Van Sangyan

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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,
PO-RFRC, Mandla Road,
Jabalpur (M.P.) - 482021.
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.)

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From the Editor’s desk

Forests are the biggest users of water worldwide and extensive forested areas have been lost or are undergoing conversion to agriculture, creating concerns about loss of hydrological functions and increasing the competition for scarce water between agriculture, urban centres, industries and wildlife. The challenge is to improve the sustainability and productivity of land and water use, especially for the growing populations of many developing countries.

Agroforestry offers one promising option for efficient and sustainable use of land and water. In simplified terms, agroforestry means combining the management of trees with productive agricultural activities. Agroforestry provides opportunities for forest conversion in the true sense of the term—that is, replacement of natural forests with other tree-based land-use systems. There are also opportunities to use agroforestry for the prevention or reversal of land degradation in the humid tropics. There are numerous potential benefits that agroforestry systems can achieve, ranging from diversification of production to improved natural-resources utilization.

It is often assumed that appropriate agroforestry systems can provide the environmental functions needed to ensure sustainability and maintain microclimatic and other favourable influences, and that such benefits may outweigh the disadvantages of a more complicated management. Secondly, it is also assumed that agroforestry might be a practical way to mimic the structure and function of natural ecosystems, since components of the latter result from natural selection towards sustainability and the ability to adjust to perturbations. Recent reviews of agroforestry findings, however, have highlighted several unexpected but substantial differences between intensive agroforestry systems and their natural counterparts that would limit their adoption for solving some of the critical land-use problems in the tropics. The most intractable problems for agroforestry appear to be in the semi-arid tropics.

In line with the above this issue of Van Sangyan contains an article on कृषि-वानिकी में जल प्रबंधन. There are also useful articles viz., Menace of Parthenium Hysterophorus on agroecosystems and its control measures, वैज्ञानिक व्यापार एवं नीम वानिकी प्रजातियों की पौधा जूड़ी के लिए साधारणमध्य: Effect of pruning on wildlife and micro-organisms, Role of nutrient cycling in forest ecosystems, and Mahogany shoots borer, Hypsipyla robusta and its control measures.

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. Pawan Rana
Scientist ‘E’ & Chief Editor
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परिचय
कृषि-वानिकी शब्द का उपयोग सामूहिक रूप से ऐसी सभी भूमि उपयोग पद्धतियों के लिये किया जाता है, जिसके अंतर्गत कादीय व्यूह वाले क्षेत्रों के अनुसार एक ही स्थान में फसल और/या पशुपालन एक साथ किये जाते हैं। इस्तेमाल एक ही समय में समब्ध व्यूह के साथ या एक के बाद दूसरा एक निश्चित रूप से अपनाया जाता है।
कृषि तथा वानिकी भारत में भूमि उपयोग की दो प्रमुख पद्धतियां हैं, जो क्रमशः 46.2 प्रतिशत तथा 21.67 प्रतिशत भूमि क्षेत्र में अपनाई जाती है। यदि कृषि-वानिकी, कृषि और वानिकी दो विज्ञान से मिलकर विकसित की गई है, तो इसे समझने के लिये कृषि और वानिकी का ज्ञान ही पर्याप्त है, बसतूँ ऐसा नहीं है। यदि एक बुधु व्यूह का समूह ही नहीं है, मनुष्य का शरीर के साथ-साथ रासायनिक तत्वों का समूह ही नहीं है कुछ और भी है। इसी प्रकार कृषि-वानिकी, कृषि और वानिकी व्यूह का मेल नहीं है, कुछ और भी है। कृषि और वानिकी दोनों ही भारत की प्राचीन पद्धतियां हैं, तथापि कृषि-वानिकी, एक ऐसा विज्ञान है जो कृषि, वानिकी, पशुपालन, मददकर पालन तथा अन्य विषयों और प्रबंधन पर आधारित है, जो सब द्रविकर भूमि उपयोग की सुविधाजनक पृष्ठभूमि का निर्माण करते हैं।
कृषि-वानिकी क्या है?
कृषि-वानिकी, भूमि उपयोग की वह धारणीय पद्धति है, जिसके अंतर्गत भूमि की उत्पादकता बनाये रखते हुये उस भूमि पर वृक्षों तथा फसलों का उत्पादन और या पशुपालन, एक ही समय में या क्रमबद्ध रूप में अपनाया जाता है, जो जन-समुदाय की आवश्यकताओं की पूर्ति तथा पारंपरिक संस्कृतियों संतुलन को बनाये रखते हैं।
अथवा
कृषि-वानिकी भूमि प्रबंधन की ऐसी पद्धति है जिसके अंतर्गत एक ही भू-खंड पर कृषि फसलों और व्यूह वाले क्षेत्रों के उत्पादन के साथ-साथ पशुपालन भी किया जाता है। कृषि वानिकी से भूमि की उपजाऊ शक्ति को बढ़ाया जाता है। सीधे शब्दों में फसलों के साथ वृक्ष फलदार, इमारती, इंधन वाले उगाने की पद्धति को कृषि वानिकी कहते हैं कृषि-वानिकी पद्धति से भूमि का उपयोग बढ़ जाता है तथा फसल उत्पादन में होने वाले जोखिमों को बढ़ाने में रोकने का उद्देश्य है।
कृषि-वानिकी के मुख्य उद्देश्य
कृषि-वानिकी के मुख्य उद्देश्य निम्नलिखित है-
कृषि उत्पादन को सुनिश्चित करना एवं खाद्यादान को बढ़ाना।
(2) मूत्रा क्षरण में निष्प्राप्त।
(3) भूमि सुधार।
(4) ईदम एवं दमार्टी लकड़ी की आपूर्ति करना।
(5) कृपी उद्योगों को बढ़ाने के लिये अधिक साधन जुटाना एवं रोजगार के अधिक अवसर प्रदान करना।
(6) पर्यावरण की सुरक्षा।
(7) पशुओं के लिये साल भर अन्धेर गुण बाले बारे प्रदान कर उनकी उत्तादन क्षमता को बढ़ाना।
(8) ऊसर एवं बीड़ कृपि का सुधार करना।
(9) फलों उत्पादन को बढ़ाना।
(10) जलाऊ लकड़ी के साथ लाभकारी ढ़ग से अपनाया जाए।
भूती-वाक्यों के साथ जलाऊ लकड़ी को बढ़ाने के लिये आवश्यक काम करने के लिये उपयोग करना।
संक्षेप में कृपि-वाक्यी का मुख्य उद्देश्य कोई विशेष लागत लगाये विनाग्रामीय लोगों की आधिक स्थितियों में सुधार लाना है। इसको लगभग हर तरह के भूमि पर ऊसरों में लाया जा सकता है। भूमि-बागीमकरण के आठ वर्गों में कृपि-वाक्यों को सभी वर्गों वाली भूमि पर थोड़ी बहुत फेरवृद्ध के साथ लाभमायों इम से अपनाया जा सकता है।

उत्पादक सिंचाई विधि का प्रवर्तन
कृपि-वाक्यी राष्ट्रवादन को प्रवर्तन करना।
(1) भूमि के गुण।
(2) फैलों के बढ़ाने की प्रवृत्ति व जल की आवश्यकता।
(3) सिंचाई के खोल का आकार।
(4) सिंचाई के जल के गुण।
(5) मौसम की दशा।

सिंचाई का समय
जब पौधों की वृक्ष में मिट्टी में उपनाम नमी की कमी के कारण महत्वपूर्ण कमी आना शुरू हो जाये तभी सिंचाई करनी चाहिये। कृपि-वाक्यी में सिंचाई करने का अनुमान निर्धारित करने के आधार पर ही लगाया जा सकता है -
(1) पौधों की बाहरी दशा देखकर।
(2) मिट्टी के गुण।
(3) मूत्रा नमी की माप।
(4) पौधों के जीवन में अवस्थाओं पर।

सिंचाई की उपयुक्त विधियां
जल एक अमूल्य निश्चित है और इसके अमाव र मृदा-वाक्यी कार्य अपतम है। इसके लगभग कम समय कार करने के अपतम की ठोकरा चाहिये। जल का उचित उपयोग तथा अपतम की कम करने में जिन उपयोगों को किया जाता है उसे जल प्रबंधन कहते हैं।
साधारणतया कृपि-वाक्यी में वातावरण तथा वृक्षारोपण क्षेत्र में जल जिन पद्धतियों से दिया
जाता है उसके अन्तर्गत मुख्य रूप से निम्न विधियां हैं -

(1) पृष्ठीय सिंचाई
(3) बाड़कूड या उप्रवाद या तोड़ विधि -
   (1) अग्रीमित सूत्र बाड़कूड
   (2) सीमान्त पट्टी या नक्सल या सारा सिंचाई विधि
(3) क्षारी या पट्टी विधि
(4) बेंसिन या रिंग या थाना विधि
(5) बूढ़ सिंचाई विधि -
   (1) गड़री बूढ़ सिंचाई विधि
   (2) समोझु बूढ़ विधि
(2) अध्यो-पृष्ठीय सिंचाई
(3) बौछारी सिंचाई विधि
(4) टपकाव या ड्रिप ड्रिफ्टिल सिंचाई विधि

उपरोक्त विधियों में (3 व 4 को छोड़कर) हमें काफी अधिक मात्रा में जल की आवश्यकता होती है तथा अपनाय एवं बहाव भी अधिक होता है। जल प्रबंधन के तहत हमें यह देखना चाहिए कि जल की मात्रा तथा उसका अपनाय कम हो। इस दृष्टि से बौछार पद्धति एवं टपक पद्धति काफी लाभदायक सिद्ध हुई है। अत: हमें रोपणी एवं बृक्षारोपण क्षेत्र में इन विधियों द्वारा सिंचाई करना चाहिए। यद्यपि ये विधियां मंहगी हैं पर इनके कई लाभ हैं तथा सबसे महत्वपूर्ण बात यह है कि इन विधियों से जल का अनुशील बहाव या व्यवस्था है और अधिक से अधिक मात्रा में जल पौधों की जड़ें तक पहुँचता है।

कृप्या-बानिकी में जल प्रबंधन की मुख्य विधियां

बौछार पद्धति
इस विधि में जल को वर्षा की तरह पूर्णता रूप से निम्न विधियां को दिया जाता है। इस विधि की विशेषता यह है कि पौधों का वर्षा का आभास होता है, पौधे एवं पत्तियां धूल जाती है जिसमें प्रकाश संतुलनकण का क्रिया अधिक होती है। इस पद्धति में जल की मात्रा कम लगती है तथा जल समान रूप से वितरित होता है। ब्यथ बहाव मौनों के कारण पिछड़ी का धरण भी कम होता है। धुलशील उबरकर, कीटनाशक तथा अन्य पौधवर्धक रसायनों का आसानी से छिड़काव किया जा सकता है। इस विधि द्वारा सिंचाई से पाला तथा पौध इत्यादि में पौधों को बचाया जा सकता है।

बौछारी पद्धति के निम्न भाग होते हैं -

पिंग सैट
यह जल का उद्विजन कर लागू करने के साथ पाइप लाइन में भेंजने का कार्य करता है।

सहायक लाइन
ये अस्थाई होती है। इनका उपयोग विशेष स्थलों तक जल पहुँचाने के लिए क्रिया जाता है, जैसे उदाहरण, उस्ताद शाला आदि।

कपालर
इनका उपयोग मुख्य पाइप लाइन तथा सहायक
पाइप लाइनों और नॉजल को जोड़ने के कार्य में होता है।

स्थिक ताकत हैः

इसमें जल ताकत के साथ पुष्टि के रूप में निकल कर दूर तक फैलता है। ये एक या दो एक साथ हो सकते हैं। ये स्थायी या चूमने वाले होते हैं।

द्रिप (टपक) सिंचाई विधि

जल ही जीवन है। इस तथ्य में सभी परिचित है।

रोपण क्षेत्र में जल के बिना कुछ भी संभव नहीं हैं, अतः सीमित जल खोयों के रहते हमें जल को व्यर्थ बहाव को रोकने एवं जल के सद्दुपयोग पर ध्यान देना पड़ता है। पररंपरागत सिंचाई पद्धति से जल का व्यर्थ बहाव तो होता ही हैं या मिली की उपजाऊ उपरि सतह का क्षरण भी होता है।

वाणीकरण एवं रिसाव से जल की लम्बाई सात प्रतिशत मात्रा नष्ट हो जाती है। द्रिप (टपक) सिंचाई विधि सिंचाई की आधुनिकतम विधियों में से एक है।

यह सिंचाई की नवीनतम पद्धति है तथा इस विधि से पौधों को निष्ठित मात्रा में कम से कम अंतर से जल दिया जाता है। इस विधि में बाणपन, बाणींवर्जन को छोड़कर अन्य कारणों से जल का व्यय नहीं होता है।

इस विधि से जल का गहराई में प्रवेश होता है और जल के वाणीकरण तथा बहाव को कम किया जा सकता है। फलस्वरूप 50 से 70 प्रतिशत तक जल की मात्रा बचाई जा सकती है। इस विधि से रामायणिक खादी धारा में मिलाकर पौधों तक पहुँचाया जा सकता है। इस प्रकार के प्रयोग से मजबूत खादी में बचत होती ही हैं मात्र ही उपज में 30 प्रतिशत तक की वृद्धि प्राप्त की जा सकती है।

द्रिप (टपक) सिंचाई विधि का प्रयोग लगभग सभी प्रकार के फसलों, उद्यानकी फसलों एवं बाणीय क्षेत्रों में सफलता पूर्वक किया जा सकता है।

फलदार खादी के तरह अनेक प्रकार के बाणीय क्षेत्र जैसे नीम, नीलिगरी, पोपलर, खम्हार, सागौन आदि की सिंचाई के लिए यह विधि उत्तम है। द्रिप (टपक) सिंचाई विधि हर प्रकार की मिट्टी जैसे रेतीली एवं काशी मिट्टी में भी सफल मिल गई है। कम वर्षा वाले क्षेत्रों के लिए तो यह विधि वरदान सिंचाई है। उपरोक्त नामों में भी इसका प्रयोग सफलता पूर्वक किया जाता है।

उपरोक्त नामों के अलावा द्रिप (टपक) सिंचाई विधि की कई अन्य विशेषताएं भी हैं जो निम्नलिखित हैं:

1- इस सिंचाई विधि द्वारा पौधों की जड़ों में आवश्यकतानुसार पानी निर्धारित दर से दिया जा सकता है।
2- महंगे रासायनिक खाद व अन्य रसायनों का प्रयोग बांधित गहराई तक किया जा सकता है तथा इसके अनावश्यक बहाव को रोका जा सकता है।

3- पीठों की बढ़वार तेज तथा फल श्रीम व समरूप लगते है।

4- बीन हाउस तथा नर्सरी में भी टपक संचार का प्रयोग सुगमता से किया जा सकता है।

5- पौधा ओजस्वी एवं स्वस्थ रहता है।

**हिंदी संयंत्र के मुख्य अवयव**

1- विद्युत मोटर
2- सेंड फिल्टर
3- स्क्रीन फिल्टर
4- प्रेशर गेज
5- बेनुरी
6- बिभागीय पी.बी.सी. पाइप
7- लेटरल्स

**मलब्रिय**

पौधों के आस-पास तथा तने के चारों ओर की भू-सतह को किसी उपयुक्त सामग्री जैसे पुआज, घास, पत्ती या प्लास्टिक शीट द्वारा ढकने की प्रक्रिया की मलब्रिय कहते हैं। इसका मुख्य उद्देश्य मृदा की सतह से वायपोस्टर्जन से होने वाली नमी के तुकसान को कम करना, खरपतवारों की वृद्धि को रोकना तथा पीठों को दिये जाने वाले खाद व पोषक तत्वों की पूर्ण उपलब्धता प्रदान करना है।

**प्लास्टिक मलब्रिय**

विशेष रासायनिक गुणधर्म के तहत बनी प्लास्टिक शीट (फिल्म) जिनमें मुख्यतः कम पानी वाले पोलीथीन (ए.डी.पी.ई), इथलीन
पौधों का तापमान है और पानी भाप बनकर उड़ता है, जो पानी से भी ज्यादा तापमान होता है, जिसे पौधों के कारण वाले पॉलीथीन (एच.डी.पी.ई) पाल्पिवनाइल के वातावरण (माइक्रोक्लाइमेट) का निर्माण हो जाता है, जिसमे यह बारे में कार्बन डाईऑक्साइड में भी वृद्धि हो जाती है, जो बढ़ते हैं। प्लास्टिक मल्टिचेक की कमी होती है तथा पानी के बचाव का बचाव होता है।

1. काली प्लास्टिक शीट
2. लगभग पारदर्शी प्लास्टिक शीट

काली प्लास्टिक शीट
काली प्लास्टिक शीट (फिल्म) से डंडे मीसम एवं रात के समय मिट्टी की गर्मी सुरक्षित रहती है। ऐसी स्थिति पौधों की बढ़ता तथा खपरतरों के नियंत्रण में सहायक होती है।

लगभग पारदर्शी प्लास्टिक शीट -
पारदर्शी फिल्म से काली फिल्म की अनुक्रिया भूमि का तापमान ज्यादा अन्वश्यक होता है तथा पारदर्शिता के कारण रोशनी भी पार हो जाती है।

प्लास्टिक मल्टिचेक के लाभ
नमी का संरक्षण
प्लास्टिक मल्टिचेक से मृदा तापमान में वृद्धि होती है और पानी भाप बनकर उड़ता है, जो फिल्म के निचली सतह पर जम जाता है। फिर यह पानी बुद्ध बनकर मिट्टी में गिर जाता है। अतः मिट्टी की नमी बनी रहती है, जिसमे पैदावार में बढ़ती होती है। विनामा प्लास्टिक मल्ट के यह संभव नहीं हो पाता है और पानी भाप बनकर उड़ जाता है, जिसमे पैदावार में विचरण के असर पड़ता है।

सिचाई में कमी
प्लास्टिक मल्टिचेक के उपयोग से रोपण क्षेत्र में सिचाई का वारंवार नहीं आता है तथा बहुमूल्य जल का हानि का बचाव होता है।

खपरतरों से बचना
काली (क्लेक) मल्टिचेक शीट से पूर्व के कीरण मृदा की सतह तक न पहुंचने के कारण खपरतरों की वृद्धि काफी कम हो जाती है।

मिट्टी का सोलराइजेषन वर्षात घुस के पूर्ण गुण प्राप्त होना
प्लास्टिक मल्टिचेक के उपयोग से पूर्व के कीरण के गुण वैज्ञानिक तरीकों से मिट्टी में पहुंचते है फलस्वरूप सुमारे जीवाणु, मूलक तथा बकर आदि पौधों के नहीं पनपते है।

मिट्टी की सही संचरण रखने व अधिकतम कार्बन डाईऑक्साइड बनाने रखने में सहायक
प्लास्टिक मल्ट से पूर्व के कीरण के पूर्ण गुण के पास कार्बन डाईऑक्साइड गैस की ज्यादा सादा एक्टिव होती है, जो बढ़ते हैं।
अधिक उत्पादन
मल्न के प्रयोग से उत्पाद की गुणवत्ता के साथ-साथ उत्पादन में भी वृद्धि होती है।

साबधानियां
मल्न्विग के लिये प्लास्टिक शीट का प्रयोग करते समय हमें कुछ बातों का विशेष ध्यान रखना चाहिए -

1. जब तेज हवा चल रही हो तब मल्न फिल्म न बिचारें इससे फिल्म के फटने की संभावना अधिक होती है।

2. मल्न फिल्म को किनारे से लगभग 10 से 15 से.मी. मिट्टी में डाल दें चाहिए ताकि फिल्म उस क्षेत्र में अच्छी तरह जमी रहें।

3. पौधे रोपण से पहले शीट पर फिल्म बिचा ले तथा सुनिश्चित कर लें कि उसमें मिलावट न हो, उसके बाद पौधे हेतु स्थायी दूरी पर फिल्म में छेद करते के पश्चात् छिद्रों पर रोपाई करें।

4. मल्न फिल्म को अत्यधिक गर्मी के समय न बिचारें।

5. पौधों के आक्रामण के कुल क्षत्रिय के 40 से 60 प्रतिशत भू-भाग को मल्न फिल्म से ढकना चाहिए।

6. खेत में लगे वृक्षों पर मल्न्विग करना हो तो वृक्ष के तने की मोटाई के आकार का शीट में छेद करने है तथा फिल्म को एक तरफ से काटकर पौधे के तने के चारों ओर बिचा दें है।
Menace of Parthenium Hysterophorus on agroecosystems and its control measures

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Introduction

Parthenium hysterophorus L., globally known as feverfew, ragweed, kadvigha, carrot weed. It is most popularly known as ‘congress grass’ throughout India while in Hindi speaking belt known by the popular name of ‘gajarghas’ (carrot grass). It belongs to family Asteraceae. The genus name Parthenium is derived from the Latin word ‘parthenice’ a reference to the plant now known as Tanacetumparthenium (L.) Bernh. or ‘feverfew’ the speciesname ‘hysterophorus’ was derived from the Greek word ‘hystera’ (womb) and ‘phoros’ (bearing), referring to the prolific seeding habit of the plant (Parsons and Cuthbertson 1992). It was first time reported from India in 1880 but recognized as a threat in 1955, Pune (Maharashtra) by Professor Paranjpe and introduced due to contaminated PL-480 wheat imported from the United States and Mexico.

Botanical description

It is an annual, erect, profuse branched and short lived herbaceous plant. Height varies between 50-150 cm, stem highly branched; leaf simple with profusely dissected leaflets; flower heads occur on a corymb, phyllaries 10 in 2 series, ovate, dull white, 3-4 mm in diameter; disc floret: numerous, dull white; stamen - 4, anther- exserted; ovary sterile; ray floret: found just opposite to inner phyllaries, only 5 ray florets per flower head, corolla obsolete, stamen-absent, stigma-parted, style short, ovary oval. Fruit cypsela, each flower head bearing 5 cypsela, flat and triangular in shape with thin, white, spoon shaped appendages (Maharjan, 2007). Parthenium weed is a prolific seed producer can produce from 15000 to 25000 seeds (Haselar, 1976; Joshi 1991).
Maharashtra, Madhya Pradesh, Punjab, Tamil Nadu and Uttar Pradesh; medium in Assam, Gujrat, Himachal Pradesh, Jharkhand, Jammu & Kashmir, Uttarakhand, Odisha, West Bengal and Rajasthan; low in Andaman & Nicobar, Arunachal Pradesh, Goa Kerala, Laknadweep, Manipur, Mizoram, Meghalaya, Nagaland, Pondicherry and Sikkim. The weed has been rapidly spread in last twenty years and now it occurs widely along the roadsides, vacant land, disturbed sites, railway tracks sides, wastelands, water courses, agricultural crops, industrial areas, forest areas and even National parks etc.

**Harmful Effects**

i. **Effects on agriculture crops:** This weed has infested about 35 million hectares of land in India. Parthenium plant contains chemicals, like parthenin, hysterin, hymenin, and ambrosin. Presence of these chemicals, the weed exerts strong allelopathic effects on different crops. The weed also affects nodulation in several legume crops due to inhibition of activity of nitrogen fixing and nitrifying bacteria, namely, Rhizobium, Actinomycetes, Azotobacter and Azospirillium. In India, it causes a yield reduction up to 40% in agricultural crops.

ii. **Effect on forests ecosystem:** Earlier, it was not considered a weed of forests but now it has spread rapidly in these areas too. The invasion of Parthenium was reported in forest and wastelands with little or no growth of any other species and local bio-diversity was found to be threatened. Parthenium has been observed in many forest nurseries in Madhya Pradesh. The weed was observed in India at alarming rates by the author during 2010 and 2011 in Pench National Park in Madhya Pradesh. Parthenium has been found responsible to reduce grass availability to herbivores in Corbett National Park in Uttarakhand (India).

iii. **Effects on Animals:** All parts of the Parthenium plant at any stage of growth are toxic to animals. The major component which causes toxicity is ‘parthenin’ and other phenolic acids such as caffeic acid, vanillic acid, anisic acid, p-anisic acid, chlorogenic acid and parahydroxy benzoic acid which are lethal to human beings and animals. It causes anorexia, pruritus, alopecia, diarrhea and eye irritation in dogs. It also causes acute illness, when bittermilk and tainted meat from buffaloes, cows and goats are fed on grass mixed with parthenium. In addition, significant amount (10–50%) of this weed in the diet can kill cattle.
iv. **Effects on Human Beings:** The allergens found in this weed are parthenin, coronopilin, tetraneuris, and ambrosin. Pollens of parthenium cause asthma (allergic bronchitis), especially in children, adults and old age persons. Contact with any parts of the Parthenium plant (such as airborne pieces of dried plant material, pollen or even root) can cause the development of sensitivity as well as the subsequent risk of allergic reactions. Clinically, the Parthenium dermatitis are of three types, as discussed below:

a) The classical pattern, also known as Air Borne Contact Dermatitis (ABCD) affects the face, especially eyelids and/or neck, V of chest, cubital and popliteal fossae.

b) The Chronic Actinic Dermatitis (CAD) pattern involves the exposed areas such as forehead, rim of ears, cheeks, nape of neck, dorsae of forearms and hands as lichenified papules, plaques or papulo nodules with relative sparing of non-sun exposed areas such as eyelids, retro-auricular areas and under surface of chin and depth of the skin folds.

c) The mixed pattern (combination of classical and CAD pattern) manifests as scattered infiltrated scaly papules over the exposed parts and dermatitis over eyelids, flexures of extremities and neck.

### Control of Parthenium Weed

Various methods, e.g. physical, chemical, allelopathic cultural, biological and integrated, which are being practiced to manage this weed around the world as discussed below:

i. **Physical control:** This method is applicable in all type of ecosystems in limited area in spite of high cost involved. Manual uprooting of Parthenium before flowering and seed setting is the most effective method. Physical control involves hand weeding, a time consuming and unpleasant job, made worse by the health hazards involved with handling Parthenium weed. If uprooting is done after the flowering stage, the pulled out plants are to be burnt without transporting too far off places, to avoid seed dispersal.

ii. **Cultural control:** This method may be applicable in crop ecosystem. It has been observed that in some crop fields, Parthenium grows profusely. To reduce the seed bank in such crops, some fast growing species of fodders like barseem and sorghum can be taken to suppress Parthenium and its seed bank in the field.

iii. **Chemical control:** Chemical control is an effective method to control...
Parthenium in the areas where its natural enemies are absent. Use of chemical herbicides, such as chlorimuron ethyl, glyphosate, atrazine, metribuzin and metasulfuron, are known to be very effective in controlling this weed. The application of 2,4-D EE (0.2%) and metribuzin (0.25 and 0.50%) was found more effective in controlling Partheniumat 15 days after spraying (DAS). The timing of chemical control is critical, which is sprayed before flowering in open waste lands, non-cropped areas, railway tracks and road sides.

iv. Allelopathic control: A study in India revealed that Cassia sericea reduces the accumulation of Parthenium by 70% and Parthenium population by 52.5% (Kandasamy and Sankaran, 1997). Another study showed that aqueous extracts from *Imperata cylindrica*, *Desmatachya bipinnata*, *Otcantium annulatum* and *Sorghum halepense* markedly suppressed seedling growth and germination of Parthenium (Javaid et al., 2005).

v. Biological control: It has been considered most effective method against Parthenium in waste land, pasture, orchards and forest ecosystems by introduction of bio agent from the native place of the weeds under classical biological approaches. During last two decades, much emphasis has been given to control Parthenium through various biological agents like pathogens, insects and plants.

a) Control of Parthenium through pathogens: In India, there are many records of various pathogenic and non-pathogenic microorganisms on Parthenium. In spite of the presence of many pathogens, not all have been evaluated as biological control agents against the weed. In Australia, two rust species, *Puccinia abrupta* var. *partheniicola* (Jackson) Parmelee (winter rust) and *Puccinia xanthii* var. *Parthenium hysterophorae* (summer rust) have established in the field, but their prevalence and impact is highly variable and sporadic, depending upon the local climatic conditions.

b) Control of Parthenium through insects: (a) By indigenous insects- In India, many insects have been reported on Parthenium but none of indigenous insect was found host specific yet. A cerembycid *Nupserha* sp. was found to cause widespread damage (5-95%) to Parthenium. (b) By exotic insects: In India in 1983 at
Bengaluru, three insects namely defoliating beetle *Zygogrammabicolorata* Pallister, the flower feeding weevil *Smicronyxlutulentus*Dietz and the stem boring moth *Epiblemastrenuana* (Walker) were imported in India. *S. lutulentus* could not be multiplied in the laboratory while *E. strenuana* was found to complete its life cycle niger crop hence, its culture was destroyed. *Z. bicolorata* involved in controversy about its host specificity due to its occasional feeding on sunflower but after in depth studies under the supervision of Fact Finding Committee constituted by Government of India, the insect was declared safe and ban was lifted for its release.

c) **Control of Parthenium by competitive replacement through plants:** In a nationwide survey under coordinated project sponsored by Department of Biotechnology (DBT), India, plant species namely *Xanthium strumarium, Tephrosiapurpurea, Achyranthes aspera, Vitexnegundo, Cassia sericea, Cassia tora, Cassia spp.* and *Cannabis sativa* were found to be competitive against the weed.

### Integrated Parthenium management

It is clear indicate that Parthenium cannot be managed by adopting any single method. Integrated Parthenium Management (IMP) scheme involving the integration of all the available and low cost methods at different time of the year keeping in view the biology and germination of Parthenium. For example, manual removal involving public participation during rainy season when soil is wet and uprooting is easy, use of chemicals during winter and summer as spot treatment, use of botanical like *Cassia tora* and exotic insect *Z. bicolorata* during rainy season.

### References


जैविक खाद एंव नीम खली वानिकी प्रजातियों की पौध वृद्धि के लिए लाभदायक
ममता मेघान

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आमतौर हम देखते हैं कि किसान ज्यादा से ज्यादा अपनी पशुधन का उत्पादन को लेकर चित्रित रहाते हैं। खेतों में अधिक उत्पादन प्राप्त करने के लिए तरह तरह रामायणिक एवं जहरीने कीनाशक का उपयोग किया करते हैं इसका प्रभाव खादान्य, मूदा स्वास्थ्य एंव पारिस्थितिकी वंश पर पड़ता है। साथ ही भूमि की उर्वरा शक्ति शरी: शर: नए होती जाती है। मृदा की उर्वरा शक्ति को बनाये रखने के लिए प्रयोग द्वारा यह पाया गया कि रामायणिक उर्वरकों के स्थान पर जैविक खादो का उपयोग अधिक लाभदायक होता है।

पौधों की बढ़वार एंव अधिक पैदावार करने के लिए कृषि के साथ साथ कृषिवानिकी क्षेत्र में भी जैविक खाद को अपनाने हेतु प्रोत्साहित किया जा रहा है। जैविक खेती से भूमि में जल धारण, उपजाऊ शरी: मूदा की वृद्धि के साथ साथ भूमि की गुणवत्ता में सुधार आता है। लर्ना में कृषि के साथ साथ वानिकी में वर्मीक्रमस्ट के प्रयोग पर बल दिया जा रहा है। वर्मीक्रमस्ट, जिसे केलुआ खाद के नाम से जाना जाता है। केलुआ खाद में भूमि में पाये जाने वाले तेल, नाइट्राट, पोटेशियम एंव फॉस्फोरस के साथ अंश आवश्यक सुश्रु शैतियम, मेंशियम, लिव्हर, जस्टा, मॉलिब्डम और अधिक मा मा में जैविक कार्बन पाया जाता है। जैविक खाद के लाभदायक परिणामों को देखते हुए वानिकी प्रजातियों महुआ, बहेड़ा, हरा एंव भिलवा के पौध उपलेखी ऊर्जा में इसका अध्ययन किया गया है। विभिन्न अनुपात में जैविक खादों के साथ नीम की खली का प्रयोग कर महुआ, बहेड़ा, हरा एंव भिलवा के पौध उपलेखी ऊर्जा में पौध वृद्धि दर का आंकलन किया गया।

इसका प्रभाव देखते हुए एक परियोजना ली गयी। इस परियोजना के तहत पौतीचीन में विभिन्न अनुपात में गोवर खाद, वर्मीक्रमस्ट के साथ नीम खली का प्रयोग किया गया। पौतीचीन में 2 किलोग्राम का मिश्रण रखा गया। इस मिश्रण
में महुआ, बहेड़ा, हर्रा एंव भिलवा के बीजों को रोपित किया गया। प्रयोजन प्रजातियों की जीवन प्रतिशत एंव पौध वृद्धि वर का अंको निर्माण किया गया।

पौलीधीन में गोबर खाद, बेरैक्स्टोप्स के साथ नीम खली का मिश्रण मिश्रि अनुपात में लिया गया:

1. अनुपातर अर्थत पौलीधीन में मात्र कापू मिट्टी लिया गया है।
2. मिट्टी रेत एंव गोबर खाद का अनुपात (1:1:1) के साथ पौलीधीन में मिश्रण लिया गया।
3. मिट्टी रेत एंव केचुअं◌ा खाद का अनुपात (1:1:1) के साथ पौलीधीन में मिश्रण लिया गया।
4. मिट्टी रेत एंव गोबर खाद का अनुपात (1:1:1) के साथ पौलीधीन में 20 ग्राम नीम खली को डाला गया।
5. मिट्टी रेत एंव गोबर खाद का अनुपात (1:1:1) के साथ पौलीधीन में 50 ग्राम नीम खली को डाला गया।
6. मिट्टी रेत एंव गोबर खाद का अनुपात (1:1:1) के साथ पौलीधीन में 100 ग्राम नीम खली को डाला गया।
7. मिट्टी रेत एंव केचुअं◌ा खाद का अनुपात (1:1:1) के साथ पौलीधीन में 20 ग्राम नीम खली को डाला गया।
8. मिट्टी रेत एंव केचुअं◌ा खाद का अनुपात (1:1:1) के साथ पौलीधीन में 50 ग्राम नीम खली को डाला गया।
9. मिट्टी रेत एंव केचुअं◌ा खाद का अनुपात (1:1:1) के साथ पौलीधीन में 100 ग्राम नीम खली को डाला गया।

इस तरह अनुपातर अर्थत मात्र कापू मिट्टी के साथ पौध वृद्धि का अंको निर्माण करते हुए उक्त अन्य मिश्रणों का पौध वृद्धिके साथ तुलनात्मक अध्ययन किया गया एंव दो वर्ष के निरन्तर अध्ययन से यह पाया गया कि हर्रा प्रजाति के पौधों की वृद्धि मिट्टी रेत एंव केचुअं◌ा खाद के अनुपात (1:1:1) में 100 ग्राम नीम खली के साथ केवल कापू मिट्टी की तुलना में 165 प्रतिशत अधिक पायी गई। जबकि भिलवा में मिट्टी रेत एंव गोबर खाद का अनुपात (1:1:1) के साथ पौलीधीन में 100 ग्राम नीम खली 146 प्रतिशत अधिक पायी गई, इसी प्रकार महुआ में मिट्टी रेत एंव गोबर खाद का अनुपात (1:1:1) के साथ पौलीधीन में 50 ग्राम नीम खली 140 प्रतिशत अधिक पायी गई जबकि बहेड़ा में मिट्टी रेत एंव गोबर खाद का अनुपात (1:1:1) के साथ पौलीधीन में 50 ग्राम नीम खली 132 प्रतिशत अधिक पायी गई।
इसी तरह उक्त उपयुक्त उपचारों में महुआ, बढ़ड़ा, हरा एंव भिलवा में केवल कापू मिट्टी की तुलना में 55 से 78 प्रतिशत तक अधिक पौध जिवित प्रतिबन्धता पायी गयी। उपरोक्त परिणामों से यह स्पष्ट होता है कि महुआ, बढ़ड़ा, हरा एंव भिलवा में पौधों की वृद्धि एंव जिवित प्रतिबन्धता में वृद्धि के लिए पौधीरीन मे नीम खली का प्रयोग कोई सार्थक हुआ है। इसके साथ ही नीम की खली के प्रयोग से पौधों मे रोग प्रतिरोध क्षमता बढी है। पौधीरीन मिट्टियों के परीक्षण से यह जाना गया है कि इन उपचारों मे पौधे द्वारा नाइट्रोजन, फॉस्फोरस, पोटेशियम एंव बुतर कैल्सियम की पूर्ति हुई है। इन समस्त अवलोकन के पश्चात यह जाना गया है कि केचुआौं खाद गोबर खाद एंव नीम खली का उपयोग पौधे वृद्धि के लिए कारगर है।
Effect of pruning on wildlife and micro-organisms

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Introduction

Silviculture is the science of controlling the growth, composition, quality and quantity of forest vegetation for the full range of forest resource. It considers habitat suitability for threatened or endangered species that need to be sustained while keeping a check on exotic invasive species. It manages the composition and structure of stands and landscapes to alleviate climate-related stresses and to enhance forest capacity. Enabling the indigenous forests to resist, tolerate and adapt to a dynamic environment (Peterson and Anderson 2009). Successful silviculture depends on defined management objectives; most important of all is density management of stands.

Density management

Density management is a part of silvicultural system which balances the site resource availability and demand of stands. The management practices include; thinning of stands that decreases the relative humidity and creates unfavourable conditions for some pathogenic fungi. Saprobic fungi represent largest proportion of fungal species in forest soil. They perform a crucial role in the decomposition of structural polymers of wood, such as cellulose, hemicellulose and lignin, thus contributing to the maintenance of the global carbon cycle. They are also involved in biotic interactions that can be pathogenic, beneficial or neutral for plants and other such organism. It was studied that some pathogenic species such as, Armillaria and Heterobasidion of Kingdom Fungi cause bud and root rot in conifers of Northern Temperate forests, by degrading the lignin and cellulose components of wood.

As per the recorded fungal species, antagonists of Armillaria and Heterobasidionsp. Includes: Mortierellales, Mucorales, P. adametzii, P. citrinum, P. janczewskii, P. spinulosum, T. geodes, and Trichoderma spp. These species of Basidiomycotainhibit the growth of Armillaria and Heterobasidion in (in vitro) paired cultures by; decreasing the extent of root rot caused by Armillaria and necrosis caused by Heterobasidion annosum on tree seedlings. Fungistatic antibiotics produced from these antagonistic fungi are the reason behind their antagonism. Just like some beneficial fungi, there are bacterial sp. like Bacillus and Pseudomonas that degrade the wood constituents, thereby, increasing the wood porosity and permeability (Kwasna et al., 2015).

FOREST THINNING

Another successful management strategy of Silviculture practices is ‘Forest Thinning’. Parts of trees are selectively removed creating gaps, eventually increasing sunlight which improves forest microclimatic condition. Forest thinning has both positive and negative effects on microorganisms. Huge gaps between the trees leads to high temperature differences
in the soil and ambient air, exposing the bacteria and fungi to be attacked by nematodes. In an observatory study of Chinese fir plantation it was reported that soil microbial diversity increases the soil organic carbon content through decomposition of leaf litter, thus, contributing towards maintenance of fertile soil (Ran et al., 2019).

**Pruning**

Next important aspect of silvicultural system is the pruning of roots and stand (Fig. 1), which inadvertently grooms individual of plant species. Root pruning of plants is a method used to adjust the sections above- and belowthe sub-surface. It improves the vegetative and reproductive growth by controlling the expanse of root system. Pruning of root stimulates the germination of a large number of fine roots from the point of incision. Root exudate increase by the incising roots fine, thereby significantly increasing the enzymatic activity and the microbial population. It enhances the effectiveness and supply capabilities of nutrients in the soil resulting in improved soil fertility (Wang et al., 2017).

![Fig:1 Root pruning of plants (Source: Wang.,2017)](image)

Pruning and mowing crops often results in the arthropod movement from cut plant material and enhances flowering in a plant (Letourneau and Altier 1999). On the other hand stand pruning of trees is the practice which is performed in an appropriate manner to control shoot height. It is basically performed to get uniform crop size, better fruit-bud differentiation and faster wound healing with ultra violet light (Hossain et al., 2004). In the case of Pennsylvania’s wildlife; pruning of fruit trees, provided food to many animals like white-tailed deer which fed on apples and black bear. Fallen fruit decayed on the ground and created a favourable environment for earthworms and birds like woodcock (Margaret and Brittingham, 2016).

Trimming and pruning enhances flowering and vegetative capacity of plants. For example, a pruned apical bud removes apical dominance and reduces competition for nutrients in other parts of plants. This may result in development of shoots from a large number of axillary buds. Trimming and Pruning also helps to revert woody plant parts into its juvenile form resulting in increased proportion of young leaves on the pruned rather than on the un-pruned shoots (table 1). It also affects the gall inducing insect population not only by modifying the plant architecture, but also by changing the timing of plant resource availability (Martinez and Wool 2003).

Winter pruning of flowering shoots by pruning a few of old branches is called artificial extinction. This method increases the leaf area of shoots and light
interception through the tree canopy by decreasing the shoot density. Additionally, it improves the physiological autonomy of the flowering shoot, mostly during the period preceding June. Furthermore, it enhances the carbon assimilation in fruits and flowers. Cutting the heads of trees induces the formation of reiterated complexes, which recommence the structural vegetative framework of the tree. In this way, enhancing the shoot type and leaf area distribution of the tree (Stephan et al., 2007).

On the other hand, the nests of songbird that are tiny and camouflaged might get destroyed due to tree trimming. Therefore, it is advised to prune trees in winter around their dormancy.

### Table 1: Length of long vegetative shoots (LVS) on non-pruned and pruned *Malus domestica* (Apple tree) (Stephan et al., 2007).

<table>
<thead>
<tr>
<th>Tree manipulation</th>
<th>N</th>
<th>Vegetative shoot length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L- trees pruned shoots</td>
<td>9</td>
<td>19.59</td>
</tr>
<tr>
<td>L- trees non-pruned shoots</td>
<td>9</td>
<td>16.87</td>
</tr>
</tbody>
</table>

Where, N= number of shoots in a tree

Summer pruning has been used as a way to manage ripening in fruit trees. This has proven to be a very effective method of controlling the growth of the tree, increasing its flowering, and enhancing the colour of the fruit for economic benefit. Not only this, this method is also effective in enhancing the soluble solids concentration and flower bud formation while decreasing titratable acid content. On the downside, summer pruning reduces cold hardiness of buds, carbohydrate levels, fruit size and promotes trunk enlargement and potentially removes 35% to 45% of the total tree leaf area. The significant loss of leaf area on summer-pruned Peach tree may lead to a reduction in the carbohydrate and nutrient element concentrations in tissues and thus limit the growth of trees. It was reported in previous pruning studies that summer pruning on apple, almond, peach, and apricot trees decreases yield efficiency compared to winter pruning (Martinez and Wool 2003).

South (1998) studied the water-saving property of pruning while focusing on the intensity of pruning in trees. It was found that the severe pruning of *Grevillea robusta* significantly reduces water demand by narrowing its xylem vessels thus also reducing its hydraulic conductivity and transpiration rate. It improves canopy translucency and adjust the relative proportions of fruit-bearing branches and vegetative shoots. Excessive pruning damages the habitat of wild animals and birds, causes floods and fire; and reduces the filtration rate of CO$_2$ emitted from anthropogenic activities (Rasmussen et al., 2010).
Table 2: Effect of intensity of pruning on height of plant, shoots and length of lateral branches (Jin et al., 2018).

<table>
<thead>
<tr>
<th>Pruning intensity</th>
<th>Plant height</th>
<th>Number of main shoots</th>
<th>Total length of lateral branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe pruning</td>
<td>~160 cm</td>
<td>1</td>
<td>125–175 cm</td>
</tr>
<tr>
<td>Regular pruning</td>
<td>~220 cm</td>
<td>3–4</td>
<td>575–625 cm</td>
</tr>
</tbody>
</table>

Above table represents that severe pruning delays the growth of plant as well as their shoot size and number of branches than the regular pruning.

Top pruning of trees is another drastic process that removes most of the branches down to the trunk. It is commonly used to train young trees to grow healthy (Jin et al., 2018). In a survey of Pacific Northwest nurseries, 90-92% of Bare root pine and Douglas-fir were top pruned to produce plants of a more uniform size and for uniform distribution of sunlight (fig 2) (Demirtas et al., 2010). Total number of buds per tree in citrus fruit plantation in Punjab were recorded higher in lightly pruned (8 feet from ground level) vigorous trees, throughout the growth period, where as the minimum were found in un-pruned trees. The highest percentage of increase in availability of buds was in the month of March (1138.50%) followed by April (184.39%), July (53.43%), May (36.62%), June (36.55%), and minimum (22.88%) was recorded in the month of August (Dhaliwal et al., 2014).

![Effects of pruning on trees](Source: Top Pruning By Thomas D. Landis)

**Silvicultural practises and its impacts**

Silviculture refers to practices that are used to manage the growth and composition of forest vegetation for an array of objectives, such as wildlife habitat, timber, water resources, recreation, and much more. Many silvicultural practices are potentially valuable tools for helping forests respond to a changing climate. Climate changes will modify the environment and cause disturbances affecting forest communities. If these modifications override the adaptive capacity of the forest ecosystem,
these forests and the goods and services they provide are vulnerable. Silvicultural practices play a crucial role in forest management and conserving forest biodiversity. Density management promotes resistant and resilient forest communities improve adaptive characteristics that permit a plant to survive and function when subjected to water deficits, temperature extremes or uncharacteristic disturbance. Pruning is also a very effective tool of silviculture which includes root pruning and stand pruning or tree pruning. The removal of lateral roots through root pruning in closed-canopy poplar induces the germination of new roots and promotes the absorption of nutrients by the root system to enhance the growth of economically important trees. On the other hand, trees contribute to their environment by providing oxygen, improving air quality, climate amelioration, conserving water, preserving soil, and supporting wildlife. Pruning of trees has been used in horticulture to increase the yield, improve the quality of crops and fruits. A pruned tree is capable of creating better environment for animals and other plants and improves wildlife habitat and ecology of forests. This review article was on effects of pruning of trees and plants on wildlife habitat and ecology, improving the quality of tree automatically improves the yield and significantly contributes to the ecology and environment. Pruning in winter season was more preferred than in summer as it removes the tree leaf area as a result carbohydrate and nutrient element concentrations in tissues were decreased and thus it limits the growth of trees.

References


Ran, W., Xiaoqin, C., and Hairong, H., 2019. The Effect of Forest Thinning on Soil Microbial Community Structure and Function, Forests, 10(4), 352.


Role of nutrient cycling in forest ecosystems

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Abstract
Nutrient cycling, an important supporting service contributes 69–89% to total value of ecosystem services. It tracks pragmatic movement of nutrients during various biological processes between biotic and abiotic components of the ecosystem. In forest ecosystems, various factors like its composite species, climate, edaphic factors, fire, harvesting, hurricanes and other natural calamities determines the pace of nutrient cycling. There is a growing demand from policy makers and forest managers for spatial estimates on nutrient cycling at local, regional, and national scales.

Introduction
Plants need light, water, and nutrients during various stages of growth and reproduction. Nutrients are chemical elements which in plants are mostly absorbed by their roots as inorganic chemicals dissolved in water. Non-mineral elements like carbon (C), hydrogen (H), oxygen (O) make up to 95% of the mass in all living organisms and these nutrients are often obtained from water (H₂O) and carbon dioxide (CO₂) in the air. Whereas, among the mineral elements, macronutrients are needed in large quantities to perform basic functions and their availability can limit the growth of an organism. These include the elements (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg).

Micronutrients including boron (B), copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) are still vital for growth and metabolism though required in much smaller amounts than the macronutrients. Nutrient cycle is dominant ecosystem function contributing 69–89% to total value of ecosystem services (Zhao et al., 2004). It is an important supporting service for ecosystem which involves the pragmatic movement of nutrients between physical environment and living organism. It also tracks nutrient usage during various biological processes and the path undertaken by them to recycle back into the environment. As an essential process of an ecosystem, it is involved in exchange of organic and inorganic matter required for growth and decomposition of the living matter. It includes all the biological, geological, environmental and chemical processes and interactions and is also known as biogeochemical cycle.

The role of each nutrient in the cycle is peculiar and depends on an organism’s biological competence, its environment, geology, chemical processes and reactions. Plants and other autotrophs absorb nutrients from soil and water to make their own food using major nutrients such as carbon, hydrogen, and oxygen. Other nutrients needed by plants are nitrogen, phosphorous, potassium, calcium, magnesium, and sulphur. From these basic nutrients, plants and other autotrophs
synthesize, or create, their own nutrients, such as sugars. Other organisms mostly need nutrients created by autotrophs.

**Nutrient cycling in forests**

In forests ecosystems, nutrient cycling is controlled primarily by four key factors: climatic, edaphic, biotic and abiotic. Whereas, animals, plants, fungi and bacteria living above- and below-ground are some of the active and visible players, mineral components of soil, dead leaves and wood, topography, parent material of the soil, even the climatic factors like sunlight, temperature, water from rain and snowfall decides the pace and fate of nutrient cycle.

During its growth, plant absorbs mineral and non-mineral nutrients from the soil through its roots. While some of the accumulated nutrients are returned back to soil in the form of withered branches and leaves, rest are conserved as the net-maintained amount in form of stems and roots. Some nutrients also enter the food chain when transferred from plants to herbivore and there forth but are ultimately transported to soil after the death of plants and animals. Also, different saprophytes likearthropods and earthworms aids in decay and mixing of the decayed material with soil while fungi and other microorganisms breaks down complex compounds returning it back to the atmosphere (Foster and Bhatti, 2006; Keehn, 2017).

**Factors determining pace of nutrient cycling in forests**

**Effect of climate on nutrient cycle**

Climatic factors play major role in determining terrestrial primary productivity and availability of nutrients in different types of forests. As reported by Foster and Bhatti (2006), above ground biomass in boreal<temperate<tropical forests. Although, contrasting trend was observed for forest floor nutrients and residence time, which was seen to increase from tropical to boreal forests. Similarly, nutrient cycling rates are low in subarctic woodland soils and Alaskan taiga forests because of extreme environmental conditions. This can be attributed to the fact that lower altitudes have lower primary productivity and nutrient cycling rates because of permafrost, short growing season, lower soil temperatures and microbial activity which slows rate of litter decomposition and nutrient availability increasing carbon accumulation in the soil(Van et al., 1991). Except in situations with periodic flooding, incidences of fire, soil erosion/ leaching and low litter quality, highly productive tropical forests are alternatingly catered with higher microbial activity throughout the year, resulting in faster decomposition and low carbon storage and higher litter production (Vitousek et al., 1986).

**Effect of composite species on nutrient cycle**

The composite species of a forest or ecosystem differs significantly in their inherent nutrient requirements and usage (Cole et al., 1981). Nutrient cycling is affected substantially by the species of a forest ecosystem thereby differing in accumulation of nutrients in the living and that disposed as the dead phytomass. Besides that, it is also strongly influenced by the quantity and quality of litter produced in a forest.Trees may obtain organic nitrogen and phosphorous from the soil mycorrhizae or by relocation from older foliage prior to abscission thereby partly reducing their dependence on soil as a source of inorganic nutrients. Litterfall from above-ground vegetation increases from boreal regions to the tropics.
following the gradient of productivity. As in many temperate and boreal forest ecosystems, microbial requirement for nitrogen increases or decreases with labile supplies of soil organic carbon. It has been reported that the increased nitrogen demand by microbes may temporarily decrease its availability to trees during the initial decomposition of forest residues with a wide C/N ratio. The rate of immobilization of nitrogen by the microbes from surrounding soil is relatively rapid for readily decomposable organic matter (needle litter) and slower for recalcitrant material (branches, boles). In temperate and tropical forests, net nitrogen mineralization rates are higher and retention of foliar nitrogen is lower as compared to that in boreal forest soils. Nitrogen limitation of productivity, therefore, is weak in tropical forests and increases from temperate to boreal and tundra forest systems.

**Effect of edaphic factors on nutrient cycle**

Differences in the elemental content of parent material also influence the tree species composition between and within a landscape unit. Heterogeneity within the landscape results in sites differing in microclimatic conditions, and physical and chemical properties, which produces different geochemical reaction rates and pools of available nutrients in soil. Soil type and topographicmicroclimate interactions are also important feedbacks that influence biological processes. The rate of nitrogen mineralization in the soil and low phosphorous availability is a characteristic of geomorphically old, highly weathered tropical, subtropical, and warm temperate soils (Vitousek, 1986). Alternately, soils in glaciated regions are relatively young and rich in weatherable minerals. Type and age of parent material from which the soil is derived influences its base status and nutrient levels. Mineral weathering is an important source of most nutrients for plant uptake, with the exception of nitrogen. But nutrient availability is regulated by the balance between weathering of soil minerals and precipitation, adsorption, and fixation reactions in soil. Edaphic conditions can exert a strong influence on forest productivity and produce considerable variation in nutrient cycling processes. Soils with low N, P, or pH support trees with low litter quality (high in lignin and tannins that bind N) that decomposes slowly. Edaphic limitations may be compensated for by an increase in rooting density and depth. Some late-succession or tolerant species have a shallower root distribution relative to intolerant pioneer species and are adapted to sites where nutrients and moisture are concentrated at the soil surface. In contrast, nutrient uptake from sub-soil horizons is more important in highly weathered warm temperate soils where nutrient depletion takes place deeper in the soil.

**Effect of various other factors on nutrient cycle**

Natural or man induced disturbances such as fire, harvesting, hurricanes, or pests have long lingering effects on nutrient cycling. Intensive wildfires in forests results in horizontal and vertical redistribution of ecosystem nutrients which are induced either due to oxidation and volatilization of living and decomposing plant material, convection of ash particles in fire generated winds, water erosion of surface soils and percolation of solutes through and out of the soil. The relative importance of these processes varies with each nutrient and is modified
by differences in fire intensity, soil characteristics, topography, and climatic patterns. Expressed as a percentage of the amount present in vegetation and litter before fire, the changes often follow the order with, N > K > Mg > Ca > P. Activities like harvesting removes nutrients from the site and interrupts nutrient cycling temporarily. The recovery of the nutrient cycle from harvest disturbance is dependent partly on the rate of re-establishment of trees and competing vegetation. Whereas, re-vegetation may occur within months in the tropics, it takes as long as 2–5 years in temperate regions, and longer in boreal and tundra regions (Keenan and Kimmins, 1993). The loss of nutrients is then followed by the process of recovery which assumes that the soils ability to supply nutrients to plant roots has not been altered by disturbance. If nutrients cannot be supplied by the soil at rates sufficient to at least maintain the rate of growth of the previous forest then fertilizer application may be necessary to maintain site productivity which is not practical in case of natural forests and hence there is reported change in canopy density, land use pattern and deterioration of forests. As the availability of nutrients like nitrogen, Phosphorous and potassium in soil largely determines the leaf area, photosynthetic rate, and net primary production of forest ecosystems. Forest management practices that produce physical and chemical changes in the soil that accentuate the cycle of nutrients between soil and trees, may increase forest productivity. Clear-cut harvesting and site preparation practices (mechanical disturbance, slash burning) remove nutrients from soil in tree components and by increased surface runoff, soil erosion, and off-site movement of nutrients in dissolved form or in sediment transport. In the tropics, potential negative impacts associated with clear felling and slash burning are greatest because a larger proportion of site nutrients are contained in the living biomass. Environmental impacts associated with such practices and forest management in general, are confounded by climatic, topographic, soil, and vegetation diversity associated with the forests. Best forest management practices can be utilized to control negative impacts on nutrient cycling (Foster and Bhatti, 2006).

Valuating nutrient cycling

Nutrient cycling is one of the most significant supporting service for forest ecosystem. There have been limited evidences of any studies and set methodology for estimation of it in India. Literature survey revealed that various authors used different methods like Bait lamina (Von Torne, 1990; Kratz 1998; André et al., 2009; Rožen et al., 2010), Litter bag method (Crossley & Hoglund, 1962; OECD, 2006; Villanyi et al., 2008), Mini container method (Knacker et al., 2003), Near-infrared reflectance spectroscopy (NIRS) (Du & Zhou 2009, Reeves 2010), Stable isotope methods (Sharkovand Lodko, 1977; Tiunov 2007; Hyodo et al. 2010). But all these methods majorly focussed on estimations of organic matter.

Although it is not feasible to directly estimate benefits derived from these services in monetary terms but various indirect methods used to quantify this ecosystem function. Alternative cost method is considered effective method and is been used in estimation nutrient cycling in ecosystem services (Adger et al 1995; Costanza, et al., 1997; SEPA, 1998; Xue and Tisdell, 2001)
Conclusion
It can be concluded that nutrient cycling majorly helps in transformation of matter from one form to another to enable absorption and utilisation in different organisms, it aids in storage and transfer of elements from one location to another. It links biotic with the abiotic elements and vice versa and are responsible for functioning of ecosystems. The wellbeing and stability of any ecosystem and its organisms is highly dependent on its dynamic yet balanced nutrient cycle and hence it acts as valuable part of ecosystem services.

References


and assessment, number 56. Paris: OECD.


Mahogany shoots borer, *Hypsipyla robusta* and its control measures

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Abstract
This article deals with the pest profile of *Hypsipyla robusta* Moore (Lepidoptera: Pyralidae), a potential shoot borer of mahogany, *Swietenia macrophylla* King and *S. mahagony* (L.) Jacq. (family Meliaceae) in seedling stage and young plantation. The management aspect of this insect pest is mentioned.

Key words: Mahogany, *Swietenia macrophylla*, *Swietenia mahagony*, shoot borer, *Hypsipyla robusta*, control measures

Introduction
*Swietenia* species (family Meliaceae), commonly known as ‘mahogany’, are native to tropical America (CABI, 2005). Three species are recognized. The most well-known and widely planted is *Swietenia macrophylla* King, commonly called ‘big-leaved’ or ‘broad-leaved’ mahogany, to distinguish it from the small-leaved *S. mahagony* (L.) Jacq (Fig. 1). The natural distribution of *S. macrophylla* covers south-east Mexico in North America; Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama in Central America; and Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela in South America. *S. mahogony* is common in the Caribbean countries (Nair, 2007). These evergreen trees grow up to 30–45 m tall. The third species, *S. humilis* Zucc., is a smaller tree, 8–10 m in height, and commonly distributed in Central America. The biological boundaries between the three species are not clear-cut and natural hybrids occur (CABI, 2005). *S. macrophylla* is the most widely distributed and the most widely planted of the trees, both in native and exotic locations. It is moderately fast-growing and is usually grown in a 30–40 year rotation. It produces one of the
world’s best furniture timbers. *S. mahagoni* is also raised in plantations, but
to a much lesser extent. Plantations of *S. macrophylla* have been raised in over 40
countries outside its native range, throughout the lowland humid and sub-
humid tropics in South and Southeast Asia, the Pacific Islands, the Caribbean
and tropical Africa (CABI, 2005). In 1995, the plantations covered 151 000 ha
worldwide (Pandey, 1997). Indonesia has about 55 000 ha (Cossalter and Nair, 2000)
and Fiji has 26 500 ha (Kamath et al., 1996).

**Overview of insect pests**

Browne (1968) has mentioned 21 insect species belonging to the order-Coleoptera
(10 species), Hemiptera (1 species), Isoptera (2 species), Lepidoptera (7
species) and Orthoptera (1 species) associated with *S. macrophylla*, whereas 8
insect species belonging to the order-Coleoptera (2 species), Hemiptera (1
species) and Lepidoptera (5 species) associated with *S. mahagoni*. However, in
exotic plantations of mahogany, the dominant pest is a shoot borer, *Hypsipyla
robusta*, which is common to both *S. macrophylla* and *S. mahagoni*. The pest
profile and control measures of this shoot borer are summarized below.

**Hypsipyla robusta** Moore (Lepidoptera: Pyralidae)

*Hypsipyla robusta* (syn. *Hypsipyla pagodella*) is commonly known as
mahogany shoot borer. This insect is widely distributed in the old world tropics
and extending into the subtropics, in the Commonwealth recorded in India, Burma,
Sri Lanka, Pakistan, Malaysia and Nigeria, and also present in most of the other
African and oriental territories (Browne, 1968). Each female lays several hundred
white eggs on leaves, young shoots or

other succulent parts of the host. The larva attains a fully grown length of about 30
mm and is of variable colour with longitudinal rows of black and setiferous
spots. One larva may infest more than one shoot during the course of its development.
The larva is principally destructive as a shoot borer, but also attacks inflorescences
and fruits (Beeson, 1941). Pupation occurs in a cocoon, either within the larval tunnel
or in other sheltered places on the host, The moth is rufous-brown mixed with grey
and black, forewing with veins streaked with black and crossed with zigzag black
lines and patches, hindwing whitish, semi-hyaline, the margin and costal zone darker,
wing expanse 26-32 mm in male and 28-42 in female (Fig. 2). In India, the length
of the life cycle varies from about 1-6 months according to season. The species
usually undergo overwintering as a fourth instar larva.

Fig. 2: Adult moth of mahogany shoot
borer, *Hypsipyla robusta*

Regarding the host plants of *H. robusta*,
21 species have been reported, such as
*Canarium schueinfurthii*, *Carapa
guianensis*, *Cedrela australis*, *C.
mexicana*, *C. multijuga*, *C. odorata*,
*C. sureni*, *C. toona*, *Chukrasia tabularis*,
*C. velutina*, *Entandrophragma angolense*,

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E. utile, Khaya anthotheca, K. ivorensis, Soymida febrifuga, Swietenia candollei, S. macrophylla, S. mahagoni, Toona ciliate, Xylocarpus guianensis and X. moluccensis (Fletcher, 1914; Beeson, 1919; Ardikoesoema and Dilmy, 1956; Brunck and Fabre, 1974; Ramaseshiah and Sankaran, 1994).

H. robusta caterpillars bore into the tips and shoots of several species of high quality timber species. In India, it is a particular pest of mahogany and is capable of causing 100 percent mortality of seedlings and young plantations. The caterpillars destroy the apical shoot causing the tree to form many side branches and frequently a deformed trunk leading to a decreased value of the timber. This insect can destroy plantations.

**Control measures**
Resistant clones/provenances need to be exploited as an element for integrated management of mahogany shoot borer (Cornelius and Watt, 2003; Wightman et al., 2008). According to Mishra (1993), the entomogenous fungus, Beauveria bassiana is a promising pathogen for the biocntrol of this serious shoot borer infesting S. macrophylla in India. Joshi and Jamaluddin (2007) have recommended pruning of attacked shoots in young plantations and regular thinning of young attacked trees. Mohanadas (2000) has suggested spraying of 0.5% Dimethoate (Rogor 30 EC) or 0.1% Phosphamidon (Dimecron 85 SL) for 100% mortality of mahogany shoot borer.

**References**


