Community Structure and Regeneration of Sub-alpine *Abies spectabilis* (D.Don) Mirb. Forest in Sagarmatha National Park, Eastern Nepal

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By

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RECOMMENDATION

This is to certify that the dissertation work entitled "**Community Structure and Regeneration of Sub- alpine *Abies spectabilia* (D.Don) Mirb. Forest in Sagarmatha National Park, Eastern Nepal**" has been carried out by Mr. Amrit Bahadur Nagarkoti under our supervision. As to our knowledge, this dissertation work has not been previously submitted for any other degree. Hence, we recommend this dissertation work be accepted for the partial fulfillment of Master of Science in Central Department of Botany from Tribhuvan University, Kathmandu, Nepal.

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EXPERT COMMITTEE

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ABSTRACT

Community structure and regeneration pattern of Himalayan Fir, *Abies spectabilis* (D.Don) Mirb was studied along the elevation gradient 27500 to 3550 m. asl in mixed *Abies spectabilis* forest located between Guranse danda and Khumjung area of Sagarmatha National Park, Eastern Nepal (Central Himalaya). Vegetation in the study area was sampled through systematic random sampling method. A total of 45 plots of 0.1 ha (33 m x 33 m) were sampled between 2750 m to 3550 m each at 100 m elevation interval. Nine vertical transects were defined within the study area and quadrats were located along each transects. Five sampling plots were laid in each elevation one or the both side of the well-established footpath. The location for the first plot in each elevation was chosen on the side of the path where there was at least one mature *Abies spectabilis* tree was. The distance between two transects were between 30-200m.Other plots in the same elevation were laid at a distance of 30-200 m difference. The distance between the plots was determined on the basis of the accessibility and presence of *Abies spectabilis* trees. If *Abies* trees were not observed along the sampling transect,a sidewise search was conducted on either side of the path at the same elevation. Canopy cover, rock cover, logging, lopping, litter and grazing/trampling damage in each quadrat were determined by visual estimation method. Soil samples were collected from each quadrat from its four corners and their physiochemical characteristics were analyzed. Number of woody plant species, number of individuals of each tree species, diameter at breast height (DBH) of each individual tree, number of seedlings and saplings of tree species were recorded in each quadrat. Various community attributes (e.g. importance percentage, species diversity and beta diversity) and population characteristics (e.g. density- diameter bar diagram) were analyzed. Ordination methods were used to analyze species composition and to relate this to environmental variables. Generalized linear models were used to relate community attributes with environmental variables.

Soil was slightly acidic with soil pH value 5.16. Soil carbon and soil nitrogen were 3.05% and 0.27% respectively. Thirty four species were recorded from the study forest. *Rhododendron arboreum* was the dominant tree species with the highest importance percentage (61.91%) and *Abies spectabilis* was the co-dominant species (22.72%). The value of beta-diversity for tree was 1.26. Simpson's Index (0.44) which was less than Shannon Wiener's Index (1.21). Species diversity of the forest was relatively high. Total tree density

was highest at 3450m and lowest at 3550m. Total tree density found changed with increasing elevation but it decreased from 3550 m towards treeline. Density-diameter curve for all trees measured was nearly reverse J- shaped that indicate a continuous regeneration trend. But the slightly deviation in the curve for *Abies spectabilis* alone from the typical reverse J-shaped, indicate a discontinuous regeneration pattern. The seedling and sapling distribution were not found uniform however 40% of the studied sub-plots were with seedlings while 66.67% without sapling and 40% of plot had no *Abies spectabilis* trees. Seedling mortality was found relatively medium and development of seedlings into saplings was also low. The lower number of sapling might be due to moderate disturbance (grazing and trampling) by livestock or environmental factors. Therefore, regeneration of *Abies spectabilis* was not sustainable.

Keywords: Central Himalayan; Community structure; species richness elevation gradient ; regeneration ; *Abies spectabilis*; multivariate analyses; DCA; beta diversity; Simpson's index; density-diameter curve; correlation coefficient matrix; GLM regression.

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ABBREVIATIONS AND ACRONYMS

AsaD	Abies sapling density
AseD	Abies seedling density
ased	Abies seedling density
asap	Abies sapling density
a.s.l.	Above Sea Level
BC	Basal Cover
CANOCO	Multivariate software
Cano	Canopy
°C	Degree Centigrate
Cum	Cumulative
DBH	Diameter at breast height
DCA	Detrended Correspondence Analysies
DHM	Department of Hydrology and Meteorology
Ele	Elevation
F	Frequency
Gra	Grazing
GLM	Generalized Linear Model
IP	Important Percentage
Lit	Litter
Log	Logging
Lop	Lopping
OC	Organic carbon
RBC	Relative Basal Cover
RF	Relative Frequency
RD	Relative Density
RRI	Relative reflective index
SNP	Sagarmatha National Park
Spp	Species richness
ttD	Total tree density
ttBA	Total tree basal area
tseD	Total seedling density
tsaD	Total sapling density