ECOLOGICAL STUDY OF FORESTS IN THE RESUNGA HILL ALONG AN ALTITUDINAL GRADIENT IN NEPAL

A Dissertation Submitted To

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LETTER OF RECOMMENDATION

This is to certify that the works incorporated in this dissertation **"Ecological Study of Forests in the Resunga Hill along an Altitudinal Gradient in Nepal"** submitted by **Mr. Krishna Prasad Pandey** was based on the original research and study under my supervision and guidance. He has worked with sincere interest during his study period. This dissertation work bears the candidate's own work. To the best of my knowledge this dissertation has not been submitted for any other degree.

Therefore, I recommend this dissertation for approval for the partial fulfillment of M. Sc. Degree in Environmental Science.

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LETTER OF APPROVAL

This dissertation paper entitled **"Ecological Study of Forests in the Resunga Hill along an Altitudinal Gradient in Nepal"** submitted by **Mr. Krishna Prasad Pandey** has been accepted as partial fulfillment of M.Sc. Degree in Environmental Science.

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Abstract

The objective of the research was to carry out the ecological study of forests in the Resunga hill along an altitudinal gradient in Central Nepal. An assessment of floristic composition, stand structure and use of forests was done on Northern slope of Resunga Hill (690-2339 m asl), during October-Novemember 2005 and March-April 2006.The study area was divided into four elevation ranges: Upper Tropical Zone(690-1000m), Lower Sub-tropical Zone(1000-1500m),Upper Sub-tropical Zone (1500-2000m) and Lower Temperate Zone (2000-2339m).Twenty eight square quadrates (20 m × 20 m) for tree, fifty six square quadrats (10 × 10 m) for sapling and fifty six square quadrates(5m × 5 m) for seedling were sampled. In 20 m x 20 m quadrats, all trees were measured for diameter at breast height. In 10m x 10m quadrats, saplings were measured for diameter at breast height. The data was analyzed for the stand structure (diameter distribution, basal area, and biodiversity index) and floristic composition (number of species, species relative frequency, and density, dominance and average importance value). The forest soils of the sample plots chosen from different bioclimatic zones were analyzed for texture and soil reaction (pH). The questionnaire survey was adopted to analyze the forest resources use of study area.

There were altogether 43 species of trees and shrubs, representing 23 plant families. There were totally 13, 19, 16 and 12 tree species with 1643,1173,3700 and 3020 pl/ha contributing to a basal area of 40.15, 32.29, 24.69,and 12.71 m^2/ha in the Lower Temperate Zone, Upper Subtropical Zone, Lower Subtropical Zone and Upper Tropical Zone respectively. As regard the composition of forest by altitude, *Shorea robusta* (Average Importance Value = 48.01), *Pinus roxburghii* (Average Importance Value = 22.44), *Lyonia ovalifolia* (Average Importance Value = 21.09) and *Quercus semecarpifolia* (Average Importance Value = 35.18) were the most ecologically important species in the Upper Tropical Zone (UTZ), Lower Sub-tropical Zone (LSZ), Upper Sub-tropical Zone (USZ) and Lower Temperate Zone (LTZ) respectively. Structure described by size (DBH) class distribution showed that the stems frequencies decreased with an increase in diameter at breast height in the Lower Temperate Zone, Upper Sub-tropical Zone and Upper Tropical Zone. This showed better regeneration and brighter future of forest stands in these zones. However, in the Lower Sub-tropical Zone (LSZ) the stem frequencies increased with increase in diameter upto diameter class 10-19.9cm and then decreased with the increase in diameter at breast height. The structure of forest stands in the Lower Temperate Zone, Upper Sub-tropical Zone and Upper Tropical Zone indicated overexploitation of higher girth individuals for firewood and other purposes by the local people. Species diversity (Shannon Weiner's index, H') was higher in Upper Sub-tropical Zone (2.4) than at the other elevational ranges. Similarly, the Evenness (j) was greatest in the Upper Sub-tropical Zone (0.81).This indicated that the Upper sub-tropical Zone had stable vegetation than other zones. Total tree basal area (BA) per hector showed positive relation with elevation. Diversity index did not show any relation with altitude. Average importance value indicated that forest was dominated

by one or two species and the value of evenness showed more or less homogeneous distribution of plants in all the forest stands.

Soil texture in the forest ranged from loams, sand loams, and silt loams.Loam soil (51.1 % sand, 40.1 % silt and 8.8 % clay) was predominant in the Upper Tropical zone and sandy loam (57.1 % sand, 35.1 % silt and 7.8 % clay) in the Lower Sub-tropical Zone. In both the Upper sub-tropical zone and Lower Temperate zone, soil was silt loam (49.1 % and 47.1 % sand, 45.1 % and 47.1 % silt and 5.8 % and 5.8 % clay).The soil pH ranged from very strongly acidic in the Upper sub-tropical zone (4.7), strongly acidic in both the Upper tropical zone (5.5) and the Lower Sub-tropical Zone (5.3) and slightly basic in the Lower temperate zone (7.3).

The dependency of local people on forest was for fuelwood, fodder, water source, recreation and religious importance. The preferred species for fuel wood from this forest were *Quercus semecarpifolia, Schima wallichii*, *Castanopsis indica*, *Rhododendron arboreum* and *Pinus roxburghii*.Similarly, the preferred species for fodder from were *Schima walichii* and *Castanopsis indica.* In comparision to situation 10 years ago, dependency on government managed forests for fuelwood, fodder and grazing had increased in 50% of households due to increase in family size, restriction in use from community forest and decreased supply from farmland. The trend showed that with increasing population, dependence on government managed forests for fuelwood, fodder and grazing will increase in future unless efficient ways of fuelwood and fodder use, alternative energy sources (biogas, solar cell) and more trees in farmland are developed.The study revealed that both the stands structure and floristic composition of Resunga Forest were sensitive to anthropogenic stress (pressure) in all the bioclimatic zones. Due to overexploitation and illicit felling as well as ruthless exploitation, floristic composition and structure of forest stands had been changed. The reduction in average importance value of *Schima wallichii* and *Castanopsis indica* from its natural range i.e. Lower Sub-tropical Zone, absence of tree-sized species from Upper Tropical Zone and much lesser number of higher girth(DBH) class individuals in the Lower Temperate Zone and in the Upper Sub-tropical Zone showed the greater stress in forest stands of these zones.Similarly, the lesser number of small sized trees in the Lower Sub-tropical Zone indicates the stress on forest regeneration Therefore, local control over the management is essential for reducing the stress in plant community structure and ensuring the sustainability of forests products use in the Resunga hill.

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Abbreviations and Acronyms

AVG IVs	Average Importance Values
BA	Basal Area
BPP	Biodiversity Profile Project
BZ	Bioclimatic Zone
C & I	Criteria and Indicator
CBS	Central Bureau of Statistics
CF	Community Forest
CFUG	Community Forest Users Group
cm	Centimeter
D	Density
DBH	Diameter at Breast Height
DFO	District Forest Office
DFRS	Department of Forest Research and Survey
Freq.	Frequency
GMF	Government Managed Forest
GoN	Government of Nepal
H'	Shannon Weiner Diversity Index
Ha	Hectare
HHs	Households
ICIMOD	International Centre for Integrated Mountain Development
ITTO	International Tropical Timber Organization
IVI	Importance value Index
LRMP	Land Resource Mapping Project
LSZ	Lower Sub-tropical Zone
LTZ	Lower Temperate Zone
m asl	Meter above sea level
mm	Millimeter
MOFSC	Ministry of Forest and Soil Conservation

MPFS	Master Plan for Forestry Sector
NARMSAP	Natural resource management support project
NTFPs	Non-timber Forest Products
pl/ha	Plants per hector
RCC	Resunga Conservation Committee
RD	Relative Density
R Do	Relative Dominance
RF	Relative Frequency
SR	Species Richness
USZ	Upper Sub-tropical Zone
UTZ	Upper Tropical Zone
V.D.C.	Village Development Committee