World Wide Journal of Multidisciplinary Research and Development

WWJMRD 2015; 1(1): 24-27
www.wwjmrd.com
e-ISSN: 2454-6615

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Seasonal variation of some medicinal and economically important tree species in Baksa district, under a part of Manas biosphere reserve, Assam, India

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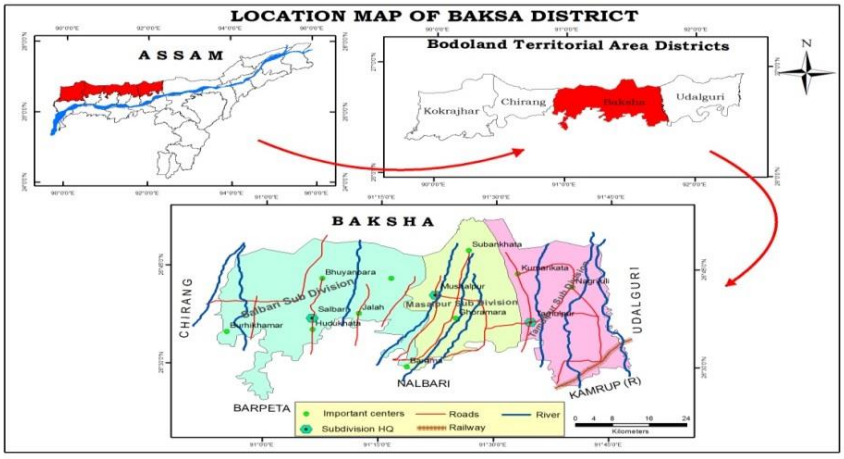
Abstract
Manas Biosphere Reserve (MBR) which is declared by UNESCO in 1989 an area of 2837 Sq. Km. from the district Kokrajhar to Udalguri district of Assam. The whole area covered the BTAD part of Assam with a number of reserve forest.. Baksa is a district of BTAD (Bodoland Territorial Autonomous districts) located in north-western part of Assam. In fact, the district is a curve out of parts of Nalbari, Barpeta, Kamrup and small portion of Darrang district. Total geographic area of the district is 2535.44 sq. km. Topography the district is covered by plain and foothills areas. The district is covered by international boundary of Bhutan in the northern and Barpeta, Nalbari and Kamrup district in the southern part. The east and western boundaries of the district respectively shares with the the district of Udalguri and Chirang. The elevation ranges between 60 meter on south and 720 meter along the Bhutan hills of the north.
Climate is warm and humid with 300-400 cm rainfall average annual rainfall. Temperature ranging between 36^0 C in summer and 6^0 C in winter with 80% of relative humidity. Natural vegetation include mainly four types viz. evergreen and semi-evergreen, deciduous, climbers, herbs, shrubs and grass. Tribal people are the main habitant in the study area and they used the forest product for their livelihood, economic and medicinal purpose. This study focus on some selected tree species and their seasonal variation with the help of phonological data which have medicinal and economic importance in our life.

Keywords: Forest, Biosphere, Vegetation, seasonal variation, tree

1. Introduction
The study area - Baksa district of B.T.A.D. area was formerly encompassed the northern part of Barpeta, Nalbari, and Kamrup district, extending from $26^05^/$ N to $26^051^/$ N latitude and $90^021^/$ E to $91^045^/$ E longitude.It possesses both foothill and plain from topographic point of view. Maximum part of the district in the northern side fall under foothill areas with high density of deciduous and semi evergreen forest, scrub forest and grass land with a rich varieties of medicinal and timber valuable plant species. Though, most part of the study area was rich in good quantum of floristic diversity with various medicinal and endemic species, during the last decades the floristic diversity has been losing its richness due to both anthropogenic and environmental causes.



Phenology is the scientific study of seasonal changes of the periodic phenomenon of organisms in relation to their climate. Different species have different period of germination, vegetation growth, flowering and fruiting, leaf fall, seed and fruitsetting, ect. Such data for the individual species are recorded. A study of the data and time of these events is Phenology. In other words, phenology with calender of event in the life history of plants. These events are known as phanerograms and each phase are known as phenophase.. Thus the phenology of different species may be differ from each other in a community and in each community we find species with different phenology, changing the composition of the community. In rain forest, where there is no seasonal fluxuation some of trees produce fruits and flowers at very regular intervals and the habitants use their phenological events to identify the season on month of the year.The environmental fectors have great influence on the phenological behaviour.

Methodology

Field survey has been carried out to collect the specimen sample from the study area during the period 2010 – 2014. The survey was conducted at regular interval covering all seasons of the year. Voucher specimens were processed and prepared. Herbarium sheets following the methods of Jain & Rao (1977). Specimens were identified with the help of relevant literature namely Hooker (1872-1897), Kanjilal *et. al.* (1934-1940),s Haridasan & Rao (1985, 1987), and Chowdhury (2005). Collected specimens were identified with the help of previously identified specimens GUBH department of botany G.U. and with relevant literature

Result and Discussion

During the field survey researcher have recorded total 47 tree species and observed their phenological circle. All the tree species are evergreen /semi-evergreen and moist mixed deciduous which are found in Bhutan foothill areas and plain forest areas of Baksa district. Researcher have arrange all the tree species in tabular form according to their Botanical name, local name, habit, flowering, fruiting, seed and seedling, germination and their part uses in medicinal or economic importance.

Table: 1 Evergreen/ Semi-Evergreen forest

Botanical and local name of plants species	Habit	Flowering	Fruiting	Seed and Seedling	Germination	Part uses
1. *Hydnocarpus kurzii* (Calmogora)	Tr	Sep-oct Nov-dec	Nov-dec Jan-feb Mar-apr	May-jun	July-Aug	Md
2. *Thespesia populnea* (Parash pipal)	Sm Tr	July-Aug Sep-oct	Nov-dec	Jan-feb	Mar-apr	Timber
3. *Terminalia arjuna* (Arjun gac)	Tr	Mar-apr May-jun	July-aug Sep-oct	Nov-dec	Nov-dec	Md
4. *Terminalia chebula* (shilikha)	Tr	Mar-apr	Mar-apr May-jun July-aug	Sep-oct	Nov-dec Jan-feb	Md
5. *Syzygium malaccansis* (panijam)	Sm Tr	Mar-apr	May-jun	July-aug	Sep-oct Nov-dec	Timber
6. *Syzygium operculatum* (godhajamu)	Sm Tr	Mar-apr	May-jun	July-aug	Sep-oct Nov-dec	Timber
7. *Alstonia scholaris* (chatiyana)	Tr	Mar-apr Sep-oct	May-jun Nov-dec	May-jun Nov-dec	July-aug Jan-feb	Timber Fiber
8. *Holarrhena antidysenterica* (Dudhkhari)	Tr	Mar-apr May-jun	May-jun July-aug		Nov-dec	Md
9. *Wrightia arborea* (Saru Dudhkhari)	Sm Tr	Mar-apr May-jun	May-jun July-aug	Sep-oct	Nov-dec Jan-feb	Md
10. *Actinodaphne abovata* (paticanda, nagabaghnala)	Tr	Sep-oct Nov-dec	Nov-dec	Jan-feb	Mar-apr	Md
11. Cinamomum tamala (Tejpat)	Sm Tr	Mar May	April Jun	April July	Oct Dec	Timber Spices
12. *Cinamomum glanduliferum* (Bar gandhasarboi)	Tr	Mar May	April Jun	April July	Oct Dec	Timber Spices
13. Linsea chinensis (Bagnala)	Tr	Mar-apr May-jun	July-aug	Sep-oct	Nov-dec Jan-feb	Md
14. *Castanopsis armata* (Saru Singgiri,Mekhu)	Tr	Sep-oct Nov-dec	Nov-dec	Jan-feb Mar-apr	May-jun	Timber Fruits
15. *Catstanopsis indica* (Singgiri)	Tr	Nov-dec Jan-feb	Nov-dec	Jan-feb Mar-apr	May-jun	Timber Fruits
16. *Flacourtia cataphracta* (panial)	Sm Tr	Mar-apr	May-jun	July-aug	Nov-dec	Fruits
17. *Garcinia cowa* (Kaourithekera)	Sm Tr	Mar-apr	Mar-apr May-jun	July-aug Sep-oct	Nov-dec Jan-feb	Fruits Spices
18. *Garcinia xanthochymus* (tepal tengga)	Tr	May-jun July-aug	May-jun July-aug Sep-oct	Nov-dec	Jan-feb	Fruits Spices
19. *Terminalia citrina* (Haritika Shilikha)	Tr					Md
20. *Dryptes assamica* (Dukaha)	Tr	Mar-apr	July-aug			Md

		May-jun				
21. *Streblus asper* (Soura)	Sm Tr	Mar-apr May-jun	May-jun July-aug			Md, Timber
22. *Michelia champaca* (Titacapa)	Tr	May-jun July-aug	July-aug Sep-oct	Nov-dec	Jan-feb Mar-apr	Timber
23. *Mesua ferrea* (Nahar)	Tr	May-jun	July-aug	Sep-oct Nov-dec	Mar-apr	Timber
24. *Linsea cinensis*(Baghnal)	Tr	Mar-apr May-jun	July-aug	Sep-oct	Mar-apr	Md, Timber

Note: Md-Medicinal plant

Table: 2 Moist mixed Deciduous

Botanical and local name of plants species	Habit	Flowering	Fruting	Seed and Seedling	Germi nation	Part uses
1. *Dillenia indica* **(**Outenga)	Tr	May-jun	May-jun July-aug	Sep-oct Nov-dec	Jan-feb	Timber Fruits
2. *Dillenia pentagyna* (Oxi)	Tr	May-jun July-aug	May-jun July-aug	Sep-oct Nov-dec	Jan-feb	Timber
3. *Sterculia villosa* **(**Odal)	Tr	Mar-apr	May-jun July-aug	Sep-oct	Nov-dec Jan-feb	Timber
4. *Bridellia stipularis* (Mou-shilikha)	Tr	May-jun	July-aug	Sep-oct	Nov-dec Jan-feb	Md
5. *Terminalia bellirica* (Vomora**)**	Tr	May-jun	July-aug	Sep-oct	Nov-dec Jan-feb	Md, Timber
6. Gmelina arborea (Gameri)		May-jun	May-jun July-aug	July-aug Sep-oct	Nov-dec Jan-feb	Timber,Md
7. *Phyllanthus emblica* (Amlakhi)	Sm Tr	Jan-feb Mar-apr May-jun	July-aug Sep-oct	Sep-oct	Nov-dec	Md
8. *Meyna spinosa* (kotkora)	Sm Tr	Mar-apr May-jun	July-aug	July-aug Sep-oct	Nov-dec Jan-feb	Md
9. *Randia spinosa* (Bihmana)	Sm Tr	Mar-apr May-jun	July-aug	July-aug Sep-oct	Nov-dec Jan-feb	Md
10. *Premma benghalensis* (Gohora)	Tr	May-jun July-aug	July-aug Sep-oct	Sep-oct	Nov-dec Jan-feb	Md
11. *Bridelia retusa*(Kuhir)	Tr	Mar-apr May-jun	July-aug	Sep-oct	Nov-dec Jan-feb	Md
12. *Malotus philippinensis*(Jarath or Sindur tree)	Sm Tr	May-jun	July-aug	Sep-oct	Nov-dec Jan-feb	Md
13. *Phyllanthus fraternus* (Mati amlakhi)	Sm Tr	May-jun July-aug	May-jun July-aug	Sep-oct	Mar-apr	Md
14. *Butea menosperma*(Palakh)	Tr	July-aug	Sep-oct	Nov-dec	May-jun	Md
15. *Dalbergia sisoo*(Sisoo)	Tr	May-jun July-aug	July-aug	Sep-oct	Mar-apr	Md
16. *Schima wallichii*(Nagavel,makari)	Tr	May-jun July-aug	Sep-oct	Nov-dec	Mar-apr	Timber
17. *Morus australis*(nuni gac)	Sm Tr	Mar-apr May-jun July-aug	May-jun July-aug	Sep-oct Nov-dec		Fruits
18. *Ficus glomerata*(Jagya Dimaru)	Tr	Jan-feb Mar-apr May-jun	Mar-apr May-jun		Mar-apr	Timber
19. *Artocarpus chama*(cam kathal)	Tr	Mar-apr May-jun July-aug	Mar-apr			Fruits
20. *Artocarpus lacusha* (Bahat)	Tr	Mar-apr May-jun July-aug	July-aug			Fruits Timber
21. *Ailanthus integrifolia* (Barpat)	Tr	May-jun	July-aug			Timber
22. *Pterospermum acerifolium* (matamarulia)	TR	Mar-apr May-jun	May-jun July-aug	Sep-oct	Nov-dec Jan-feb	Timber
23. Semecarpus anacardium (Vella)	Sm Tr	May-jun	July-aug Sep-oct			Timber

Among the entire 47 tree species 24 number of species are evergreen or semi-evergreen and 23 species are moist mixed deciduous under the habit tree and small tree. Maximum number of recorded tree species the flowering stage the month between March to April and May to June Which are mainly in *Terminalia arjuna* (Arjun gac), *Artocarpus lacusha* (Bahat), *Meyna spinosa* (kotkora), *Syzygium malaccansis* (panijam) etc. But some tree species like *Hydnocarpus kurzii* (Calmogora), *Castanopsis armata* (Saru Singgiri,Mekhu) which flowering season are in the

month of September to December in year. Like flowering stage fruiting stage of maximum plant are in the month of May, June July but some other are the stage come on September to October month. Seedling and germination are also important stage because from this stage a new plant species born. September to October are main stage for seedling of maximum tree species but may June, July, August are also month which some plant have seedling stage going on. November and January are the month which most of plant have germination stage but *Butea menosperma*(Palakh), *Ficus glomerata*(Jagya Dimaru), *Linsea cinensis*(Baghnal) are the some tree species which germination stage going on march april to june. All the recorded tree species have a good medicinal and economic value. All most 22 plants have medicinal importance and remaining other has timber, forest, spices and fruit value.

Conclusion

Baksa district have a good quantum of forest area and all the forest area cover maximum number of medicinal and economically important tree species which are very helpful to our present day life. In whole Assam it is one of the part which have maximum diversity of plant species in forest areas so it is very urgent to conserve this area and protect the tree species. The plant diversity decreased in the disturbed forest area with increase the human settlement and development of transport facilities. Due to forest destruction in the study area, rainfall of that area have slightly change which affect the phenology of plant species especially in flowering time. Though some local NGO have tried to stop the forest destruction and regeneration of deforest areas but it very essential to aware the local people and government to conserve the forest flora and stop cutting tree species in the study are.

Acknowledgement

The author is thankful to department of forest, govt. of Assam and different N.G.O' s of Baksa district to help and support during the field survey and collect information about forest flora in the district. A sincere thanks is also given to Dr. D.K. Jha, Head department of botany, Gauhati University for providing identification facility of herbarium in G.U.B.H.

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