

Year - 2019

Vol. 6, No. 5

(ISSN 2395 - 468X)

Issue: May 2019

Van Sangyan

A monthly open access e-magazine



Indexed in:



COSMOS
Foundation
(Germany)



International
Inst. of Org. Res.
(Australia)



Tropical Forest Research Institute
(Indian Council of Forestry Research and Education)
Ministry of Environment, Forests and Climate Change (MoEFCC)
PO RFRC, Mandla Road, Jabalpur – 482021, India

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Note to Authors:

We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

by e-mail to vansangyan_tfri@icfre.org

or, through post to

The Editor, Van Sangyan,
Tropical Forest Research Institute,
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The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number. TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve

Photo credit: Dr. N. Roychoudhury and Dr. Rajesh Kumar Mishra, TFRI, Jabalpur (M.P.)

From the Editor's desk



In recent years there is a revival of interest in the traditional system of medicine. Medicinal plants are a major source of biodynamic compounds of therapeutic values! The ethno-medico-botanical study can bring out many efficient drugs for the treatment of many common human diseases.

Rural men and women, especially in poor households, engage in diverse and multiple activities to improve their livelihoods by maximizing income-generating activities, while minimizing vulnerability and risk, and achieving other household objectives (improved health, nutrition and education, etc.). The livelihoods of forest communities depend largely on the renewable goods and services from the natural resources as well as activities that impact the integrity of the forests and disrupt the livelihoods of the dependent communities. As one of the oldest civilizations of the world, India has kaleidoscopic multiethnic society, the forest being an integral part of its rich socio-cultural heritage. Traditionally, the Indian society depended on a large number of plant species for its subsistence and sustenance needs.

Medicinal plants are widely used in non-industrialized societies, mainly because they are readily available and cheaper than modern medicines. The annual global export value of 50,000 to 70,000 types of plants with suspected medicinal properties was estimated to be US\$2.2 billion in 2012, and in 2017, the potential global market for botanical extracts and medicines was estimated at several hundred billion dollars. In many countries, there is little regulation of traditional medicine, but the World Health Organization coordinates a network to encourage safe and rational usage. Medicinal plants face both general threats, such as climate change and habitat destruction, and the specific threat of over-collection to meet market demand.

Medicinal plants are harvested from the wild rather than cultivated, they are subject to both general and specific threats. General threats include climate change and habitat loss to development and agriculture. A specific threat is over-collection to meet rising demand for medicines. A case in point was the pressure on wild populations of the Pacific yew soon after news of taxol's effectiveness became public. The threat from over-collection could be addressed by cultivation of some medicinal plants, or by a system of certification to make wild harvesting sustainable.

*In line with the above this issue of Van Sangyan contains an article on Prospective of lesser known medicinal tree species: *Soymida febrifuga* Roxb. There are other useful articles viz. विलुप्त होती प्राचीन फल प्रजातियाँ (in Hindi), Biofencing – a sustainable boundary in agroforestry, Effect of pruning on yield performance of annual crops under *Azadirachta indica* based agroforestry system, *Pinus gerardiana* Wall.-The Threatened Conifer of Western Himalayas, वनस्पतियों से प्राप्त नशाकारक रसायन (in Hindi), and अतुल्य वन (in Hindi).*

I hope that readers would find maximum information in this issue relevant and valuable to the sustainable management of forests. Van Sangyan welcomes articles, views and queries on various such issues in the field of forest science.

Looking forward to meet you all through forthcoming issues

Dr. R. K. Verma
Scientist 'G' & Chief Editor

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Prospective of lesser known medicinal tree species: *Soymida febrifuga* Roxb.

Madhuri Sukhadiya, C. A. Dholariya, L.K. Behera, D. Nayak, R.P. Gunaga and S.M. Patel

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Introduction

Soymida febrifuga (Roxb.) A. Juss. synonymously known as *Swietenia febrifuga* is a Meliaceae family member, an indigenous medicinal tree. It is a monotypic genus endemic to India (Anon., 1952). *S. febrifuga* commonly known as 'Mamsarhohini or Indian redwood' is a reputed folk medicinal plant (Ananta *et al.*, 2012). It is a lofty deciduous which grows up to 22-25m tall and girth of 2.5-3.0 m (Kirtikar and Basu, 2003). Indian redwood is a huge tree having a tough dark brown bark exfoliating in plates or scales. The compound leaves are crowded at the ends of branches. Leaflets are 3 to 6, elliptic or oblong, elliptic or suborbicular, 4.5-15×4-15 cm, apex obtuse or rounded, glabrous, base unequal, spinulosa when young with small peltate glands; petiole 0-5mm. The greenish white flowers are borne in large clusters. Fruit is a woody capsule. Capsule large, ovoid, woody, reddish purple or blackish brown, ellipsoid, obovoid or oblong, 7.5×5 cm, septifragal. Fruits of the Indian redwood are very common ingredients in imported potpourri. Whole fruits are sold as 'wild lily flowers' while the columellas (central interior columns) are sold as 'lily pods' and segments of the pericarp, or valves are sold as 'lily petals'. Seeds oblong, 4×1.5 cm, compressed. Frequently found in moist deciduous forest. It generally flowers during February to April whereas fruiting

during the period of May to June. The wood is hard and is used for various purposes.

Distribution

It is only confined to India and Sri Lanka (Hooker, 1982), In India, it is distributed in the hilly districts of North Western, Central and Southern India, extending to Southward to Travencore (Hooker, 1982). Occasionally found in mixed deciduous forest on Aravalli hill slopes and its outliers in Rajasthan. It is common in deciduous forests of Maharashtra (Singh and Karthikeyan, 2000). Its distribution also found in other states such as Uttar Pradesh, Bihar, Odisha, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala (Sharma *et al.*, 1993). In Gujarat occasionally seen in the districts of Dangs, Vyara, Rajpipla (South Gujarat), Chhotaudepur, Panchmahals (Central Gujarat) and some part of Saurashtra region (Shah, 1978). It has very wide extent of occurrence with less area of occupancy. Due to non scientific and over extraction of bark the population of old trees has been declining and kept in the status of Near Threatened regional basis in Gujarat (Anon, 2008)

Climate and soil

A plant of dry to moist, mainly lowland areas in the tropics, where it is found at elevations up to 900 meters. It grows best in areas where annual daytime temperatures are within the range of 32 to

40°C, though it can tolerate 10 to 47°C. It prefers a mean annual rainfall of 800 to 1,300mm, tolerating 600 to 1,500 mm, growing in areas with a distinct dry season. Succeed in most well drained soils. Prefers a pH in the range of 5.5 to 6.5 and can sustains pH of 4.5 to 7.8.

Commercial utilization

Generally bark, leaves and woods are utilized in commercial basis. Stem bark contains bitter substances. Lupeol, sitosterol, methyl angolensate, deoxyandirobin whereas quercetin-3-O-L-rhamnoside, 3-O-rutinoside from leaves (Kirtikar and Basu, 1975). Three tetraterpenoids from fruits of *S. febrifuga* epoxyfebrinin B, 14, 15 dihydroepoxyfebrinin B, febrinolide. The bark is acrid; refrigerant, anthelmintic, aphrodisiac, laxative; good for sore throat; removes “vata “ cures “tridosha” fevers, cough, asthma; removes blood impurities; good for ulcers, leprosy, dysentery (Kirtikar and Basu, 1994). The decoction of the bark is useful in rheumatism swellings, arthritis, diarrhea, dysentery and as enemata. Further the bark useful as an anti-cancer remedy, for blood coagulation, wounds, dental diseases, uterine bleeding and haemorrhage. Secondary metabolites such as methyl angolensate isolated from callus of *S. febrifuga* which possess antimicrobial and anticancer properties (Kishore *et al.*, 2010). The bark is also used for tanning, dyeing and for intoxicating fish The leaf has potential antioxidant, astringent and antimicrobial properties. It is also used for anti aging, leucorrhoea and dysmenorrhoea. Timber of Indian Redwood is durable, strong and much valued for building purposes and furniture, wells etc. (Patel, 1971).

Conclusion

The Indian redwood found in the moist deciduous forest of India has a great potential towards medicinal and timber uses. Therefore details study should be carried out for its propagation, commercial plantation techniques, sustainable harvesting methods and value addition

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Photographs of *Soymida febrifuga*



Tree



Leaves



Flowers



Bark



Seeds



Fruits

विलुप्त होती प्राचीन फल प्रजातियाँ

अनिता तोमर, अनुभा श्रीवास्तव तथा सत्येन्द्र देव शुक्ला

सामाजिक वानिकी एवं पारि-पुनर्स्थापन केन्द्र

(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

इलाहाबाद

मानव सभ्यता में जंगली फलों का उपयोग पिछले कुछ समय से फल, औषधि, धार्मिक तथा वैवाहिक उत्सवों आदि में करते रहें हैं। जंगली तथा स्थानीय फलों के पेड़ ग्रामीण इलाकों के विकास में महत्वपूर्ण भूमिका निभा रहे हैं। फल कई देशों की समृद्धि में महत्वपूर्ण भूमिका निभा रहे हैं, जैसे हवाई में अनानास, वेस्ट इंडीज में केले और अमेरिका में सन्तरा। इन देशों की अर्थव्यवस्था फल संस्कृति पर भी निर्भर है। जंगली खाद्य फल ग्रामीण निवासियों के पोषण में महत्वपूर्ण भूमिका निभा सकते हैं। भोजन की कमी के समय में हम इन फलों का उपयोग खाद्य सामग्री के रूप में कर सकते हैं। कई फल प्रजातियाँ ऐसी हैं जो विलुप्त होने के कगार पर हैं जिनका उपयोग हम प्राचीन काल में खाद्य सामग्री के रूप में किया करते थे परन्तु आधुनिक समय में हम खाद्य के रूप में ज्यादा प्रचलित प्रजातियों का ही उपयोग कर रहे हैं, जिसके चलते इन विलुप्त हो रहे फलों की प्रजातियों के रोपण हेतु कोई नर्सरी तकनीक नहीं विकसित की जा रही है। ऐसी ही कुछ विलुप्त हो रही फल प्रजातियों का विवरण दिया जा रहा है।

आमरा (Amra)

वानस्पतिक नाम- स्पांडियस पिनाटा (*Spondias pinnata*)

कुल - एनाकार्डिएसी (*Anacardiaceae*)

आमरा भारतवर्ष के मैदानी भागों में अधिकतर पाया जाता है, आमरा को जंगली आम भी कहा जाता है, उ-प्र- में आमरा प्रायः इलाहाबाद,

मिर्जापुर, सोनभद्र, चन्दौली, प्रतापगढ़ तथा वाराणसी आदि क्षेत्रों में पाया जाता है। इसका आसानी से उत्पादन सम्भव है, इस कारण इसे गरीबों का फल भी कहते हैं।

वानस्पतिक विवरण

आमरा का वृक्ष सदाबहार होता है। इसके पेड़ की ऊँचाई 15- 25 मीटर तक होती है। जड़े लम्बी व मूसलाकार, पत्तियाँ एकान्तर क्रम में वृन्त युक्त तथा साधारण होती हैं, पत्तियों का रंग गहरा हरा लम्बाई 15-20 सेमी तथा चौड़ाई 5-10 सेमी तक होती है। आमरा का पुष्प गुच्छदार शाखादार होता है, जो प्ररोह के उपरी भाग (शीर्ष) से निकलता है। पुष्प मंजरी की लम्बाई 45 सेमी, पीली या हल्की गुलाबी रंग की होती है, आमरा का फल प्रायः अण्डाकार होता है। फल आस्वादित, सुवासित, स्वादिष्ट आकर्षक एवं अच्छे रंग वाले होते हैं।

जलवायु

आमरा नम तथा सूखी दोनों ही प्रकार की जलवायु में पैदा किया जा सकता है। आमरा की अच्छी वृद्धि के लिए तापक्रम का विशेष महत्व है। आमरा के लिए 5-10⁰ न्यूनतम, 42⁰ अधिकतम तापमान की आवश्यकता होती है।

मिट्टी

आमरा का उत्पादन सभी प्रकार की मिट्टियों में किया जाता है। इसका उत्पादन 6.5 - 8.5 पी एच में अच्छा किया जा सकता है, केवल कंकरीली, पथरीली मिट्टी को छोड़कर सभी प्रकार के मिट्टी में उत्पादन किया जा सकता।

प्रवर्धन या प्रसारण

आमरा का प्रवर्धन प्रायः बीजों के द्वारा किया जाता है। आमरा का प्रवर्धन कटिंग तथा एयर लेयरिंग (गूटी) के द्वारा भी किया जाता है। आमरा में गूटी पर रूटेक्स के साथ 65 प्रतिशत तक सफलता प्राप्त की गई है।

रोपण

आमरा के पौधों के क्षेत्र को गहरी जुताई द्वारा तैयार किया जाता है। आमरा के पौधों को लगाने के लिए 90 x 90 x 90 सेमी. आकार के गड्डे की आवश्यकता होती है। इन गड्डों में खाद, बालू तथा मिट्टी का मिश्रण भर देना चाहिये तथा पौधों को वर्षा ऋतु में लगाना चाहिए।

पौधों की रक्षा

आमरा के पौधों को पाले से तथा दीमक आदि से बचाना चाहिए।

फूल आना तथा फल लगना

आमरा में प्रायः फूल फरवरी, मार्च में आता है तथा फल सितम्बर-नवम्बर तक लग जाते हैं।

फलों का उपयोग

आमरा के फलों का उपयोग प्रायः अचार बनाने में किया जाता है।

बड़हल (Barhal)

वानस्पतिक नाम- आर्टोकार्पस लकूचा

(*Artocarpus lakoocha*)

कुल - मोरेसी (Moraceae)

बड़हल प्रायः भारत के ग्रामीण क्षेत्रों में पाया जाने वाला फल है, बड़हल को आजकल नई पीढी कम पसन्द करती है। बड़हल का परिपक्व फल लगभग 150-250 ग्राम तक होता है, इसके पके फलों का रंग पीला होता है, बड़हल का फूल भी पीले रंग का होता है, इसे गाँवों में प्रायः फुलैरी नाम से जाना जाता है। इसके फल का स्वाद हल्का खट्टा-मीठा होता है।

वानस्पतिक विवरण

बड़हल का पेड़ सदाबहारी 9-18 मीटर तक ऊँचा होता है। इसके पेड़ों का जीवन 80 वर्षों तक होता है। पत्तियां मध्यम आकार की होती है, इसके फूल

का रंग पीला तथा आकार गोल होता है जो कि परागण के उपरान्त गिर जाते हैं।

जलवायु तथा मिट्टी

बड़हल के लिए गर्म-तर जलवायु सबसे उपयुक्त होती है। बड़हल के लिए अच्छी जल निकास वाली जलोढ़ मिट्टी की आवश्यकता होती है। इसके लिए 6-8 पीएच की मृदा में अच्छी तरह से उगाया जा सकता है।

प्रसारण

बड़हल को प्रायः बीजों के द्वारा ही उगाया जाता है। इसके बीज फल से निकलने के 10 दिनों तक ही अंकुरित होते हैं, उसके बाद बीजों में अंकुरण नहीं होता है, इसमें कटिंग तथा गूटी 12-15 प्रतिशत तक ही सफल है अतः सबसे अच्छा अंकुरण बीजों द्वारा ही होता है।

रोपण

बड़हल के पौधों को लगाने हेतु 90 x 90 x 90 सेमी. के आकार के गड्डे खोदे जाते हैं। गड्डों के बीच का अन्तराल 9-12 मीटर रखा जाता है। औसतन 10 मीटर रखना उचित रहता है। गड्डों को गोबर की खाद तथा मिट्टी को बराबर मात्रा में मिलाकर भर देना चाहिए। पौधों को वर्षा ऋतु में पहली बारिश होने के बाद लगाना उचित रहता है।

फूल आना तथा फल लगना

बड़हल के पौधों में फूल फरवरी, मार्च में लगता है तथा जून-जुलाई तक फल मिलते हैं।

फलों का उपयोग

कच्चे परिपक्व फलों का उपयोग अचार, सिरके आदि में डालने के लिए किया जाता है। बड़हल के पके फल बड़े ही स्वादिष्ट तथा पौष्टिक होते हैं। बड़हल के कच्चे तथा पके फलों का बाजार में अच्छा दाम मिलता है।

बेर (Ber)

वानस्पतिक नाम- जिजिफस मोरिसियाना

(*Zizyphus mauritiana*)

कुल - रैमिनेसी (Rhamnaceae)

बेर भारत के लगभग सभी भागों में पाई जाती है लेकिन आजकल इसको कम पसंद किया जाता है

इसलिए यह लगभग विलुप्त होने के कगार पर है। इसमें विटामिन ए तथा बी की कुछ मात्रा पाई जाती है। बेर को ताजे रूप में प्रयोग करने के अतिरिक्त सुखाकर जेली, मुरब्बा, चटनी, जैम इत्यादि के रूप में भी प्रयोग किया जाता है।

जलवायु तथा मिट्टी

बेर उष्ण एवं शुष्क जलवायु का फल है जिसको नमी या पानी की कम आवश्यकता होती है। यह विभिन्न प्रकार की जलवायु में पैदा हो सकता है। बेर को समुद्र से 900 मीटर की ऊँचाई पर भी आसानी से उत्पन्न किया जा सकता है। बेर सभी प्रकार की मिट्टियों में पैदा किया जाता है यहां तक की क्षारीय मृदा के प्रति यह अधिक सहिष्णु होता है, बेर की वृद्धि एवं फलन जीवांशपूर्ण दोमट मिट्टी में अच्छी प्रकार से होती है।

प्रसारण

साधारण रूप से बेर को बीज के द्वारा प्रसारित किया जाता है। बेर को गुट्टी द्वारा भी प्रसारित किया जा सकता है।

रोपण

बेर के पेड़ काफी इधर-उधर फैलते हैं अतः इनको अधिक स्थान दिया जाता है। पौधों को 8 X 8 मी. स्थान देकर लगाते हैं।

फूल आना तथा फल लगना

बेर में फूल नये प्ररोहों पर पैदा होते हैं। इसके पेड़ चौथे या पांचवें वर्ष फल देना शुरू कर देते हैं। उत्तर भारत में बेर फरवरी-अप्रैल तक तोड़े जाते हैं। पूर्ण वृद्धि किये हुए पेड़ से 3-4 कुन्तल फल मिलता है।

उपयोग

बेर के सूखे फलों से पेक्टिन निकाल कर जेली, मुरब्बा, चटनी, जैम आदि बनाया जाता है। गाँव में बेर का उपयोग चूर्ण के रूप में प्रचलित है, जो पेट के रोगों में बहुत फायदेमंद है।

फालसा (Phalsa)

वानस्पतिक नाम- गेविया सबिनाइकैलिस

(*Grewia subinaequalis*)

कुल - टीलिएसी (Tiliaceae)

फालसा भारत वर्ष के सभी राज्यों में पाया जाता है। इसका पौधा झाड़ीनुमा, सहिष्णु स्वभाव का होता है। पकने पर फलों का रंग गहरा लाल एवं बैंगनी होता है, फल छोटे-छोटे अम्लीय स्वाद के होते हैं, पकने के बाद फलों को ज्यादा दिन तक नहीं रखा जाता है, फालसा का फल अश्लि होता है, स्वाद मीठा, खट्टास युक्त तथा परागकण काफी बड़े 60-125 माइक्रान तथा इनमें जनन क्षमता अधिक होती है। इसका गूदा खाया जाता है, जो सम्पूर्ण फल का 69 प्रतिशत होता है।

जलवायु तथा मिट्टी

फालसा केवल उत्तरी भारत के ऊँचे पहाड़ी स्थानों को छोड़कर शेष सभी स्थानों पर सफलता पूर्वक पैदा किया जा सकता है। यह गर्म एवं अधिक शुष्क मैदानी भागों में तथा अधिक वर्षा वाले नम स्थान दोनों ही प्रकार की जलवायु में सरलता पूर्वक हो सकता है। फालसा के लिए सभी तरह की मिट्टियाँ उपयुक्त होती हैं। यह ऊसर जमीन में भी अच्छी वृद्धि करता है।

प्रसारण

फालसा का प्रसारण बीज की सहायता से किया जाता है। मई के महीने में स्वस्थ एवं पके फलों से बीजों को निकाल लिया जाता है, बीजों को अधिक समय तक रखने से अंकुरण क्षमता नष्ट हो जाती है। अतः इसको 15-20 दिनों के अंदर में बुवाई कर देनी चाहिए।

रोपण

फालसा को उगाने हेतु गर्मियों में गड्डों 30 x 30 x 30 सेमी. आकार के तैयार किए जाते हैं। गड्डों को गोबर की खाद तथा मिट्टी का मिश्रण बना कर अच्छी तरह से भर देना चाहिए तथा वर्षा के शुरूआत में पौधों को लगा देना चाहिए।

फूल आना तथा फल लगना

फालसा में फूल नई वृद्धि पर पैदा होता है, पौधा लगाने के 3 वर्ष पश्चात यह अच्छी उपज देने लगता है। उत्तर प्रदेश में इसके फल मार्च-मई तक लगते हैं।

उपयोग

फालसा को शुष्क फल के रूप में उपयोग में लाया जाता है, कुछ जगहों पर इसका उपयोग शरबत तथा पेय पदार्थ के रूप में किया जाता है। ग्रामीण इन पेड़ों से दवाइया, भूसा, जलावन लकड़ी, भवन सामग्री आदि के रूप में प्रयोग कर रहे हैं। इन जंगली पेड़ों से ग्रामीण लोगों को औषधियों, तेल, विटामिन और खनिज तत्व पर्याप्त मात्रा में प्राप्त हो जाता है। हमारे अच्छे स्वास्थ्य को लगातार बनाये रखने में ये स्थानीय फल महत्वपूर्ण भूमिका निभा सकते हैं। भारत में ग्रामीण इलाकों में कुपोषण की समस्या आम है

परिणाम स्वरूप बहुत से लोग विशेषकर बच्चे महामारी का शिकार हो रहे हैं। शरीर में पोषक तत्वों की कमी को पूरा करने में ये जंगली फल महत्वपूर्ण भूमिका निभा सकते हैं। सौभाग्य से भारत इस प्रकार के देशी खाद्य पौधों से परिपूर्ण है जो की हमारे स्वास्थ्य को उत्तम रखने में सक्षम हैं। बढ़ती हुई जनसंख्या धनत्व के कारण मनुष्यों ने जंगल को काट कर खेतों को निर्माण किया है जिससे इन जंगली फलों के पेड़ों में कमी आयी है। हम इन जंगली फलों के पौधों का रोपण करके पर्यावरण तथा अपने स्वास्थ्य की रक्षा कर सकते हैं।

Biofencing – a sustainable boundary in agroforestry

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Introduction

Agroforestry is a traditional land use practices practiced with various models and systems. Among several systems live fence/bio fence is a primitive form of agroforestry and remains poorly understood and least documented in India. The migration of nomadic animals also cause serious damages to the existing crop plant and severely affects the productivity of agricultural and allied sectors. In a holistic sense the damage due to domestic and wild animals create huge menace to the farmers to protect their farms and home gardens. This necessitated the establishment of a protective barrier to keep the animals away from the lands and to protect the crop. Establishment of strong physical barrier is one of the options, but the huge cost involved in establishment of physical barrier in large stretches of fragmented land use system detract its viability and feasibility. Hence there is a need to explore alternate forms of protection. Among several alternate forms, the potential of biofencing using trees, shrubs and herbs is very well witnessed both within and outside the country (Mishra *et al.*, 2011; Choudhury *et al.*, 2004; Das *et al.*, 2014). However the significant potential of biofence has not been exploited fully for want of suitable species coupled with the associated management technologies. Against this backdrop, the current chapter has been conceived and presented to benefit the readers towards adaptation of the biofencing concept.

Biofence

A *Living Fence* or a *biofence* is a fence made of living trees and shrubs. Made from thorny or non-thorny plants, it can also be called a green fence, or hedge. Biofences are narrow linear strips of a single or two rows of closely planted species which are raised on farm or field boundaries for the purpose of protection against animals. Apart from protection against animals, biofences provide us many services viz., fuel wood, fodder, green manure, medicine, small timber, fencing poles, it provides shade to the grazing animals and also it acts as wind break and shelter belts and as a whole, it plays an important role in biodiversity conservation. The World Agroforestry Center defined it as 'A way of establishing a boundary by planting a line of trees and/or shrubs the latter usually from large stem cuttings or stumps, at relatively close spacing and by fixing wires to them (Huxley 1997). Biofences are the lines of trees or shrubs planted on farm boundaries or on the borders of home compounds, pastures, fields or animal enclosures (Holst, 1995).

Live fence can be defined as the boundary vegetation, comprising of single or multiple species in some sort of spatial arrangements with or without deliberate earthwork, maintained around a cultivated landscape to provide protection as well as multiple products and services (Choudhury *et al.*, 2004). "Live fences" refers to narrow lines of trees or shrub species planted on farm boundaries or between

pastures, fields, or animal enclosures whose primary purpose is to control the movement of animals or people (Budowski and Russo 1993). Live fences usually are composed of a single row of trees or shrubs that are closely planted at uniform distances and may support barbed wire (Westley 1990), although sometimes they arise from natural regeneration underneath fence lines.

Significance of biofencing

Biofences are very significant due to its productive, protective and ameliorative potentials. The biofence is able to restrict the entry of animals there by help to protect the farm lands against any grazing or browsing. The boundary demarcation is a major threat in fragmented land use system for which the role of biofence to demark the specific farm land is very significant. Apart from their protective role, live fences play an important part in environment management, nutritional balance, employment generation and economic security (Mishra *et al.*, 2011).

Characteristics of biofence crops

Selection of plant species for biofencing depends on the location of the site, climatic condition of the locality, landscape, soil properties etc., Based on this, there are many plants that can be used for biofencing. The desirable characters of biofence crops are ease of propagation preferably through vegetative means, fast-growing, medium height, long-life,

Potential biofence crops

capability to grow under adverse conditions and closer spacing with minimal maintenance and ability to deter animals.

Following are the important characters that a good biofence crop should possess

- The plant or crop chosen for biofencing should be a densely growing type
- The biofence crop should protect the field from entry of animals and human beings
- The crop should provide shade and fodder for the livestock grown inside the farm
- The biofence crop should act as a wind break and shelter belts
- The plant species chosen for biofencing should be resistant to pest and diseases
- The species should enrich the soil nutrient status and prevent the surface runoff
- It should be a dwelling place for the bees and beneficial insects
- It should have multipurpose utility viz., fodder, firewood, medicine, timber, nectar, etc.,
- It should be amenable for lopping and pollarding
- The biofence crop should be amenable for vegetative multiplication

Sl.No	Species	Salient features
1.	<i>Inga dulce</i> (<i>Pithecellobium dulce</i>)	It is a thorny tree amenable for lopping and pollarding. By establishing dense plantation, it can act as excellent barrier against domestic and wild animals. The leaves are excellent fodder and the fruits are edible.
2.	<i>Protium cardatum</i>	It is a non thorny species but is a very dense crop. The species can easily be propagated by cuttings. Generally 1m tall cuttings are collected and planted at a spacing of

		15 cm x 30 cm. Within 2 to 3 months the cuttings starts sprouting and connects with each other and forms dense thickest biomass. This act as an excellent barrier against animals.
3.	<i>Caesalpinia pulcherima</i>	It is a thorny, ornamental and attractive shrub. This species is an excellent biofence crop due to its denseness with thorny stems. The species can easily be propagated by both seeds and cuttings. 60 – 90 cm tall cuttings can be collected and can be directly planted along the boundaries at a spacing of 30 cm. The cuttings sprouts easily and forms a dense thickest in a short period of 3 months and act as an excellent barrier. It also act as an ornamental plant and can be a good biofence crop for domestic and public gardens.
4.	<i>Jatropha curcas</i>	<i>Jatropha curcas</i> is one of the excellent crop for biofence. It is easily propagated through seeds and cuttings. Cuttings of 60 - 90 cm tall can be collected from the existing live hedges and planted directly around the boundaries at a spacing of 30 cm each. The cuttings sprouts rapidly and forms a thick vegetative barrier within 3-6 months. The leaves of are not edible and hence it could act as an excellent barrier. The biofenced <i>Jatropha</i> yields abundant seeds and these seeds could act as a potential resource for biofuel production. It is a good crop for fencing in dry lands. It is also good ornamental crop and can be planted around home gardens, field bunds, public and private gardens.
5.	<i>Lucaena leucocephala</i> (subabul)	<i>Lucaena leucocephala</i> is one of the potential biofence crop. It can easily be propagated by seeds. The seeds after treatment with hot water for 24 hours can directly be sown around the farm land. It germinates very rapidly and forms a good vegetative barrier within 6 months. Only problem with subabul is it is easily browseable. Hence protection of the crop still its establishment as a vegetative barriers is very essential. Hence spraying with cowdung solution till its establishment is essential. It is a good N fixer and hence improve the soil fertility. Once established subabul biofence can act as an excellent fodder supplement to the cattle.
6.	<i>Gliricidia</i>	<i>G. sepium</i> is one of the preferred biofence crops due to its amenability for vegetative multiplication and rapid growth and development. <i>Gliricidia</i> can easily be propagated by cuttings. The cuttings of 30cm – 60 cm size are planted at a spacing of 30 cm. The cuttings

		sprout rapidly and establish in the form of thick vegetative cover. The leaves are excellent fodder to the cattle. It is also an N fixer and improve the soil health. In areas with increased grazing issues, the cuttings of over 1m tall could be planted, which will protect the plants from damage.
7.	<i>Euphorbia tirucalli</i>	It is a succulent plant and could be excellent bio fence crop in dry localities, arid and semi arid regions. It can be a biofence crop for boundary demarcation, as an ornamental fence crop around city parks and gardens. In some of the traditional land use system it can act as excellent life fence crop. It is a very good ornamental plant and act as wind barrier and protect the animal from entry due to the spiny nature. Since it is a succulent crop, the succulent stem can be collected and directly planted as fence crop at a spacing of 30 and 60 cm.
8.	Agave	Agaves are excellent biofence crop for degraded, arid and semi arid localities. The agaves are with leafy blades and spiny tips and act as an excellent barrier for animals. The agaves can easily be propagated by planting bulbs directly on the boundary areas. Agaves are excellent leaf fibre and hence with judicious management, it can act as both fence crop as well as money spinning crop in dry localities.
9.	Bamboos	Bamboos are excellent biofence crops in irrigated farm lands, parks and gardens of the urban and semi urban localities. In areas with grazing problem, B. bamboo which contains thorns can be planted. Bamboos can easily be propagated by rhizomes and for biofence crop the rhizome can be planted at a spacing of 1 to 1.5 m. Bamboos culms form a thick vegetation cover and protect against all domestic animals. It can also act as an ornamental crop, wind break and also for conserving soil and water.
10.	Casuarina	Casuarina are gaining attraction as a biofence crop due to its thick vegetation cover. It can easily be propagated by seeds. The seeds are sown in the mother bed and the germinated seedlings with 5-10 cm tall and pricked out and planted around the boundaries. The naked seedlings are planted at a spacing of 10-15 cm. The seedlings gets establish and grow rapidly. Once it reaches 1.5 m tall, it is possible in 3-6 months. The tip can be looped and maintained as thick hedges which will restrict the entry of goats, sheeps and cow. Casuarina is an excellent N fixer

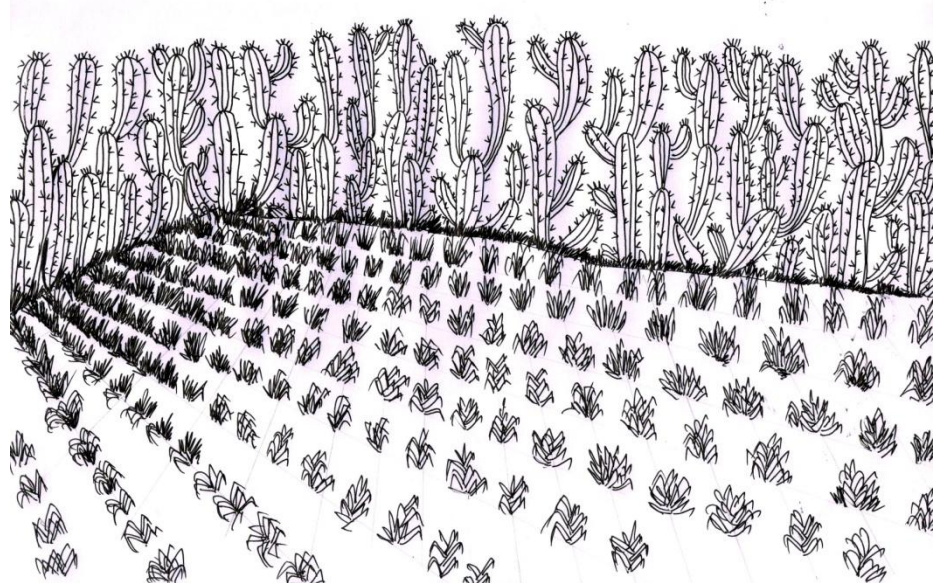
		and hence improves the soil fertility.
11.	<i>Lantana camara</i>	<i>Lantana camara</i> has been grown specifically for use as an ornamental plant. Due to its ability to withstand drought and resistant to pests or diseases, this crop can be grown as biofence crop. <i>Lantana camara</i> also attracts butterflies and birds and so is frequently used in gardens and parks.

Design of biofence for different land use

The practice of fencing around the farm land and home gardens is an age old system but has been practiced less than two per cent of the total land area. The species used for live fencing and the design depends on the crops to be protected, area to be covered, availability of planting material and other factors deciding the establishment of live fencing. Though wide range of trees and shrubs are used in live fence establishment but only 11 species are deployed on larger scale. The design and establishment of live fence depends on the locality and objective. The following four biofence models are generally in practice across farm lands and home gardens which are depicted in the picture 1 to 4.

i) Biofence around field crops

Field crops are more prone to cattle stress passing and cause severe damage to the farmer. Hence species with thorny nature, short stature, organized canopy are preferred. For this purpose single or double or multiple species based biofence hedges can be established around the farm. The species like *Portium cardatum*, Inga dulce, *Lantana camara*, *Acacia meelifera*, *Jatropha*, *optentia* sp. etc., can be planted from 1 to 3 rows at a closer spacing of 0.3 to 0.5 m. these livefence crops are established during rainy season and managed with constant pruning and lopping in order to establish full thickest of and to ensure complete protection against animals.



Biofencing for field crops

ii) Live fence around home gardens

Home garden is a traditional practice in humid tropical region which is practiced in the form of multitier system. The home gardens are housed with trees, shrubs, herbs, grasses, medicinal plant, fruit and

flower plants and hence their protection is very essential. These home gardens are to be protected by establishing both thorny and non thorny species and the model is depicted in the fig.

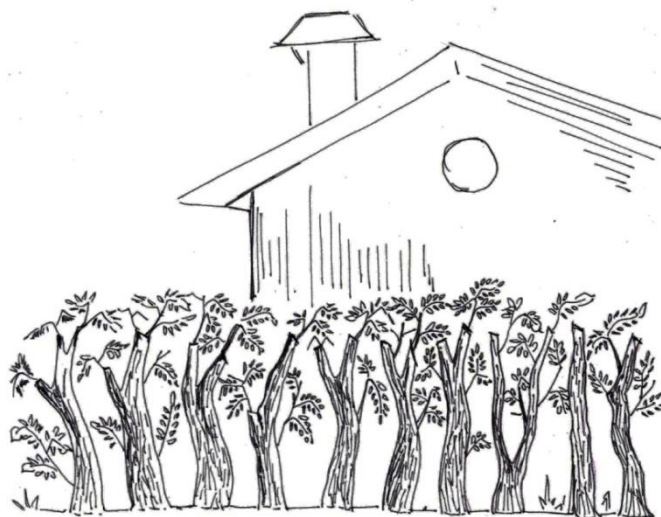


Biofencing for Home Garden / Kitchen Garden

iii) Live fence around Farm house

There is a growing interest on the establishment of farm house particularly in medium and large land holdings. The farm houses are very well protected by establishing live hedges around the farm house. For this purpose, the species with

flowering nature like *Lantana camara*, *Bougainvillea* and thick vegetative cover like *Duranta*, *Inga dulce*, *Casuarina*, *subabul* etc., can be planted. Generally for farm houses the non thorny species are preferred.

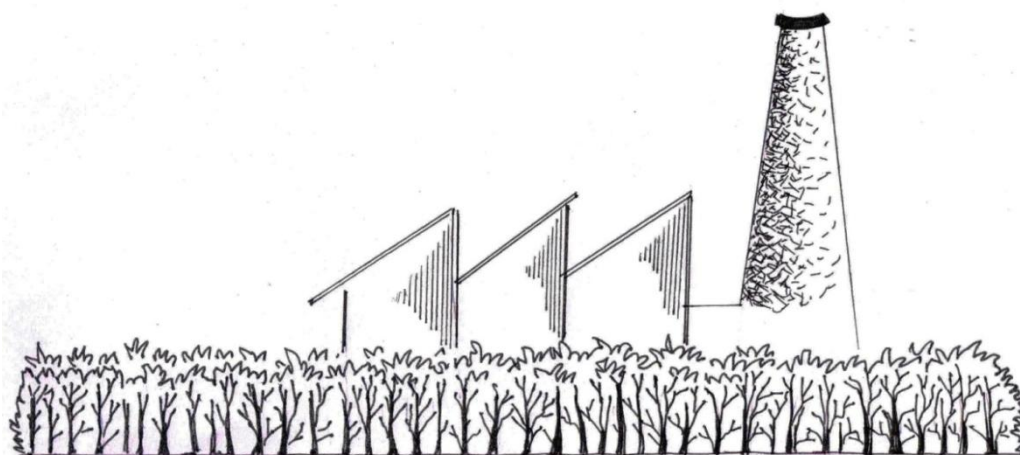


Biofencing for Farm House

iv) Live fence around Industries

Industries are encouraged to develop green belt plantation for the purpose of boundary demarcation and to act as a sink of air and noise pollutants. In this case, the fences are made with tall trees with casuarina, subabul, eucalyptus, teak, neem etc.,

depending on the industry and the purpose of establishment. The fast growing trees with thick foliage are preferred around the industries to act as a fence crop, simultaneously catering the needs of environmental benefits.



Biofencing for Industries

Advantages of biofencing

There are many number of benefits which the farming community can make use of bio fencing. Apart from protection against animals, biofences provide us many services viz., fuel wood, fodder, green manure, medicine, small timber, fencing poles, it provides shade to the grazing animals and also it acts as wind break and shelter belts and as a whole, it plays an important role in biodiversity conservation. Major uses of live fences are support and protection from farm and other animal species; production of poles; fodder production; shade for home; production of firewood; fruits for human and animals; medicinal use and as a leafy vegetable (Jayavanan *et al.*, 2014). Fencing plants attract birds as well as butterflies. Number of insects and ants are also recorded on these plant species.

Fencings can be considered as promising sites to locate the seedlings of species which are dispersed by birds (Gokhale *et al.* 2010; Mahesh V Gokhale, 2015).

Summary and conclusions

Biofences are age old land use practice followed by the people as a source of protective barrier against domestic and wild animals. These biofence acts as a promising tool for sustaining the agriculture across landscape. This biofence is very well suitable for resource poor farmers particularly in arid and semiarid regions. The biofence crop besides acting as a protective barrier extends support to meet all the domestic needs of the practicing farmers. These biofence are also acting as an excellent bio resource for soil fertility improvement, biodiversity conservation, microclimate amelioration, habitat for birds and insects and

moderating the climate change associated risks and uncertainties. Wild range of crops are available as a source of biofence crop but the suitability depends on its mode of propagation, growth and development, protection capacity along with the multiple benefits associated with the species. This chapter has elaborated the biofence types, significance, potential characteristics and most important species amenable for biofence.

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Effect of pruning on yield performance of annual crops under *Azadirachta indica* based agroforestry system

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Abstract

The present study was conducted to assess effect of pruning on yield performance on annual crops (cowpea, black gram and green gram) under the neem based agroforestry system, where the trees are regularly pruned. The results revealed that, the annual crops performed well under the neem based agroforestry system and the yield was 159 kg/ha in cowpea, 304 kg/ha in green-gram and 578 kg/ha in black-gram which is 16.5%, 24.5% and 19.5% higher under the pruned area compared to un-pruned area.

Key words: Agroforestry system, neem, pruning and yield performance.

Introduction

Agroforestry is gaining importance as land use practice in different parts of India with recent emphasis on sustainable agriculture. Tree based land use practices could accompany both tangible and intangible benefits securing the interests of both local and global communities (Puri and Nair, 2004). Agrisilviculture is one among the important system being practiced by the farming communities where the fast growing, multipurpose and indigenous trees, which could compatible with annual crops and provide maximum economic returns in a sustained manner. The productivity of crops under agrisilviculture system will be affected due to competition for light, water

and nutrients between trees and annual crops (Heinemann *et al.*, 1997). A major problem of agrisilviculture system is the competition between annual and perennial crops in which tree adversely effect crop yield of understorey crop. The competition for resources sharing will gradually increase with the expansion of canopy and root systems with their age. Site resources availability in agroforestry systems can be altered through managerial interventions. One of the important silvicultural tool (pruning) that can alter competitive interactions in intercropping systems for maximum production (Nandal *et al.* 1997). The above-ground competition may be avoided by removing some parts or the entire crown of the tree which obviously reduce the competition of tree for light and will facilitate more light to understorey crop. Light is the principal limiting factor for the growth and production of understorey vegetation as the light penetration decreases with the increasing standing density of trees. Pruning of tree component is a powerful approach to regulate the competition. A high response to tree pruning suggested aboveground competition for light dominated tree-crop interactions in agrisilviculture system (Osman *et al.*, 1998). This present study was carried out to study the effect of pruning on agricultural crops

under *Azadirachta indica* (Neem) agroforestry system and the pruning gives around 25% higher yield than compared with un-pruned one. The present study will through light on effect of pruning on yield performance on intercrops under rainfed conditions.

Materials and methods

The present study was conducted in the Narasipuram village of Walayar watershed of Coimbatore district falling under the Western agro-climatic zone of Tamil Nadu situated between 10°50' and 11° North latitudes and 77° and 77°10' East longitudes. The altitude ranges from 160-270 m above MSL. The climate in the study area is dry and hot with frequent occurrence of severe drought. However, from November to February the climate is cool during night and warm during day. The average annual rainfall ranges from 600 to 720 mm, or which the major portion is received during northeast monsoon (October-November). The annual average temperature varies from 23°C to 29°C.

Azadirachta indica commonly known as neem, the miracle tree is a tall evergreen tree with the small bright green leaves. It is a popular village tree. Neem tree can easily be grown in the dry, stony, shallow and clayey soils. It needs very little water and plenty of sunlight. It grows slowly during the first year of planting. It can be propagated through the seeds and cuttings. Young neem tree can not tolerate excessive cold. Neem also holds medicinal value. Each part of neem is used in the medicines. It has been used in Ayurvedic medicines for more than 4000 years. Neem oil extracted from its seeds is used in medicines, pest control and

cosmetics etc. Its leaves are used in the treat Chickenpox. Neem tea is usually taken to reduce the headache and fever. Its flowers are used to cure intestinal problems. Neem bark acts as an analgesic and can cure high fever as of malaria. Even the skin diseases can be cured from the Neem leaves. Indians even believe that the Neem can even purify diseases. In south India its wood is used to make the furniture. Neem cake is widely used in India as fertilizer for sugarcane, vegetable and other cash crops. Many countries have been consistently growing the Neem tree against the global warming. The worldwide Neem Foundation has helped in making the people aware about the importance of neem and its uses globally. One can find Neem in almost all the parts of India. It is said that planting Neem tree in the house is an ensured passage to heaven. Neem based agroforestry model was laid out in Randomized Block Design (RBD) with 8 x 4 m spacing in four replications. Land was ploughed and watering channels were made 8m apart and 45 cm³ pits were dug in the channels at 4 m distance for establishing Neem based model. The density of Neem remained as 312 trees/ha (in the espacement of 8x4 m). The experiment was conducted for a period of 2 years and the age of the Neem is 5 years. To study the effect of pruning on agricultural crop yield, trees of alternative rows were pruned (100%) and the agricultural crops were raised. The pruning has been carried out in the month of June and the intercrops were sown in the same month as well as in the month of October. Being a practice of dry land farming, no fertilizers were applied to the agricultural components. For intercropping

activities, annuals like cowpea (CO-6), greengram (CO-4) and blackgram (VBN-4) were used under neem based agroforestry system.

The agricultural crops of cowpea, greengram and blackgram were raised in between the rows of pruned and un-pruned neem plot. At the time of harvesting, 1m² block were marked randomly in 6 places and the yield was recorded for the above three crops. The yield data were statistically analysed and the results were presented (Panse and Sukhatme, 1985).

Results and discussion

The data on grain and fodder yield (kg/ha) obtained from sole and intercrops are given in Table-1. The grain yield of intercrops in agrisilviculture system was significantly less than that of pure crop. The effect of management system of pruning practices clearly showed that the grain yield of intercrops was significantly higher with pruning. The grain and fodder of all annual crops were influenced by pruning of neem. The grains of annual crops were lower under the un-pruned area when compared to pruned area and sole crop. Under the cowpea based system, the grain yield was 33% and 16% lower under un-pruned area and pruned area compared to sole crop.

Under greengram based system the yield reduction was recorded under un-pruned area and pruned area were 40.5% and 16% respectively when compared to sole crop. The same trend was observed in black-gram also and the grain yield reduction was 32.5% and 13% under un-pruned and pruned area, compared with sole crop.

In the case of fodder yield, the un-pruned area recorded an average of 40% reduction

compared to sole crop. The cowpea registered 41% fodder reduction under un-pruned area and 16.5% reduction under pruned area compared to sole crop.

The same trend was observed in green-gram and black-gram in reduction of fodder yield (39.5% under un-pruned area and 15.5% under pruned area in green-gram and 38.5% under un-pruned area and 12.5% under pruned area in black-gram) compared to sole crop. Tiwari (1994) also reported that, the same trend noticed under *Ailanthus* based agroforestry system with annual crops.

The effect of pruning on yield of annual crops were also worked out under this experiment and the green-gram registered more grain yield (24.5%) compared to un-pruned area. The black-gram and cow pea recorded 19.5% and 16.5% more grain yield compared to un-pruned area.

Under the fodder yield, there is no much variation among the annual crops and the fodder yield recorded 24%, 27% and 27.5% more under pruned area compared to un-pruned area in green-gram, black-gram and cowpea respectively. Jaimini *et al.* (2006) also reported that, the grain and fodder yield were high under pruned area compared to un-pruned area.

The results revealed that, the annual crops performed well under the Neem based agroforestry system and the yield was 16.5%, 19.5% and 24.5% higher under the pruned area compared to un-pruned area in cowpea, black-gram and green-gram respectively. The results of grain yield of intercrops indicated that pruning if trees up to 70%, had increased the grain yield significantly. In a similar study, Yadav and Blyth (1996) reported that, adverse effect of

P. cineraria on crop by its canopy, pruning at the time of crop sowing helps in reducing the negative impact of tree on the crop yield. Pruning of trees facilitate more light to understorey crop which benefit higher crop yield. This is due to efficient utilization of natural resource (light) by the agriculture crop due to pruning. In three year old poplar plant, yield reduction in wheat was 23.3% and pruning after 3rd year permitted some recovery in yield (Ralhan *et al.*, 1992). In agrisilviculture system, pruning at suitable age and interval is of vital importance to get production of intercrops due to more light transmission to crop otherwise the yield will be reduced to unacceptable limit. The benefit of pruning has been well recognized by several workers (Sharma and Singh, 1992; Acciaresi *et al.*, 1994; Osman *et al.*, 1998). Further, this study concludes that, Neem is best suited tree component especially for dry land agroforestry system.

Conclusion

Tree pruning strongly favours the light availability to the understorey crop which benefited the crop for higher yield. Tree pruning also disfavours the shoot and root growth of trees. Our results suggested that the pruning of tree is necessary to get regular crop yield from an agrisilviculture system besides other silvicultural and agronomic practices. However, there is a need to further study the amount of canopy pruning with intensity under tree-crop system, so that tree growth as well as understorey crop yield should not be affected.

Acknowledgement

The authors are thankful to the Director General, Indian Council of Forestry

Research and Education and the Director, Institute of Forest Genetics and Tree Breeding for providing financial and moral support for conducting this study.

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Table-1: Grain and fodder yield performance under Neem based agroforestry system (kg/ha).

Intercrop	2011-12								
	Un-pruned area			Pruned area			Open		
	Grain	Fodder	Market price	Grain	Fodder	Market price	Grain	Fodder	Market price
Cowpea (Rs. 10/kg)	122.4 (33)*	310 (39)	1224.00	159.0 (16)	455 (11)	1590.00	189.2	509	1892.00
Green-gram (Rs. 35/kg)	236.3 (44)	191 (39)	8270.50	303.6 (15)	265 (15)	10626.00	360.6	313	12621.00
Black-gram (Rs. 50/kg)	441.6 (33)	186 (40)	22080.00	578.2 (12)	259 (14)	28910.00	656.8	308	32840.00
Intercrop	2011-12								
	Un-pruned area			Pruned area			Open		
	Grain	Fodder	Market price	Grain	Fodder	Market price	Grain	Fodder	Market price
Cowpea (Rs. 18/kg)	128.7 (33)	285 (43)	2316.60	161.6 (17)	421 (16)	2908.80	192.5	496	3465.00
Green-gram (Rs. 46/kg)	233.8 (37)	198 (40)	10754.80	309.2 (17)	277 (16)	14223.20	371.2	326	17075.20
Black-gram (Rs. 67/kg)	446.5 (32)	195 (37)	29915.50	561.7 (14)	264 (9)	37633.90	648.1	311	43422.70

* Value in brackets represents the yield reduction in percentage compared to sole crop.

Pinus gerardiana Wall. - The threatened conifer of Western Himalayas

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History

Pinus gerardiana Wall., was first discovered by British Army Officer Captain Patrick Gerard (1794–1848) in 1832 in India. Gerard was a writer on geographical science. He received a Bengal cadetship in 1812. Most of his service was regimental; part of it attached to the hill corps. Gerard was author of 'Observations on the Climate of Subathoo and Kotguhr' in 'Asiat. Res.' xv. 469–88, meteorological observations made hourly for the space of nearly two years; of 'Account of the Climate and Agriculture of Subathoo and Kotguhr' in 'Edinburgh Journal of Science' (1828), ix. 233–41, cf. Froriep's 'Notizen' (1829), xxiii. cols. 65–71; and of 'Remarks on some Mineral Products of the Himalayas' in 'Delhi Medical Journal' (1844), i. 62–71. A joint paper by Alexander and Patrick Gerard, entitled 'Account of a Journey through the Himalaya Mountains,' appeared in 'Edinburgh Philos. Journal' (1824), x. 295–305. 'A Journal of Meteorological Observations made in India from 1817 to 1829,' by Patrick Gerard, forms British Museum Addit. MSS. 24017–22.

Habitat

Pinus gerardiana Wall. is an important conifer of inner drier regions of Himachal Pradesh. It is commonly known as Chilgoza or Neoza Pine. It is a conifer of compact appearance with short lateral branches. It belongs to the family Pinaceae. Its distribution is very sparse in **Area under chilgoza forest in H.P.**

the world, confined only to the mountains of Eastern Afghanistan, Pakistan, India and other scattered localities in Hindu Kush Himalayas (30° - 37°N to 66° - 80°E). In India, it occurs in North-West Himalayan ranges from 31° 55' - 32° 05' N to 77° 35' - 79° 35' E and grows between 1600 and 3300 m amsl in rocky and dry regions of Kinnaur & Chamba districts of Himachal Pradesh and Kishtwar district of Jammu & Kashmir (Polunin and Stainton, 1984). In Himachal Pradesh, it occurs in Sutlej Valley in Kinnaur District and some



Figure 1: *Pinus gerardiana* Forest

pockets of Pangi and Bharmour areas in Chamba district. It is known by various names in different areas of its natural occurrence. It is commonly known as Chilgoza/Jhalgoza in Afghanistan, Kashti in Kashmir, Chilgoza or Neoza in Hindi, Ree in Kinnaur and Miri in Chamba. Its habitat lies very well outside of the influence of the Monsoons but with heavy snow fall (Gamble, 1972).

S. No.	Name of Forest Range	Area in Ha.
1	Moorang Forest Range	1435.83
2	Kalpa Forest Range	777.80
3	Pooh forest Range	630.90
Total		2844.53

According to Neoza Working Circle of Kinnaur District (2001-07), total area under the Neoza/Chilgoza Pine is 2844.53 Ha. Moorang Forest Range has highest chilgoza/neoza pine area (1435.83 Ha.). Chilgoza forests cover an area of more than 35 hectares in Chamba district. In Chamba district, Chilgoza forests occur in Killar, Bharmour, Salori and Holi ranges.



Figure 2: Area under Chilgoza Forest in Kinnaur (L) and Chamba Districts (R)

Severe biotic interference and lack of regeneration in this pine may result in the extinction of this species in years to come. This species is listed in the near threatened category as per IUCN Red List.

Physical characteristics

Chilgoza pine is a very slow growing pine tree with an average life span is 150-200 years. It is only pine in India which provides edible nuts/Kernels. It is for this reason that it has played important role in socio-economic upliftment of people in tribal areas of the State. It is a multipurpose tree species used for fuel wood, fencing

and bedding for cattle. The tree is an excellent soil binder and prevents large scale soil erosion. The tree is capable to growing on excessively dry, barren hill-sides with shallow soil. As it grows under difficult conditions, it is known as



Figure 3: Tree showing physical characteristics

“Champion of Rocks”.

The trees are 10-25 m tall and 1.8 – 3.5 m in girth with usually deep, wide and open crowns with long, erect branches. However, in dense forests crowns are narrower and shallower. The bark is very flaky and reveals light greyish-green patches on peeling. The branchlets are olive-green in colour and have smooth texture. Its wood is tough, durable and comparatively heavy amongst all pines. The leaves are needle-like, in fascicles of 3, 6–10 cm long, spreading stiffly, glossy green on the outer surface, with blue-green stomatal lines on the inner face; the sheaths falling in the first year.

Its cones are 10–18 cm long, 9–11 cm wide when open, with wrinkled, reflexed apophyses and an umbo curved inward at the base. The chilgoza seeds are 17–23 mm long and 5–7 mm broad, with a thin shell and a rudimentary wing. Flowering occurs in May/June and thereafter pollination takes place. Male and female cones appear on same tree. In the first year the cones show a slight increase whereas during second year there is a rapid increase in size, each scale has two seeds which are cylindrical and pointed towards at one end. Chilgoza pine demands sufficient light & is a quite hardy tree withstanding considerable cold and excessive drought conditions. It withstands winds firmly and on highly exposed situations become stunted and gnarled. Its seeds can germinate in crevices, hollows of rocks and also under bushy plants.

Associated species

It generally grows in association with *Quercus ilex*, *Cedrus deodara*, *Pinus wallichiana*, *Olea cuspidata*, *Rhus succedanea*, *R. punjabensis*, *Daphne oleoides*, *Artemisia maritima*, *Rosa webbiana*, *Lonicera angustifolia*, *Berberis sp.*, *Desmodium sp.*, *Indigofera gerardiana*, *Fraxinus xanthoxyloides*, *Ephedra gerardiana*, *Alnus nitida*, and *Celtis australis*.

Uses of Chilgoza pine

Pinus gerardiana is well known for its edible seeds. The seed (chilgoza) rich in oil, starch, and albumenoids is eaten as dry fruit. Seeds are obtained from cones which are still green. The cones are gathered from the trees, heaped up and burned to open them, after which seeds are picked out. The chilgoza fetch very high price ranging from Rs. 1500-2000/kg in the open market and play an important role in socio-economic upliftment of the people in

tribal areas of Kinnaur district (Sehgal and Khosla, 1986; Malik *et al.*, 2012).

On an average, 25-30 cones are required



Figure 4: Cone of Chilgoza pine for extracting 1kg of Chilgoza nuts. The seeds are extremely nutritious and are a rich source of fats, carbohydrates and proteins. They are medicinally used for general debility, lowering high cholesterol level and cardiac problems. Its oil is used



Figure 5: Chilgoza nuts

1986), chronic arthritis, respiratory complaints, burns, cough and cold etc. Nuts are also used for preparation of garlands to be offered to local deities, relatives & guests during marriage ceremonies and for preparation of local Namkeen Tea “Cha”.

Kernel ingredients [air dried]

Water	8.6%
Fat/oil	49.9 to 51.3%
Starch/carbohydrates	21.5 to 22.5%
Proteins	15.9%
Fiber	0.9 to 2.2%
Ash	3%

The nuts are a rich source of fat. Out of total fat, 90% are unsaturated fats which are beneficial for lowering cholesterol levels by reducing low density lipoprotein (LDL) cholesterol. They contain proteins, amino acids, Gallocatechin, Catechin, Lutien, Tocopherols, Squalene and Phytosterols which are powerful antioxidants, preventing oxidation of lipids and reducing generation of free radicals. Pine nuts when consumed in large amount are helpful in weight gain, but when used in small amount, help in weight loss too, as it contains long chain fatty acid that induces the release of CCK-8 hormone which is satiety hormone that provides feeling of fullness and reduces appetite.

Silvicultural characters and natural regeneration

Natural regeneration of Chilgoza Pine is



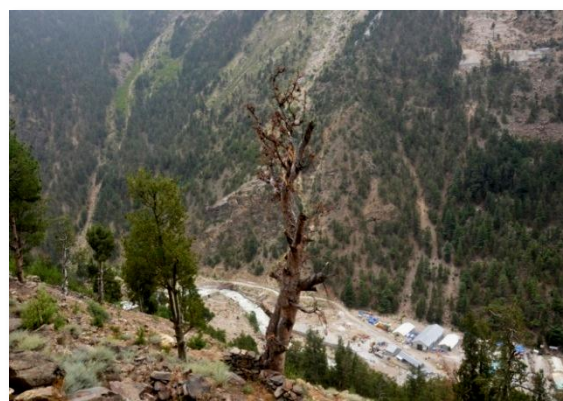
Figure 6: Chilgoza nut garlands

very low due to many biotic and abiotic factors. There are a number of factors responsible for poor natural regeneration.

- i) The Chilgoza nuts are one of the most important cash crops of tribal people living in Kinnaur district and are sold at very high rates in the market. The local right holders lop each and every tree for extracting edible nuts. Chilgoza cones are ruthlessly harvested

every year for seed extraction for local consumption and marketing making it one of the major reasons for the poor natural regeneration of this pine. There is no restriction on the quantity of Chilgoza seeds which may be collected (Negi, 2002).

- ii) Left out seeds are immediately eaten by wild life species especially rats, crows and birds.
- iii) Grazing by goat and sheep and extraction of timber and resinous torchwoods have made this important species an endangered



conifer of the Himalayas.

Figure 7: Excessively lopped Chilgoza

iv) Seed mycoflora plays an important role in the spoilage of seed. Initially, greyish discolouration occurs at the point of infection and later, greenish fungal growth is observed on entire seed. Many of the seed-borne fungi like *Penicillium*, *Trichothecium*, *Aspergillus*, *Mucor*, and *Rhizopus* often colonize seeds. Chilgoza nuts form a good substrate for *Aspergillus flavus* infestation and production of aflatoxins with potential health hazard of the consumers. Male cones are attacked by cone borers [*Dioryctria abietella*, *Caterina cedrella* Fm: Pyralidae] which even tunnels into branches.

- v) Occasional fires destroy seedlings, seeds as well as cones.

vi) Urbanization, developmental activities especially construction of hydro electric power plants and roads damage the soil profile and pose a serious challenge for the survival of Chilgoza trees in their zone of occurrence.

vii) Early drought during March to May also kills seedlings.



Figure 8: Excessively lopped Chilgoza pine tree forest due to developmental activities

The natural population of *Pinus gerardianais* decreasing day by day. Immediately steps must be initiated to conserve this valuable plant resource so that its further degradation may be stopped to some extent. Conservation efforts can be undertaken both in its natural environment (*in-situ*) as well as outside its natural environment (*ex -situ*). The regeneration of this species occurs through seeds in natural habitat, however, artificial regeneration of these species through seeds as well as vegetative means has not been done successfully till now.

Chilgoza Pine is generally raised through seeds in the nurseries. However, availability of seed is not always sure every year due to several reasons. Like other conifers, *Pinus gerardiana* too is difficult to regenerate through vegetative means. The vegetative propagation of Chilgoza pine through grafting is still not standardized. There is urgent need to

investigate phyto-sociological and



Figure 9: Extraction of Chilgoza regeneration status of Chilgoza Pine in its natural zone.

Management of chilgoza crop

Studies showed that natural regeneration of Chilgoza pine is very poor (5-15%), hence the species is facing higher risk of extinction. Suitable strategy and action plan for conservation of this species including sustainable harvesting practices are urgently required to be devised. In its natural zone, farmers should be



Figure 10: Raising Chilgoza pine encouraged to carry out intensive management practices to get more Chilgoza yield like:

- Sustainable and judicious branch lopping.
- Application of suitable fungicides on the lopped branches during cone collection.

- Use of modern equipments for cone collection.
- As previous year's branches contain flowers/fruitlet bodies for next year's crop, so they should not be lopped during cone collection.
- Addition of farm yard manure.
- Awareness workshops in its zone of occurrence to sensitize people on conservation efforts by various agencies.

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वनस्पतियों से प्राप्त नशाकारक रसायन

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पारि-पुनर्स्थापन वन अनुसंधान केन्द्र

(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

प्रयागराज

रसायनयुक्त वनस्पतियाँ बहुत प्रकार के औषधीय पौधों के समान अल्कलॉयड सक्रिय समूह से सामान्यतः सम्बन्धित होती हैं। अल्कलॉयड नाइट्रोजन युक्त सक्रिय बेसिक यौगिक हैं, जो वनस्पतियों के विभिन्न भागों में द्वितीयक उत्पाद के रूप में पाये जाते हैं। यह लगभग 40 पादप प्रजाति समूह की वनस्पतियों के पत्तियों, तना, जड़ तथा बीजों में मिलते हैं। अल्प मात्रा में यह रसायन औषधि के रूप में प्रयुक्त होता है, किन्तु नशाकारक रसायन के रूप में आदी होने से गम्भीर बीमारियों का कारण होता है। स्थिति मृत्युकारक भी हो सकती है। अधिक मात्रा में सेवन केन्द्रीय तंत्रिका तन्त्र को प्रत्यक्ष रूप से तुरन्त ही प्रभावित करता है, परिणामतः उपभोक्ता अपनी भूख, दर्द, पीड़ा, सब कुछ नशे की हालत में भूल जाता है। धीरे धीरे प्रयोगकर्ता आदी हो जाता है। अल्कोहॉलिक पेय पदार्थों की तरह ही लगातार सेवन मनुष्य को इन अल्कलॉयड ड्रग्स से सतत् विनाश की ओर ले जाता है। इसके प्रयोग की मात्रा तथा बारम्बारता मनुष्य की इच्छा के वश में नहीं रहती है। यह उचित होगा कि नशाकारक रसायन युक्त औषधियों का सेवन चिकित्सक की सलाह पर ही सावधानीपूर्वक किया जाय। वनस्पतियों से प्राप्त होने वाले महत्वपूर्ण नशाकारक रसायन हैं :

मॉर्फिन

यह एक ओपियम अल्कलॉयड है तथा अफीम का मुख्य घटक है। यह पापी या पापेवर सोमनिफेरम पादप के बीजों से प्राप्त होता है। अफीम के दो अन्य अल्कलॉयड कोडीन तथा थीबेन है। मॉर्फिन पानी में अघुलनशील तथा पीड़ाहारी है तथा दर्दनिवारक औषधियों में प्रयुक्त होता है। अधिक मात्रा में इस रसायन का प्रयोग तंत्रिका तंत्र को नशे के प्रभाव से नियंत्रित करता है तथा प्रयोग करने वाले को शीघ्र ही आदी बना देता है। अतः आवश्यकता पड़ने पर अल्प मात्रा में ही सेवन लाभकारी है। मॉर्फिन का ही डाईएसेटाइल व्युत्पन्न औषधि जगत में हेरोइन के नाम से जाना जाता है। इसमें मॉर्फिन से ज्यादा नशीले गुण होने से मनुष्य को शीघ्रता से आदी बना देता है।

एट्रोपीन

सोलेनेसी पादप समूह की वनस्पतियों में यह सामान्यतः पाया जाता है। एट्रोपा बैलेडोना, दतूरा स्ट्रामोनियम, (धतूरा) तथा हायोसाइमस नाइजर (हेनबेन) मुख्य प्रजातियाँ हैं। एट्रोपीन, एट्रोपा बैलेडोना, के रस से मिलता है। यह एक कसैला तथा तेज जहर है। यह अल्प मात्रा में आँखों हेतु औषधि रूप में उपयोगी है। शरीर के अन्दर एट्रोपीन का प्रयोग केन्द्रीय तंत्रिका तन्त्र को प्रभावित करता है। अधिक मात्रा में इसका प्रयोग हानिकारक है।

कोनाइन – हेमलॉक

यह अल्कलॉयड कोनियम मैकुलेटम वनस्पति का मुख्य सक्रिय घटक है। इसके जहरीले गुण प्राचीन

काल में अपराधियों को दण्डित करने में भी प्रयुक्त होते थे। इसका अधिक मात्रा में सेवन केन्द्रीय तन्त्रिका तन्त्र को निष्क्रिय कर देता है जिससे सांस लेने में कष्ट होने लगता है और स्थिति मृत्यु तक पहुँच जाती है

निकोटीन

यह निकोटियाना टोबेकम नामक वनस्पति से मिलता है तम्बाकू का यह मुख्य सक्रिय घटक है। यह जहरीला होता है। 30-40 मि.ग्रा. का सेवन तन्त्रिका तन्त्र का नियंत्रण समाप्त कर देता है। सिगरेट में तम्बाकू का प्रयोग हृदय सम्बन्धी अनेक बीमारियों के लिये उत्तरदायी है। तम्बाकू के अन्य सक्रिय रसायन निकोटिमीन, निकोटायरिन तथा नॉरनिकोटीन हैं।

पेपावरीन-ओपियम

यह ओपियम - पाँपी में 24 अन्य अल्कलॉयड के साथ उपस्थित होता है। अफीम के मुख्य रसायन हैं - मार्फीन: 10-16 %, नार्कोटीन: 4-8 %, कोडीन: 0.8-2.5 %, पेपावरीन : 0.5-2.5 %, तथा थीबेन: 0.5-2.0 % है। अल्प मात्रा में पेपावरीन का सेवन निद्राकरक है तथा अधिक मात्रा में हृदय गति को प्रभावित करता है।

स्ट्रीकनीन

अल्कलायड समूह का यह रसायन स्ट्रिकनाँस नक्य वोमिका नामक वनस्पति के बीजों व पत्तियों से निकाला जाता है। अल्पमात्रा में स्ट्रीकनीन प्रभावित उत्तेजक होता है। ज्यादा मात्रा (30 मि. ग्रा.) में यह केन्द्रीय तंत्रिका तन्त्र को प्रभावित करके मृत्युकारक भी हो सकता है। स्ट्रीकनीन का डार्डिमीथाँक्सी व्यूत्पन्न ब्रूसीन कहलाता है। यह स्ट्रीकनीन से कम नशीला होता है।

गांजा, चरस व भांग

यह कैनाबिस सैटाइवा नामक पौधों से तैयार होते हैं। मादा पौधों के फूल तथा पत्तियों से 'चरस'

निकलता है जो नशीला व उत्तेजक गुणों वाला है। यह रेसिन समूह का रसायन है। 'भांग' नर तथा मादा पौधों की पत्तियाँ सुखा कर तैयार करते हैं। मादा पौधों का अगला पुष्पीय भाग सूख कर गांजा कहलाता है। यह सभी रसायन अत्यन्त नशीले तथा अधिक मात्रा में सेवन हानिकारक है।

ताड़ी
अल्कोहॉलिक पेय विभिन्न वनस्पतियों के तनों से मीठा जूस निकलता है, जो नीरा के नाम से जाना जाता है। यह जूस औसतन 8-10 घंटे तक रखने पर फर्मेन्ट हो जाता है, जिससे अल्कोहॉलिक पेय तैयार हो जाता है। यह पेय संग्रह करने पर समय के साथ ज्यादा नशीले गुणों वाला हो जाता है। पामेसी वर्ग की वनस्पतियों जैसे - कैरियोटा यूरेन्स, फोएनिक्स सिलवेस्ट्रिस तथा कोरिफा उतन से ताड़ी तैयार की जाती है।

नशाकारक रसायनयुक्त वनस्पतियों की श्रृंखला में लगभग सभी प्रजातियाँ औषधीय गुणों से युक्त हैं जो विभिन्न गम्भीर रोगों का निदान करने में चिकित्सा जगत के लिये वरदान है। महत्वपूर्ण है, आवश्यकता पड़ने पर ही इनके प्रयोग व उचित मात्रा की जानकारी होना चाहिए। प्राकृतिक उत्पादों से सम्बन्धित अनुसंधान केन्द्र नित्य नई औषधियों पर शोध कर रहे हैं, जिससे नवीन रसायन प्रकाश में आ रहे हैं तथा वनस्पतियों की भी उपयोगिता बढ़ रही है। हानिकारक पहलू इन रसायनों का अत्यधिक उपयोग करना व इनका आदी होना है। विज्ञान तथा तकनीक के इस युग में आवश्यक है कि सकारात्मक सोच रखने हेतु मानव जाति को इन नशीले रसायन के खतरों से सावधान रहना चाहिये तथा इस दिशा में हो रहे अनुसंधान कार्यों को प्रश्रय मिलना चाहिये।

अतुल्य वन

ममता पुरोहित एवं राजेश कुमार मिश्रा

उष्णकटिबंधीय वन अनुसंधान संस्थान

(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

जबलपुर



वन मानव समुदाय के लिए प्रकृति का दिया अनमोल उपहार है। वृक्षों द्वारा सघन रूप से ढके हुए विस्तृत भू क्षेत्र को वन कहते हैं। आदिकाल से वन आदिवासियों की जीवनशैली और जीविका के मूलभूत स्रोत हैं। जन्म से मृत्यु तक मानव का वनों से गहरा संबंध रहा है। मानव सभ्यता की शुरुआत में आदिमानव घने वनों में ही रहता था और अपनी सभी मूलभूत आवश्यकताओं जैसे भोजन वस्त्र और आवास के लिए वनों पर ही आश्रित था। समय के साथ-साथ मानव तथा वनों के संबंध में परिवर्तन आने लगा। जहाँ आदि मानव वनों का पुजारी था वहीं आधुनिक मानव समाज भौतिकवाद की दौड़ में वनों का शत्रु बन गया। भारतीय संस्कृति के जन्मदाता ऋषि-मुनियों के आश्रम वनों में ही होते थे जहाँ विद्यार्थी, आमजन, राजा, सैनिक, व्यवसायी आदि गुरु के पास बैठकर मानव धर्म, व्यक्तिगत कर्तव्य, सामाजिक व्यवस्था, आर्थिक तंत्र, राजनीति, कूटनीति, न्याय एवं दंड व्यवस्था तथा

संस्कृति आदि की शिक्षा ग्रहण करते थे। वनों के शांत-एकांत वातावरण में ऋषि-मुनियों ने विश्व कल्याण के लिए चिन्तन कर बहुमूल्य सूत्र प्रतिपादित किये। वन और वनों के पेड़-पौधे ही वो प्राकृतिक आवास हैं जहाँ भिन्न-भिन्न प्रकार के पशु-पक्षी, कीट-पतंगे, जीव-जन्तु आदि स्वतंत्रता पूर्वक रहते हैं। वनों का पारिस्थितिक तंत्र को नियमित बनाये रखने में सतत योगदान है। आज के इस विश्वव्यापी व्यापारिक वन दोहन के युग में व्यक्ति, समाज, देश तथा विश्व के हित में अधिक से अधिक वृक्षों को लगाना तथा उनकी देखभाल करना ये सरकार के साथ-साथ आम जन का भी कर्तव्य है। तभी वृक्षारोपण एवं वन प्रबंधन द्वारा धरती का विस्तृत क्षेत्र पुनः हरा-भरा हो सकेगा। देश के विकास में वनों की महत्वपूर्ण भूमिका है -

- वन विभिन्न मौसम में उत्सवेदन, श्वसन आदि जैविक प्रक्रियाओं द्वारा तापमान संतुलित बनाये रखते हैं।
- वन पतझड़ द्वारा मृदा की उर्वरता बढ़ाने में सहायक होते हैं।
- वन वायुमण्डल से कार्बन डाईआक्साइड जैसी हानिकारक गैसों का अवशोषण कर

पर्यावरण को स्वस्थ बनाये रखते हैं।



- वन वायुमण्डल में कार्बन डाईआक्साइड और आक्सीजन के संतुलन को बनाये रखते हैं।
- वन वायुमण्डल की आर्द्रता को अवक्षेपित करने में सहयोग देकर वर्षा में सहायक होते हैं।
- वन वर्षा के जल के तीव्र बहाव को रोककर बाढ़ की संभावना को कम करते हैं।
- वन इमारती और जलाऊ लकड़ी द्वारा अर्थतंत्र में सहायक होते हैं।
- जलाऊ लकड़ी से कोयला बनाया जाता है जो ईंधन के रूप में उपयोग किया जाता है।
- बांस ग्रामीणों की आय का मुख्य साधन है एवं विभिन्न कुटीर उद्योगों द्वारा जैसे घरेलु

सामान, सजावटी सामान, मकान एवं फर्नीचर आदि बनाने के काम आता है।

- बहुत से अन्य कुटीर उद्योग जैसे खिलौने बनाना, फर्नीचर बनाना, खेती-बाड़ी के औजार एवं बैलगाड़ी आदि बनाना, बीड़ी बनाना आदि वनों पर आधारित है।
- अनेकों उद्योग जैसे कागज बनाना, प्लाइवुड बनाना, माचिस की तीली बनाना, कत्था बनाना आदि वनों पर आधारित है।
- विभिन्न प्रकार की जड़ी-बूटियाँ वनों से प्राप्त होती हैं।



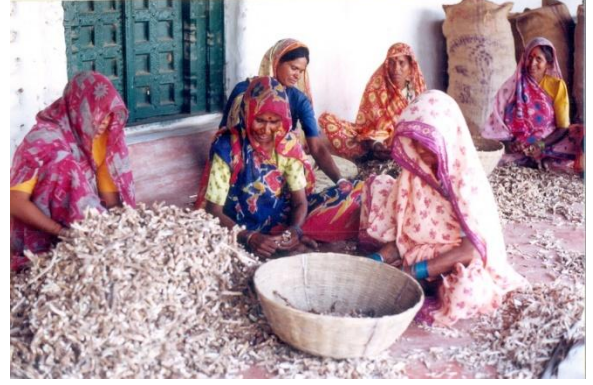
- पालतू जानवरों के लिए पौष्टिक चारा वनों से प्राप्त होता है।
- जंगली जानवरों के आवास एवं भोजन श्रृंखला वनों में ही होते हैं।
- विभिन्न पक्षियों एवं कीट-पतंगों के घरोंदे एवं भोजन वनों में ही होते हैं।
- जलमार्ग द्वारा यात्रा एवं माल ढोने के लिए नाव एवं जहाज आदि के लिए लकड़ी वनों से ही प्राप्त होती है।
- शहद, लाख, रेशम, मशरूम आदि व्यापारिक उत्पाद वनों से प्राप्त किये जाते हैं।

- गोंद, रबर, रेजिन आदि वृक्षों से एकत्रित किये जाते हैं।
- अनाज एवं अन्य सामग्री भरने व एक स्थान से दूसरे स्थान ले जाने के लिए आवश्यक बोरे सन/जूट से तैयार किये जाते हैं।
- विभिन्न प्राकृतिक रंग, वृक्षों के फल, फूल, पत्ती आदि से प्राप्त किये जाते हैं।
- करंज, महुआ, रतनजोत आदि तेल उद्योग के आधार हैं।
- वनों का प्राकृतिक सौन्दर्य पर्यटन को प्रोत्साहित कर प्रदेश का राजस्व बढ़ाता है।
- दोना-पातल बनाने के लिये पत्तों का एकत्रीकरण पलाश एवं माहुल आदि के वृक्षों से किया जाता है।
- जंगली फल जैसे महुआ, तेंदू, अचार आदि बड़े चाव से खाये जाते हैं।
- हर्षा, बहेड़ा, बेल आंवला आदि व्यापारिक महत्व के फल हैं।



- वृक्षों और विभिन्न प्रकार की घांस प्रजातियों से प्राप्त रेशे रस्सी बनाने के काम आते हैं।

- धार्मिक कार्यों के लिए तैयार की जाने वाली हवन सामग्री, धूप, अगरबत्ती आदि वन उत्पादों से निर्मित की जाती है।



- विभिन्न उद्योगों के लिए आवश्यक विभिन्न वन उत्पादों का संग्रह, ग्रामीण एवं आदिवासी समुदाय को रोजगार उपलब्ध कराता है।

वनों के शत्रु

जन्म से लेकर मृत्यु तक मानव समाज, वन्य एवं पालतु प्राणी समुदाय एवं पर्यावरण की सतत सेवा करने वाले वनों के भी शत्रु हैं। बड़े खेद की बात है कि इन परोपकारी वनों का सबसे बड़ा शत्रु पढ़ा-लिखा, अच्छे-बुरे का ज्ञान रखने वाला बुद्धिमान मनुष्य ही है। वन जैसी महत्वपूर्ण प्राकृतिक संपदा को मानव ने कभी अज्ञानतावश तो कभी लोभवश नुकसान पहुँचाया है। लालच के वशीभूत हो बिना सोचे समझे वनों की अंधाधुंध



कटाई इस सीमा तक की गई की जहाँ प्रारंभ में लगभग 70 प्रतिशत भू-भाग वनों से आच्छादित था वहीं अब वन केवल 15-16 प्रतिशत भू-भाग में सिमट गये हैं जबकि 22 प्रतिशत वनक्षेत्र का होना अतिआवश्यक है। वनों की कटाई यहीं पर नहीं रुकी बल्कि विभिन्न कुटीर एवं बड़े-बड़े उद्योगों की वन उत्पादों की मांग पूर्ति करने के लिए कटाई प्रक्रिया बिना क्षतिपूर्ति किये निरंतर जारी है। फलस्वरूप कई प्रजातियाँ लुप्त हो चुकी हैं एवं कई प्रजातियाँ लुप्त होने की कतार में हैं। बढ़ती जनसँख्या की खाद्य समस्या को हल करने के लिए कृषि भूमि विस्तार हेतु, नदी घाटी परियोजनाओं के द्वारा सिंचाई हेतु, विद्युत उत्पादन हेतु एवं विभिन्न व्यवसायी उद्योगों की पूर्ति के लिए आये दिन बड़े-बड़े वन क्षेत्र साफ किये जा रहे हैं। अतः वन संरक्षण एवं वृक्षारोपण को प्रभावी बनाने के लिये कारगर

योजनाएं बनाकर उनका गंभीरता से कार्यान्वयन करना होगा।



वनों का दूसरा प्रमुख शत्रु अग्नि है जिससे वनों को बहुत नुकसान होता है। गर्मी के दिनों में प्रायः जंगलों में आग लग जाने से बहुत बड़े-बड़े वन क्षेत्र प्रभावित हो जाते हैं। मनुष्य भी अपने निजी स्वार्थों के लिए वनों में आग लगाता है। जिससे बहुत से पौधे जलकर नष्ट हो जाते हैं एवं पुनरुत्पादन के प्रभावी होने से वन क्षेत्रों में वृक्षों की सँख्या एवं प्रजातियाँ प्रभावित होती है।

वनों का तीसरा शत्रु पालतु जानवरों द्वारा अत्यधिक चराई का होना है। वर्षा ऋतु व उसके बाद निज प्रदेश तथा समीपवर्ती प्रदेशों से आनेवाले लाखों पशु वनों में चराई करते हैं। पशुओं द्वारा रौंदी गई गीली मिट्टी सख्त हो जाती है जिससे वारिश का पानी भूमि में न समाकर व्यर्थ ही बह जाता है। पशुओं के रौंदे जाने से नव अंकुरित पौधे नष्ट हो जाते हैं।

वनों की निरंतर कटाई से पर्यावरण पर पड़ रहे हानिकारक प्रभाव एवं दूरगामी दुष्परिणामों से भारत ही नहीं पूरा विश्व चिन्तित है। तापमान का निरन्तर बढ़ना, कहीं सूखा तो कहीं भयंकर बाढ़, बेमौसम व अनियमित बरसात से कृषि उत्पादन का प्रभावित होना, वनस्पति एवं जीव प्रजातियों के निरंतर कम व लुप्त होते जाने से पर्यावरण पर पड़नेवाले प्रत्यक्ष एवं अप्रत्यक्ष प्रभाव चिन्ता के गंभीर विषय हैं। सरकार द्वारा वन संरक्षण, वन प्रबंधन एवं वृक्षारोपण के लिए योजनाएं बनाकर

बहुत पैसा खर्च किया जा रहा है परन्तु आशानुकूल परिणाम प्राप्त नहीं हो रहे हैं। अतः प्रशासनिक अधिकारियों, वन अधिकारियों, वैज्ञानिकों, पर्यावरणविदों, गैरसरकारी संस्थाओं, समाजसेवी संगठनों आदि को सम्मिलित रूप से बैठकर पुनः वन नीतियों, योजनाओं एवं उनके क्रियान्वयन पर विचार कर जन समुदाय की भागीदारी को भी सुनिश्चित कर ऐसे निर्णय लेना होंगे जिससे वन संरक्षण एवं वृक्षारोपण कार्यक्रम सफल हो सके। वन क्षेत्र बढ़ने से प्राकृतिक आपदाएं तो नियंत्रित होंगी ही साथ ही पर्यावरण का सुधार, देश का विकास एवं आम नागरिक का जीवन स्तर भी उन्नत होगा।



Published by:



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(Indian Council of Forestry Research & Education)
(An autonomous council under Ministry of Environment, Forests and Climate Change)
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