International Journal Of

Recent Scientific Research

ISSN: 0976-3031

Volume: 7(11) November -2015

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THE OFFICIAL PUBLICATION OF
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH (IJRSR)
http://www.recentscientific.com/ recentscientific@gmail.com

ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 6, Issue, 11, pp. 7319-7321, November, 2015

International Journal of Recent Scientific Research

RESEARCH ARTICLE

ASSESSMENT OF SOIL SEEDBANK COMPOSITION OF WOODY SPECIES IN MORAGHAT FOREST, JALPAIGURI, INDIA

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ARTICLE INFO

Article History:

Received 06th August, 2015
Received in revised form 14th September, 2015
Accepted 23rd October, 2015
Published online 28st November, 2015

Key words:

Soil, Seed bank, Territorial forest, Quadrate, Woody species, Viable eed, Regeneration.

ABSTRACT

The soil seed bank plays an important role in the natural environment of many forest ecosystems, functioning as natural seed reserves for future regeneration of many plant species. Seed mortality in soil is one of the key factors for the persistence and density fluctuations of plant populations. In restoring forests, the first step is to quantify the actual and potential levels of natural regeneration ability of plant by examining the role of soil seed banks as propagule donors. In present work, soil seed bank assessment of woody plant species was made in Moraghat forests so as to evaluate composition and estimate their regeneration status. A total of 32 quadrates were established in selected four sites of the forest. The quadrates (20m x 20m) were laid along line transects. Composition and status were determined by direct count. Results showed the presence of seeds of 14 plant species in the soil. *Schima wallichii* (DC.) Koth. had the highest seed density and Importance Value Index. The similarity between the soil seed bank, and above-ground vegetation was more or less same in most of the quadrate sites. However natural regeneration ability is very poor in many tree species. Therefore natural regeneration process should be assisted through direct seedling planting.

INTRODUCTION

Ecologically and economically forests are very significant. These provide huge amount of renewable sources which are being utilized by all organisms including human. A forest is usually a large area of land inhabited by trees, shrubs, herbs, climbers and lots of other organisms. The vegetation of forest is uncultivated and it forms the wild growth.. But the world is coming to recognize the grim truith that in many forests vegetation is under extinction risk. Forest vegetation is either severely disturbed by environmental factor or conditions of soil or due to anthropogenic disturbances. The level of such disturbances and the status of regeneration can be determined by the assessment of soil seed bank. Soil seed bank of a forest refers the viable seed reservoir present in soilbed of forest, that would germinate after favourable conditions. Therefore the investigation of the soil seed bank has been considered indispensable part of plant ecology and an active research area of restoration ecology.

The existence of soil seed banks in forests has several ecological consequences:

1. At the population level, the lasting seed reserve in the soil may reduce the local extinction risk of vulnerable species (Venable & Brown, 1988 ; Aparicio & Guisande, 1997).
2. The seed bank is a reflection of past environmental conditions and tends to have a different genetic structure to that of above-ground plants, thus possibly affecting evolutionary trends (Levin, 1990).
3. At the community level, the reservoir of propagules in the forest soil, regenerates the vegetation after disturbances (Hyatt & Casper, 2000).
4. Species with a seed bank may co-exist in temporally variable environments (Pake & Venable, 1995), contributing to the community diversity. In fact, the floristic diversity of a vegetation patch should include the species contained in its soil seed bank (Major & Pyott, 1966).

Present study deals with the soil seed bank of tree species of Moraghat forest range. Though forest does not comprise of tree alone but in most forest ecosystems, tree species play a crucial role in the overall plant diversity. Hence this study enables policy makers and the community to make appropriate interventions in managing this ecologically important forest. To my knowledge there is no documented study on soil seed bank of tree vegetation of Moraghat Forest. Hence this study was designed to abridge the prevailing gap on the seed bank flora of tree vegetation and relate it with the above ground vegetation.

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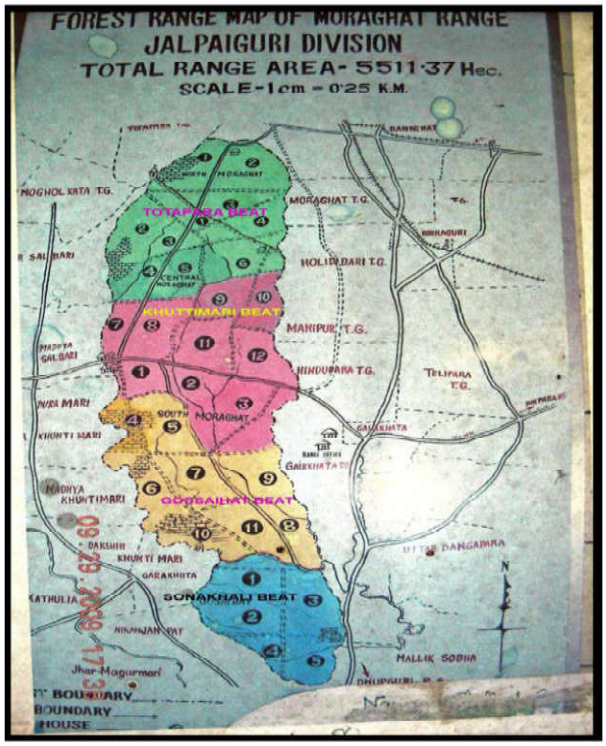


Fig 1 Forest Map of Moraghat Range

MATERIALS AND METHODS

Description of Study Site

The Moraghat forest range is a territorial forest of Jalpaiguri district and is located in close proximity to Gairkata.This range is totally recommended for plantation of commercially important timber plants.Total range area is 5511.37 hectors. The Moraghat forest range (latitude 26°47'28.04"N to 26°37'48.33"N, longitude 88°59'57.38"E to 89°00'55.65"E and 473 to 267 ft. elevation.) has four beats i.e. Totapara, Khuttimari, Gossaihat and Sonakhali (Fig1).Two rivers passes out through the forest, namely,Garati River and Nonai River. The common plant species found here are *Shorea robusta* Gaertn. f, *Schima wallichii (DC.) Koth., Bischofia javanica* Blume, *Toona ciliata* Roem., *Dillenia pentagyna* Roxb., *Lagerstromia perviflora* Roxb., *Sapium baccatum* Roxb.,Acrocarpus fraxinifolius Wight & Arn., *Castanopsis hystrix* A. DC. *Stereospermum colais* L., *Amoora spectabilis* Miq, *Amoora walichii* King., *Lagerstromia speciosa*, *Terminalia alata* Heyne ex Roth., *Tectona grandis* ,*Terminalia arjuna*, *Premna* spp. ,*Terminalia belerica*, *Persia fructifera* Kosterm, *Alstonia scholaris* etc.

Data Collection

The composition of standing vegetation data of Moraghat forest was collected to study the similarity between above ground and soil seed bank flora.

A total of 32 quadrants, 8 quadrants in each of four forest sites were laid at 100 m interval along 1000 m long line transects having quadrant size of 20 m x 20 m (400 m^2) (Esmailzadeh *et al*., 2011). Plant species found within each sampling plot were photo graphed and identified by their vernacular and scientific names, using various books, internet web pages and available articles.

Soil Sampling

Soil seed bank density, diversity, frequency and composition were assessed by collecting 128 soil samples (4 vertically successive layers x 32 plots) from 32quadrants (8 in each four selected forest community sites along 100 m interval of 1000 m long line transects).Soil samples were collected carefully from the 3 separate soil layers, each layer was 3 cm thick (0-3 cm, 3-6 cm and 6-9 cm), totally 9 cm deep as done by using digger and labelled metal rods. The litter layer was included with the soil samples as 4th layer because it contained a high number of seeds (Esmailzadeh *et al*., 2011).

Then persistent seeds in each sample were counted. The samples were taken from five points covering 10cm x 10cm (one at the centre and the other four at the corners) of each 32 sample quadrants. Similar layers from these five points within a quadrant were mixed to form a soil composite in order to reduce variability within the quadrants. The composite sample for each soil layer was again divided into five equal parts among which one was randomly selected for further study. Sampling was completed within two weeks to avoid differences between habitats, and thus any temporal bias in seed availability and composition following the method used by Toledo and Ramos (2011).The samples from each soil layer were used to determine variations of seed distribution at each depth of the soil layers. Soil samples from each layer were picked in to plastic bags and transported for the further study.

Soil samples were first sieved (Dainoua *et al*., 2011) with a mesh size of 2 mm and then using a mesh size of 0.5 mm to recover seeds of various plant species. The recovered seeds were collected into paper bags and taken back to the study area for identification by discussing (asking) with local people and forest guards. Internet web pages were also used to know more about the recovered seeds.

Data Analysis Techniques

In order to analyze the diversity of the seed bank in soil Frequency, Relative frequency, density and Relative density were calculated (Phillips, 1959;Misra *et al*.,1968). Importance Value Index was calculated by adding Relative frequency and Relative density.

$$\text{Frequency}(\%) = \frac{\text{No. of plot in which the species is present}}{\text{Total No. of plots sampled}} \times 100$$

$$\text{Density} = \frac{\text{No. individuals of the species}}{\text{Total No. of plots sampled}}$$

$$\text{Relative Frequency}\ (\%) = \frac{\text{Occurance of the species}}{\text{Occurance of all the species}} \times 100$$

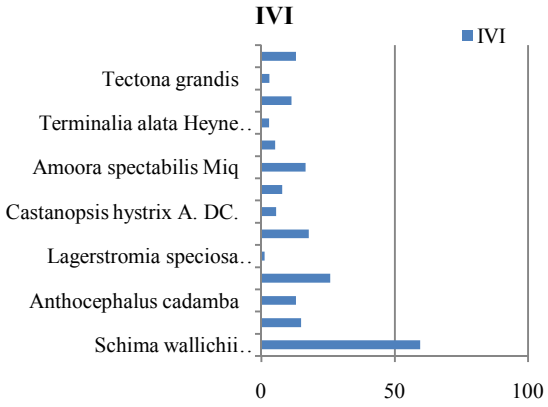
$$\text{Relative Density} = \frac{\text{Density of the species}}{\text{Density of all the species}}$$

IVI= Relative Frequency + Relative Density

RESULTS

Table 1 Frequency, Relative frequency, density, Relative density and Importance Value Index of the soil seed bank

SL. NO	NAME OF SPECIES	DENSITY	FREQUENCY (%)	RELATIVE DENSITY	RELATIVE FREQUENCY	IVI
1	*Schima wallichii* (DC.)Koth.	3.40	75.00	37.07	22.43	59.50
2	*Shorea robusta* Gaertn. f	9.50	31.25	5.52	9.34	14.86
3	*Anthocephalus cadamba*	4.25	25.00	5.52	7.47	12.99
4	*Lagerstromia perviflora* Roxb.	5.57	43.75	12.68	13.08	25.76
5	*Lagerstromia speciosa* Pers.	2.00	3.12	0.32	0.93	1.25
6	*Terminalia belerica* Retz	4.18	34.37	7.47	10.27	17.74
7	*Castanopsis hystrix* A. DC.	2.75	12.50	1.78	3.73	5.51
8	*Stereospermum colais* L.	3.80	15.62	3.08	4.67	7.75
9	*Amoora spectabilis* Miq	7.00	25.00	9.10	7.47	16.57
10	*Amoora walichii* King.	10.00	6.25	3.25	1.86	5.11
11	*Terminalia alata* Heyne ex Roth.	12.00	3.12	1.95	0.93	2.88
12	*Terminalia arjuna*	8.20	15.62	6.66	4.67	11.33
13	*Tectona grandis*	3.50	6.25	1.13	1.86	2.99
14	*Persia fructifera* Kosterm.	4.25	25.00	5.52	7.47	12.99



Graph 1 IVI of of the soil seed bank

DISCUSSION

A total of 14 seeds of standing woody species were recorded from the selected forest sites of Moraghat Range. Almost all the sites, seed bank flora is similar to the above ground flora. However the density and abundance were different in above ground flora and soil seed bank flora.This work indicates that Schima wallichii (DC.) Koth. soil seed bank had highest IVI of 59.50 and. Lagerstromia speciosa Pers. had minimum IVI of 1.25. Though Shorea robusta Gaertn.f, Anthocephalus cadamba, Tectona grandis, Amoora spectabilis Miq and Amoora walichii King. were abundant in above ground flora, but surprisingly their soil seedbank density were very less(Table 1). The seeds of such species are either highly affected by animals or collected by humans as these plants are economically very important. This study also suggested to the followers for the research of germination ability of soil seed bank of the forest range. Hope that, this research help to a better plan of biodiversity conservation and its socio-economic significance for Moraghat forest range and other territorial forests.

Acknowledgements

I convey my thanks to The Chief Conservator of Forest and Divisional Forest Officer of Jalpaiguri for their kind permission. I thank ful to Range Officer and forest guards of Moraghat Range for their cooperation. I also great ful to some of my students for their help in data collection and field study.

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ISSN 0976-3031