuca indica, Magnolia champaca, Millingtonia hortensis, Mimusops elengi, Morinda pubescens, Murraya paniculata, Nycanthus arbor-trisits, Plumeria rubra, Saraca asoca, Schrebera swietenioides

Biofencing trees

Vitex trifolia, Tectona grandis, Gmelina aroborea, Morinda tinctorea, Acacia catechu, Acacia nilotica, Balanites roxburghii, Caesalpinia pulcherrima, Catunaregam spinosa, Ziziphus mauritiana

Wild ornamental trees

Anthocephalus chinensis, Bauhinia variegata, Butea monosperma, Cochlospermum religiosum, Careya arborea, Dillenia indica, Gardenia latifolia, Gmelia arborea, Helicteres isora, Holarrhena pubescens, Mallotus philippensis, Memecylon umbellatum, Naringi crenulata, Ochna obtusata, Tamilnadia uliginosa, Wrightea tinctoria.

Avenue Plantation

To enhance the aesthetic beauty and to improve the greenery in the area large scale avenue plantations are taken up along national highways, state highways, roads which are maintained under the Department of Road and Buildings and Panchayat Raj and Municipal roads in one to three rows on either side of the road depending on the availability of the road margin. So many indigenous tree species are recomended for avenue plantation i.e., *Alstonia scholaris, Dalbergia sissoo, Ficus benghalensis, Ficus religiosa, Manilkara hexandra, Melia azedirach, Mimusops elengi, Pongamia pinnata, Sapindus emarginatus, Schleichera oleosa, Sterculia foetida, Swietenia mahogani, Syzygium cumuni* etc.

Urban Parks

Existing Forest blocks adjacent to major cities and towns are being developed into urban parks which are acting as urban lung spaces for the local people. Urban parks act as green lungs of the neighbouring cities and towns inorder to improve the air quality by puming the oxygen into air. Native plants along with limited use of exotic tree species are suggested without altering the existing terrestial forest ecosystem.

Seed Balls

During this year the concept of seed bombing has been introduced under Telangana *ku Haritha Haram* to take up greenery on slopes, hillocks and remote areas. Seed balls are prepared with earth, manure and other nutrients. Seeds belong to trees of Legumincaeous group are very suitable for preparation of seed balls i.e., *Albizia amara, Butea monosperma, Bauhinia purpurea, Bauhinia racemosa, Cassia fistula, Pongamia pinnata, Tamarindus indica* etc.

DISCUSSION

Though exotic trees can reduce pressure on native forests by providing timber (*Eucalyptus* spp.), fodder (*Leucaena leucocephala*), firewood (*Prosopis juliflora*) etc., thier impact on natural ecosystems are detrimental. Exotic trees are preferred in plantation programmes for their attributing characters like fast growing ness, adaptability etc. The impact of invasive species on native species, communities and ecosystems have been recognised for decades and invasive species are now viewd as a signficant component of global change (Elton 1958, Lodge, 1993a, b, Simberloff 1996 and Vitousek et al 1996). Exotic plants have been introduced deliberately as forage, fiber, medicines and ornamentals for erosion centres and for timber planations (Baker 1974, 1986). Ecological interactions between native and invasive species may be direct like predation, herbivory, parasitism, competition, mutualism or indirect like habit alteration, apparent predation, cascading trophic interactions and result in changes in the population biology (births, deaths, migration) of the native species. As a consequence, rapid evolutionary changes also may occur in the native species in response to the invading species. In the long run exotic species may replace the natives and ultimately result in extinction of the native species (Levin *et al*., 1996; Rhymer and Simberloff 1996; Lonsdale, 1999). Invasive plant reports from mostly from herabceous plants, further research is prioritized on naturalized, exotic, introduced tree species (Murthy 2007; Murthy, 2017; Sateesh *et al*., 2016). Various studies reported the impacts of invasive species on native species and community structure (Gordon, 1988; Parker *et al*., 1999; Sala *et al*., 2000; Stein *et al.,* 2000; Williamson, 1996; Wilcove *et al*., 1998).

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. Some tree species have peculiar habits that make them unsuitable if planted in speciefic locations. Afforestaion of forest by using indigenous species is ideal practice in forestry. Mostly the indigenous species are favourable 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 (Dhanya *et al*., 2014).

Besides failing to monitor or nurture the large numbers planted exotics, such tree planting can cause more harm than good. Across India, tree planting efforts suffer from five main problems like planting trees in the wrong places, planting the wrong species an species mix, planting too few species, failing to consder seed provenance, and planting without considering the rights of local people and without consulting the experts in Botany, Forestry, Ecology and Agriculture (Shankar Raman 2021a). For example, Seeds of most Ficus species get propagated and germinated through bird droppings. Ficus species are therefore not suitable for planting in the vicinty of buildings. Such trees hence should not be planted close to busy roads. It is necessary to understand the primary botanical data of a tree before going to plantation viz. a specific style of growth for its roots, trunks, canopy and nativity etc.. It is was an attempt of first of its kind to find out important indigenous trees where they can use to fill the fragmented forest gaps for protecting remaining forests as a priority. Ecological restoration of respective ecosystems like grassland, desert, savanna, or rainforest is preferable to invite their own native

species only. Ignoring of these facts, Urban Local Bodies are busy involved in massive planting of exotic trees which is eventually becoming death knell to urban ecosytems. Miyawaki forests are now becoming a trend in urban areas which hosts full of exotic trees. These forests are mainly located in urban areas purely developed based on methods improved by Japanese Botanist Akira Miyawaki with densely packed planted trees which are renamed as Pattana Prakrithi Vanams in urban areas and Palle Pakrithi Vanams in rural areas in Telugu by the authorities of Telangana where indigenous species are recommended on exotics.

Restoration of existing forests

Ecological restoration of existing natural forests involves the planting of the native plant species by following proper scientific methodology. In most of the cases, plantation programmes are tend to prefer the attractive exotic tree species owing to its fast growing character and adaptations. When observed, a good number exotic tree species are planted in Telangana's Haritha Haram without proper study of their impact on natural vegetation and ecosystems. Telangana has a diverse range of natural ecosytem including grasslands, tree savannas, dry thorn forests and deciduous forests, with hundreds of native plant species, from grasses and shrubs to trees. Several exotic tree species such as *Tecoma stans, Marchamia platycalyx , Spathodea campanulata, Casuarina equisetifolia, Conocarpus erectus, Delonix regia, Peltophorum pterocarpum, Parkia biglandulosa, Tabebuia argentea, Tabebuia rosea* etc. are rigorously planted. Though they are very attractive and fast growing species, but their negative impacts on ecosystem is very enormous. It is observed that these exotic trees are not suitable to Telangana. Numerous studies have summarised the impacts of invasive species on native species and community structure (Gordon 1988, Parker et al 1999, Sala et al 2000, Stein et al 2000, Williamson 1996, Wilcove et al 1998). Few of these species are not only inappropriate to Telangana, some are downright harmful as observed in Conocorpus erectus (Shamukh 2020). Yet, millions of saplings are being planted and millions of seed balls tossed around of whether the right species are being planted or even whether trees should be planted in that ecosytem at all. Tree planting in open natural ecosystems can also affect local hydrology and reduce water availability. One study estimates that about 6,452 sq. km or half the open natural ecosystems in Telangana could suffer from inappropriate tree planting. Across India, 51% of open natural ecosystems are similarly threatened (Shankar Raman 2021b). Informaiton to put use in screening of potential plant introduction is highly required (Richardson and Hamilton 1997, Richardson et al 2000). A proper scientifc strategy is need of the hour where indigenous trees are prioritized to restore and enhance the natural forest cover of the state.

Importnace of Indian traditional/ religious plantations/ Vanams

Since ancient times, in India, There is an existing practice of planting and maintenance of native tree species with traditional and religious importance to offer rituals in the name of respective dieties in sacred places and temple compounds, hill shrines, piligrimages etc. Each and every planted tree species are assigned a diety to offer rituals inorder to please the respective god. So that Indians have an in-built traditional practices to protect the religious indigenous tree species (Anonymous, 1992). There are various names attributed based on the compositon of the tree species like, Raasi Vanam, Nakshatra Vanam, Shiva Panchayata Vanam, Ashoka Vanam, Saptharshi Vanam, Nava graha Vanam, Nandana Vanam, Santhana Vanam etc. Hence, It is adviced to the respective government organisations to encourage the traditional/ religious plantations inorder to encourage awareness on tree protection.

Aided Natural Regeneration (ANR)

Predominantly, Most of the forested areas in Telangana state are in degraded conditions. So that, it is planned to improve quality and density of the forest, treatment to degraded forests under Aided Natural Regeneration. Soil and Moisture Conservation works are taken up to improve the moisture in the forest area which will help in rejuvenation of the viable root stock. To take up ANR indigenous tree species are highly preferred to improve the natural vegetation cover.

Importance of Tamarind grooves

There is prevailing negligence in maintenance of Tamarind groves which are surviving since many years in court yards, tankbunds, temple compounds etc. Rigorous felling of Tamarind trees is found in rural areas attirbuting to various reasons which leads to unavailability of Tamarind pods in villages, contributing to soaring prices in the open markets of both urban and rural areas (Murthy, 2017). Keeping inview of situation, planting new saplings and management of existing Tamarind groves should be encouraged not only to meet the needs of rural market but also to maintain the rural ecosystem as well.

Limited and wise use of exotics

Exotic trees have the potential to take intensive pressure and can mitigate the timber demand of huge population. From various studies 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. But the indigenous species has better resistance to disease and pest as compared to the exotic. The exotic 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, not provide shelter to birds, use of excess water and effect on soil and invasive nature (Sonia Panigrahi, 2020). These risks can be reduced by taking some precautions before introduction of an exotic species. Introducing material through proper evaluation before mass plantation, keeping wide genetic base, etc must be taken into consideration at the time of selection. (Almeilla and Freitas, 2001; Kumari and Choudhary, 2016; Lovich Jeff, 2003; Richardson and Higgins 1998). Limited use of exotic tree species are recommended because they may not suitable in a new ecosytem which may cause lesser or more damage to the existing infrasture. A study proved that exotic *Conocorpus erectus* has damaged the infrastructure faciltieis in Iraq (Shamukh *et al*., 2020). Keeping in mind the damage done by exotic tree species, wise and limited use is advised particularly in urban ecosytems. *Conocorpus erectus* trees are replaced with the suitable indigenous tree species like Mimusops elengi etc (Figure 1). If desired, exotic tree species are meticulously planted after careful guidance taken from the Botanists, Agriculture and Forestry experts.

Otherwise It will have long lasting impact on the ecosystem.

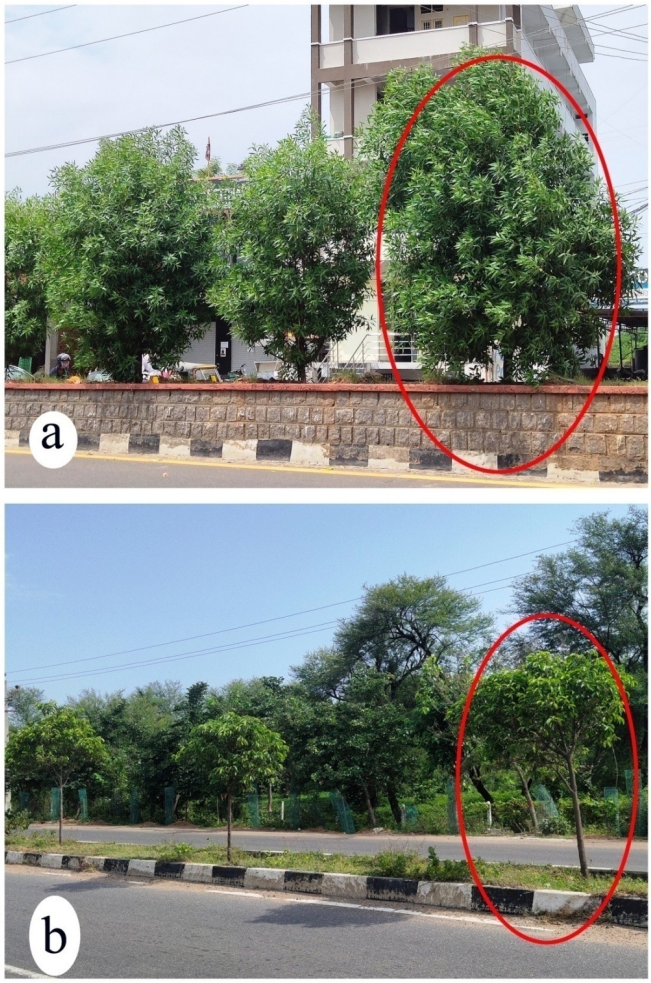

Fig. 1. a) Conocorpus erectus b) Mimusops elengi (Conocorpus can be substituted with native tree species like Mimusoops elengi at median of the roads in urban areas

CONCLUSION

Introduction and naturalization of exotic tree species can cause the imbalance of the existing ecosystem. So that, indigenous tree species are widely used in plantation programmes and restoration of natural forest vegetations. An effort has been made to suggest the indigenous tree species suitable for "Telangana *Ku Haritha Haaram* (TKHH)". Further, research studies to findout suitable indigenous species and impact of exotic tree species are required in improving the forest cover in Telangana state. Administrative people need 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. Active participation of Researchers and Academicians from Botany, Forestry and Ecology belong to various Botany departments of respective Universities, Botanical institutes, forest personnel and scientists of agriculture etc. is need of the hour for proper implementation of this massive plantation programme and to achieve the set goals. Further research on Ecology, Genetics, Evolutionary Biology of invasive species may eventually provide the practical information that will be essential for preventing the homogenization of the existing natural vegetation.

Acknowledgement

We thank the Head, Department of Botany, Satavahana University for facilities. We are grateful to to the Department of Forest, Government of Telangana for their help in field work. We also thank the Urban Local Bodies of Telangana Government for their cooperation during our interaction about massive plantation programme.

REFERENCES

Aarif Ali Gattoo (2013). An Overview of Exotic Forestry in India. Annals of Agri Bio Research 18(1):55-61.

Almeilla, I. D. and H. Freitas (2001). The exotic and invasive flora of Portugal. *Bot. Complutensis*, 25: 317-327.

Ann K. Sakai, Fred W. Allendorf, Jodie S. Holt, David M. Lodge, Jane Molofsky, Kimberly A. With, Syndallas Baughman, Robert J. Cabin, Joel E. Cohen, Norman C. Ellstrand, David E. McCauley, Pamela O'Neil, Ingrid M. Parker, John N. Thompson, and Stephen G. Weller, (2001) The Population Biology of Invasive Species. *Ann. Rev. of Ecol. and Syst.* 32:1, 305-332

Anonymous (2021). http://www.telanganakuharithaharam.in. accessed on 25/07/2021

Anonymous (1992). Sacred plants. Tirumala Tirupati Devasthanams Press, Tirupati.India

Baker HG. (1965). Characteristics and modes of origin of weeds. In *The Genetics of Colonizing Species* , ed. HG Baker, GL Stebbins, pp.147–69. New York: Academic.

Baker HG. (1974). The evolution of weeds. *Annu. Rev. Ecol. Syst.*5:1–24

Baker HG. (1986). *Patterns of plant invasion in North America*. See Mooney & Drake 1986, pp. 44–57

Brandis, D. (1906) "*Indian Trees*," Archibald Constable 7 Co. Ltd., London,

Dhanya, B. B.N. Sathish, Syam Viswanath & Seema Purushothaman (2014) Ecosystem services of native trees: experiences from two traditional agroforestry systems in Karnataka, Southern India, *International Journal of Biodiversity Science, Ecosystem Services & Management,* 10:2, 101-111

Elton CS. (1958). *The Ecology of Invasions by Animals and Plants*. London: Methuen. 181 pp.

Gordon DR. (1998). Effects of invasive, non-indigenous plant species on ecosystem pro-cesses: lessons from Florida. *Ecol. Appl.* 8:975–89

Khan, M.S. (1953). *Forest Flora of Hyderabad State*, being the revised and enlarged edition for Patridge's Forest Flora of Hyderabad. Government Press, Hyderabad.

Kumari P & Choudhary AK (2016) Exotic species invasion threats to forests: A case study from the Betla national park, Palamu, Jharkhand, India. *Tropical Plant Research* 3(3): 592–599.

Levin DA, Francisco-Ortega J, Jansen RK. (1996). Hybridization and the extinction of rare plant species. *Conserv. Biol.* 10:10–16

Lodge DM. (1993a). Biological invasions: les-sons for ecology. *Trends Ecol. Evol.* 8:133–37

Lodge DM. (1993b). Species invasions and deletions: community effects and responses to

climate and habitat change. In *Biotic Interactions and Global Change*, ed. PM Karieva, JG Kingsolver, RB Huey, pp. 367–87. Sunderland, MA: Sinauer. 559 pp.

Lonsdale WM. (1999). Global patterns of plant invasions and the concept of invasibility. *Ecology* 80:1522–36

Lovich Jeff. (2003.) The Ecological impacts of invasive exotic species. Western Ecological Research Center. U.S. Geological Survey, Muhammad R, Chaudhry Muhammad Faisal', Waqar Ahmed"; Chaudhry Abdul

Rashid', Abdul Rahim and Zahid Ali1 (2004) choice of exotic and indigenous tree species for planting on farmlands. *Pak. J Agri. Sci,* 41(1-2):58-60.

Murthy, E.N. Reddy C.S. and Raju V.S. (2007) Occurrence of Exotic *Hyptis suaveolens*: *Current Science* 93(9): 1203.

Murthy, E.N., Reddy C.S. and Raju V.S. (2009). Assessment of impact of Hyptis suaveolens in the Protected Areas of Southern India. Book of Abstracts. *World Conference on Biological Invasions and Ecosystem Functioning*. Porto, Portugal, 27–30 October, 2009, 134pp

Murthy, E.N. (2017). Atavi Vistheernam Haritha Lakshyam. Eenadu. dated 23/12/2017.

Parker IM, Simberloff D, Lonsdale WM,Goodell K, Wonham M, et al. (1999). Impact: toward a framework for understanding the ecological effects of invaders. *Biol. Invasions*1:3–19

Patridge, (1911). *Forest Flora of H.E.H. The Nizam's Dominions, Hyderabad*. Deccan, Hyderabad.

Prasanna, P.V., Chndramohanareddy, N., Ramana, M.V. and Venu, P. (2012). *Trees of Hyderabad – a pictorial guide,* Botanical Survey of India, Kolkatta, India.

Pullaiah T. (1999). *Trees of Andhra Pradesh*, Regency Publications. New Delhi.

Rao, K.S. (1986). Enumeration and Assessment of University of Hyderabad campus plant resources (M.Phil. dissertation (in. edu.) University of Hyderabad.

Rao, K.S. (2012). Flora of University of Hyderabad. (online version).http://ks-lab.in/uhflora/.accessed on 20/02/2021.

Reddy, C.S, Bhanja, M.R., Rao, P.S. and Raju, V.S. (2000). A Contribution to the Tree flora of Hyderabad, Andhra Pradesh, India. *Higher Plants of Indian Sub-Continent* Vol. IX: 33-48.

Reddy, C. S. (2008) "Catalogue of Invasive Alien Flora of India," *Life Science Journal*, 5(2): 84-89.

Reddy, C.S. & Reddy, K.N. (2016). Flora of Telangana State, India. Bishen Singh Mahendra Pal Singh, Dehradun.

Reichard SH, Hamilton CW. (1997). Predicting invasions of woody plants introduced into North America. *Conserv. Biol*. 11:193–203

Rhymer JM, Simberloff D. (1996). Extinction byhybridization and introgression. *Annu. Rev. Ecol. Syst.*27:83–109

Richardson D.M, Higgins S.I. (1998). Pines as invasion in the Southern hemisphere. In: Richardson DM (ed) *Ecology and biogeography of Pinus*. Cambridge: Cambridge University Press,

Richardson DM, Allsopp N, D'Antonio CM,Milton SJ, Rejmanek M. (2000). Plant invasions: the role of mutualisms. *Biol. Rev.*75:65–93

Sala OE. (1999).Global change, biodiversity and ecological complexity. In: Walker B, Steffen WL, Canadell J & Ingram JSI (eds) *The Terrestrial Biosphere and Global Change: Implications for Natural and Managed Ecosystems*.

Cambridge University Press, Cambridge, UK. Sala OE, Chapin FS III, Armesto JJ, Berlow E, Bloomfield J, et al. (2000). Global biodiversity scenarios for the year 2100. *Science*. 287:1770–74

Sangha K, Jalota RK. (2005). Value of Ecological Services of Exotic Eucalyptus tereticornis and Native Dalbergia sissoo Tree Plantations of North-Western India. *Conservation and Society.* 3(1):92-109.

Sateesh S., Ramesh K., Ragan A. and Raju V.S. (2016) Incidence of alien Asteraceae in Telangana and residual Andhra Pradesh and possible ecological implications. Curr. Sci. 110(7) 1337-1343.

Sayeeduddin, M. (1935-36). Some of the common flowering plants of the Hyderabad State: their distribution economic and medicinal importance. *J. Asiat. Soc. Bengal Soc*. 1: 9-22; 2: 73-94.

Sayeeduddin, M. (1938). A further contribution so some of the common flowering plants of the Hyderabad State; their distribution and economic importance. *J. Bombay Nat. Hist. Soc*. 40: 190-212.

Sayeeduddin, M. (1941). Additions to our knowledge of the flowering plants of H.E.H. The Nizam's Dominions, Hyderabad, Deccan. *J. Bombay Nat. Hist. Soc.* 42: 903-924.

Sayeeduddin, M. (1954). *A brief sketch of the flora of Hyderabad, Deccan*. Souvenir, 41st Session, Indian Science Congress, Hyderabad.

Shamukh A., F., Ghailan, S., A., Mohsen, D., M., (2020) Effect of *Conocarpus erecturs* on the infrastructure of Misan Province, Iraq. Plant Archives 20:(2) 1224-1227.

Shankar Raman, T.R. (2021a). The right shade of green. The Hindu. 08-08-2021

Shankar Raman T. R., Chayant Gonsalves, Jeganathan, P Divya Mudappa (2021b). Native shade trees aid bird conservation in tea plantations in southern India. Curr. Sci. 121:2, 294-305.

Shrikant Ingalhalikar & Sharvari Barve (2010). Trees of Pune. Corolla Publiations, Pune.

Simberloff D. (1996). Impacts of introduced species in the United States. Consequences: *Nat. Implic. Environ. Change*. 2:13–22.

Sonia Panigrahi (2020) Exotic tree species in India: Problems and prospects. *International Journal of Botany Studies*, 5: (3) 417-421.

Stein B, Kutner L. S, Adams JS. (2000). *Precious Heritage: The Status of Biodiversity in the United States.* Oxford: Oxford Univ. Press.399 pp.

United States Environmental Protection Agency, (2003). Exotic. http://en.wikipedia.org/wiki/Exotic_species. (Accessed on 25/08/2021).

Vitousek PM, D'Antonio CM, Loope LL,Westbrooks R. (1996). Biological invasions as global environmental change. *Am. Sci*.84:218–28

Wilcove DS, Rothstein D, Dubow J, Phillips A, Losos E. (1998). Quantifying threats to imperilled species in the United States. *BioScience* . 48:607–15

Williamson M. (1996). *Biological Invasions.* New York: Chapman & Hall. 244 pp.