

Population Structure and Regeneration Status of *Dipterocarpus macrocarpus*, *Sapium baccatum* and *Stereospermum personatum* Along three Disturbance Regime in Singphan Wildlife Sanctuary, Nagaland, India

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Abstract The population structure of *Stereospermum personatum*, *Dipterocarpus macrocarpus* and *Sapium baccatum* in undisturbed forest (UD), moderately disturbed forest (MD) and highly disturbed forest (HD) of Singphan wildlife sanctuary, Nagaland consists of seedling, sapling and tree which are 20.16%, 67.4% and 12.4% respectively. The highest density of sapling was recorded in *Dipterocarpus macrocarpus* i.e. 78.23% whereas highest density in seedling was recorded in *Stereospermum personatum* (40%).

Keywords Singphan wildlife sanctuary, Undisturbed forest, Population structure, Regeneration.

Introduction

The population structure and regeneration of plant are important factors for the conservation of biological

diversity. The natural regeneration takes place in forest ecosystem a significant role in the preservation and maintenance of biological diversity [1]. Whereas, the population structure study is useful for predicting regeneration status of species [2]. The regeneration potential is indicated by the presence of number of seedling of any species [3]. The number of seedlings, saplings and young trees in a given population is a good indicator of successful regeneration [4]. The growth status of a species is very important to determine the stability of a forest ecosystem [5, 6]. However, the forests at worldwide level are adversely affected due to anthropogenic pressure that has resulted in change in the population structure and regeneration of forest. The north-eastern region of India, which is a biodiversity rich area, has been adversely affected by various these factors viz. deforestation, farming, encroachment, grazing, human wildlife conflict, forest fire, illicit felling [7].

Similarly, Singphan wildlife sanctuary, an important protected area of Nagaland, has under gone anthropogenic pressure for many decades [8]. At present there are 185 species belong to 86 families found in the wildlife sanctuary [9]. Till now, no detail study has been done in the PA on population structure and regeneration status of forest based on disturbance index, which is an important study from the conservation of biodiversity point of view. This study was conducted from October 2014 to April 2015.

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Materials and Methods

The Singphan wildlife sanctuary is located in Mon district of Nagaland. It covers an area of 23.57 sq km. It is situated within geographical limits of 26°56'49" to 26°54'17" North latitude and 94°52' to 94°56' East longitude.

The vegetation analysis was done at three disturbance regime viz. highly disturbed forest (HD), moderately disturbed forest (MD) and undisturbed forest (UD). The disturbance index was calculated as per Rao et al. [10]. The stratified random sampling was adopted for the study wherein 27 quadrats were laid down in HD, UD (23 quadrats) and MD (15 quadrats). In this study, for woody species 10 m × 10 m quadrats were laid randomly, shrubs (5 m × 5 m) and herbs or seedling (1 m × 1 m). The plant individuals bearing 10 to 30 cm GBH were considered as saplings category whereas individuals with less than 1 m height was considered as seedlings. Herbariums were prepared as per Jain and Rao [11] and identification of the plants was done using published literatures, Flora of Assam [12] and also with the help of the scholars.

Results and Discussion

Population structure and regeneration

The population structure of *Dipterocarpus*

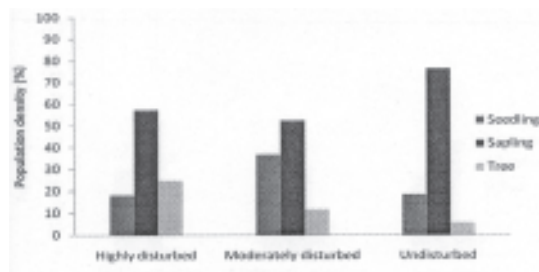


Fig. 1. Population structure of tree species in all the forest types.

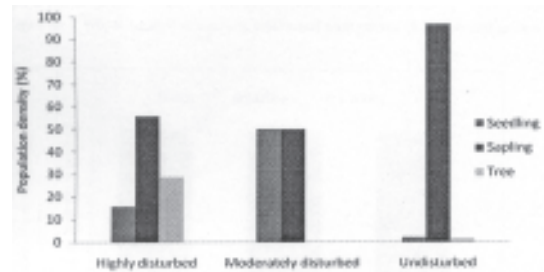


Fig. 2. Population structure of the selected *Dipterocarpus macrocarpus* tree species.

macrocarpus, *Sapium baccatum* and *Stereospermum personatum* in terms of seedlings, saplings and adult trees varied greatly in the three disturbance regime (Fig. 1). In HD, seedling consists of 18.06%, sapling (57.1%) and tree (24.74%). In UD, seedling consists of 18.25%, sapling (76.38%) and tree (5.35%). Whereas in MD, seedling consists of 36.33%, sapling (52.12%) and tree (11.54%) (Fig. 1).

The population structure of *Dipterocarpus macrocarpus*, *Sapium baccatum* and *Stereospermum personatum* in total is consist of seedling which is of 20.16%, sapling (67.4%) and tree (12.4%). In seedling category of the three species, highest the population density was recorded in UD, which is 50.9% followed by (29%) HD and (19.5%) MD, which is lower than the seedling population of forest of Barak valley, Assam that consists of 31–45% in undisturbed forest followed by (18-23%), disturbed forest [13]. On the other hand, the population density of the saplings was noted highest in UD (63.69%), followed by HD

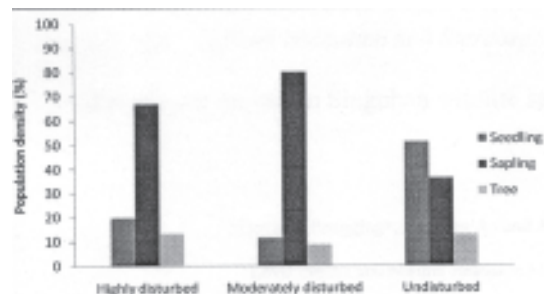


Fig. 3. Population structure of *Sapium baccatum*.

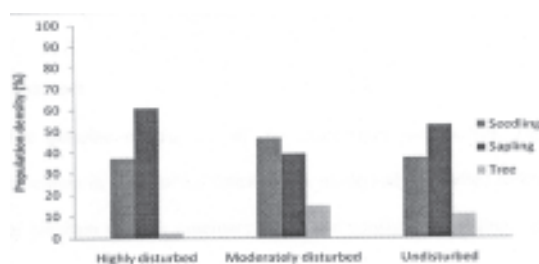


Fig. 4. Population structure of *Stereospermum personatum*.

(27.9%) and lowest in MD (8.4%), which was higher than the sapling population forest of Barak valley, Assam that consists of 7-10% in undisturbed forest followed by (20-21%) disturbed forest [13]. The mature trees were recorded highest in HD (65.6%), followed by UD (24%) with and lowest in MD (10.1%).

The selected three species viz. *Dipterocarpus macrocarpus*, *Stereospermum personatum* and *Sapium baccatum*, show good population structure in the three disturbance regime with seedlings, saplings and adults (Figs. 2, 3 and 4). However, there is a variation in density (ha^{-1}) seedlings, saplings and adults of all the selected tree species in the three disturbance regime (HD, MD and UD). In HD, the seedling of *Dipterocarpus macrocarpus* was recorded highest with 70.18%, followed by *Stereospermum personatum* (19.5%) and *Sapium baccatum* (10.24%). On the other hand, the saplings of *Dipterocarpus macrocarpus* was recorded highest with 78.9%, followed by *Sapium baccatum* (10.89%) and *Stereospermum personatum* (10.20%). The distribution of mature trees was also recorded as

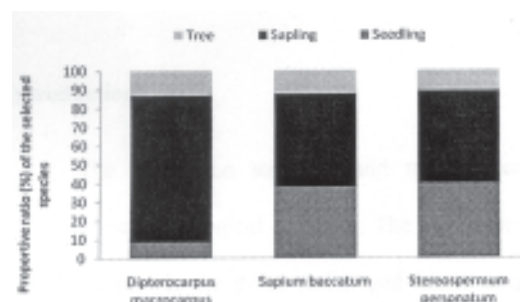


Fig. 5. Proportive ratio of seedling, sapling and adult trees of all the selected species.

Dipterocarpus macrocarpus was recorded highest with 94.1%, followed by *Sapium baccatum* (4.9%) and *Stereospermum personatum* (0.9%). The all three selected species show fair regeneration in HD.

While in MD, seedling of *Stereospermum personatum* was recorded highest with 78.03%, followed by *Dipterocarpus macrocarpus* (12.6%) and *Sapium baccatum* (9%). In sapling stage, both *Stereospermum personatum* and *Sapium baccatum* were recorded highest with 45.6%, followed by *Dipterocarpus macrocarpus* (8%). Whereas in mature trees, *Stereospermum personatum* was recorded highest with 77.94%, followed by *Sapium baccatum* (22.05%). MD shows better regeneration as compared to UD and HD.

Whereas in UD, seedlings of *Sapium baccatum* was recorded highest with 53.9% followed by *Stereospermum personatum* (39%) and *Dipterocarpus macrocarpus* (7%). However, in sapling of *Dipterocarpus macrocarpus* was recorded

Table 1. Population structure and regeneration status of seedlings, saplings and adults (density ha^{-1}) of different tree species in Singphan wildlife sanctuary, Nagaland.

Name of the species	Highly disturbed forest				Undisturbed forest				Moderately disturbed forest			
	Seedling	Sapling	Mature	Total	Seedling	Sapling	Mature	Total	Seedling	Sapling	Mature	Total
<i>Dipterocarpus macrocarpus</i>	226	804	415	1445	39	1804	26	1869	27	27	0	54
<i>Sapium baccatum</i>	33	111	22	166	300	213	75	588	20	140	15	175
<i>Stereospermum personatum</i>	63	104	4	171	217	309	62	588	167	140	53	229
Total	322	1019	441	1782	556	2326	163	3045	214	307	68	589

highest with 77.55%, followed by *Stereospermum personatum* (13.28%) and *Sapium baccatum* (9.15%).

In *Dipterocarpus macrocarpus*, the plant density in UD varies from 39 to 1804, whereas MD (27) and HD (226-804) (Table 1), which is higher than the plant density in UD (951) and HD (97) of Deomali forest division, Arunachal Pradesh [14]. The sapling density is recorded highest (96.5%), followed by seedling and tree in UD. Whereas, in HD, the sapling density is recorded highest (55.6%), followed by trees (28.7%) and seedling (15.6%) (Fig. 2).

In *Sapium baccatum*, the plant density in UD varies from 75 to 300, whereas MD (15-140) and HD (22—111) (Table 1), which is higher than the plant density in UD (7), MD and HD of Deomali forest division, Arunachal Pradesh [14]. The seedling density is recorded highest (51%), followed by sapling (36.22%) and tree (12.75%) in UD. Whereas, in MD, the sapling is recorded highest (80%), followed by seedling (11.42%) and tree (8.57%) (Fig. 3).

In *Stereospermum personatum*, the sapling density is recorded highest (52.5%), followed by seedling (37%) and tree (10.5%) in UD. Similarly, in HD, the sapling density is recorded highest (60.8%), followed by seedling (36.8%) and tree (2%). Whereas, in MD, the seedling density is recorded highest (46.3%), followed by sapling (38.8%) and tree (14.7%) (Fig. 4).

The selected species like *Dipterocarpus macrocarpus*, *Sapium baccatum* and *Stereospermum personatum* show fair regeneration in all the three study stands. *Stereospermum personatum* was recorded as the highest density in seedling (40%), followed by *Sapium baccatum* (38%) and lowest in *Dipterocarpus macrocarpus* (8.6%). However, *Dipterocarpus macrocarpus* was recorded highest density in sapling with 78.23%, followed by *Sapium baccatum* (50%) and lowest in *Stereospermum personatum* (49.4%). Adult trees were recorded highest (13.09%) in *Dipterocarpus macrocarpus* as compared to *Stereospermum personatum* and *Sapium baccatum* with 12% and 10.63% respectively (Fig. 5).

Dipterocarpus macrocarpus, *Sapium baccatum* and *Stereospermum personatum* have a fair regeneration.

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