

CARBON STOCK OF SELECTED TREE SPECIES IN A COMMUNITY MANAGED TROPICAL FOREST OF RUPANDEHI DISTRICT, WESTERN NEPAL

**A dissertation Submitted for the partial Fulfillment
of Master of Science in Botany,
Institute of Science and Technology,
Tribhuvan University
Kathmandu, Nepal**

***Submitted by:*
OKMAYA SHRISH
Exam Roll No: 6277
Batch No: 065/068 (2008)
T.U. Regd.No: 5-3-28-19-2008**

**Central Department of Botany,
Tribhuvan University
Kirtipur, Kathmandu, Nepal
October 2012**

RECOMMENDATION

This is to certify that the dissertation work entitled “ **Carbon Stock Assessment of selected tree species in a Community managed tropical Forest of Karahiya VDC, Rupandehi district, Western Nepal**” submitted by **Okmaya Shrish** has been carried out under my supervision. The entire work is primarily based on the results of her thesis work and has not been submitted for any other degree. I recommend this dissertation work to be accepted for the partial fulfillment of Master of Science in Botany.

.....

Dr. Ram Kailash Yadav

Supervisor

Central Department of botany

Tribhuvan University

Kirtipur, Kathmandu, Nepal

10th October 2012

LETTER OF APPROVAL

The dissertation work entitled “ **Carbon Stock Assessment of selected tree species in Community managed tropical Forest of Karahiya VDC, Rupandehi district, Western Nepal**” submitted by **Okmaya Shrish** has been accepted as a partial fulfillment of the requirements for the Masters of Science in Botany (Plant Ecology).

EXPERT COMMITTEE

.....
(Supervisor)

Dr. Ram Kailash Yadav

Associate Professor
Central Department of Botany
Tribhuvan University
Kathmandu, Nepal

.....
Dr. Pramod Kumar Jha

Professor and Head
Central Department of Botany
Tribhuvan University
Kathmandu, Nepal

.....
(External Examiner)

Dr. Mohan Devkota
Associate Professor
Department of Botany
Amrit Science Campus (T.U)
Kathmandu, Nepal

.....
(Internal Examiner)

Dr. Bharat Babu Shrestha
Lecturer
Central Department of Botany
Tribhuvan University
Kathmandu, Nepal

Date of Examination: 14th October 2012

ACKNOWLEDGEMENTS

I express my deepest appreciation, sincere gratitude and deep sense of honour to my respected supervisor Associate Prof. Dr. Ram Kailash Prasad Yadav for his kind support, supervision, constructive suggestion, intellectual support and regular encouragement during the research by devoting his valuable time.

My profound gratitude goes to Dr. Pramod Kumar Jha, Professor and Head of Central Department of Botany, TU, Kirtipur for his administrative support, and I express my gratitude to Prof. Dr. Krishna Kumar Shrestha, former Head of the Department for his support.

I am highly thankful to R.A Mandal for providing the articles related to carbon stock and REDD.

I would like to thank Shivaraj Ghimire for his kind co-operation during lab work. I am also thankful to Krishna Sharma who guide me to run GPS. I am thankful to Sushila Shrestha. I express my thanks to my brother and father who helped me during my field work. My special thanks goes to Janardhan Mainali for his valuable help for creating Map of the study area. I also express my special thanks to Khum Thapa magar for his valuable guide and ideas in data analysis.

I am very much grateful to the authorities of Community Forest , Karahiya VDC for granting me permission to work in the forest. This M.Sc. dissertation has been possible with the financial support provided by Cornell Nepal Study Programme (CNSP). I am extremely thankful to the generosity extended by the CNSP.

Finally, I heartly express my thanks to my beloved parents for their continuous support, encouragement and inspiration for the completion of my master degree.

October 2012

Okmaya Shrish

ABSTRACT

Forest ecosystems play a critical role in the global carbon cycle, sequestering CO₂ through photosynthesis and storing carbon in plant biomass and in soil organic matter. So, forests have a significant potential to capture carbon and thus could play important role in climate change mitigation. Tropical forest also plays a significant role in carbon stock and climate change. For the present study four forest sites (1,2,3 and 5) was selected out of the seven sites of the community forest,(1,2,3,4,5,6and 7) , sites 1 and 2 were dominated by *Dalbergia sissoo* and sites 3 and 5 were dominated by *Shorea robusta*. The forest sites 1and 2 was collectively taken as the *Dalbergia sissoo* dominated sites, similarly site 3and 5 was collectively taken as *Shorea robusta* dominated sites. For this study about 32 Quadrats of size 10×10m were laid randomly. Altogether biomass and soil carbon stock of 16 Quadtrats of each dominated site were compared. The biomass was converted to carbon stock. Soil was sampled from the depth of 0-10cm and 10-20cm in each site. Total of 64 soil samples were collected. The sampled soils were air dried and brought to the laboratory for the further analysis. Bulk density and soil carbon stock were calculated at different horizontal depth of 0-10cm and 10-20cm. Then, biomass carbon and soil carbon were summed up to get total carbon stock.

The mean biomass, biomass carbon stock and soil carbon stock of the selected sites of Community Forest of Karahiya VDC were 436.60 Mg/ha, 205.12C Mg/ha, 66.21 C Mg/ha. From the research it was found that the total mean biomass carbon stock was not significantly different in sites dominated by *Dalbergia sissoo* and *Shorea robusta*. The total mean biomass carbon stock were 221.70 C Mg/ha and 188.55Mg/ha in the *Dalbergia sissoo* and *Shorea robusta* dominated sites. The mean soil carbon stock in *Shorea robusta* dominated sites of the forest was significantly higher (81.40 Mg/ha) than in the *Dalbergia sissoo* dominated sites (51.00 Mg/ha). Soil carbon stock and soil bulk density were not significantly different with depth. The bulk density at different depth were not significantly different 0.935 gm/cm³ at 0-10cm and 0.944 gm/cm³ at 10-20cm. The total mean bulk density in *Dalbergia sissoo* and *Shorea robusta* dominated site were not significantly different 0.957 gm/cm³ and 0.922 gm/cm³.

Keywords: Tropical Community forest, *Dalbergia sissoo*, *Shorea robusta*, Biomass carbon stock, Soil carbon stock.

Contents

	Page
Recommendations	
Letter of Approval	
Acknowledgement.....	i
Abstract.....	ii
Contents.....	iii
List of tables.....	vi
List of figures.....	vi
Photo plate.....	vii
Acronyms.....	viii
Chapter 1: Introduction.....	1
1.1 Background.....	1
1.2 Carbon stock in forest vegetation.....	3
1.3 Carbon stock in forest soil.....	4
1.4 Carbon stock in community forest	5
1.5 Rationale of study.....	6
1.6 Research Questions.....	7
1.7 Objectives.....	7
1.8 Limitations.....	8
Chapter 2: Study Area.....	8
2.1 Geographical location topography and elevation.....	8
2.2 Climate.....	8
2.3 Vegetation.....	12
Chapter 3: Materials and Methods.....	13

3.1 Description of studied sites of the forest.....	13
3.2 Site selection and Biomass sampling.....	16
3.2.1 Estimation of Basal Area.....	17
3.2.2 Estimation of Tree Trunk Volume (TTV).....	18
3.2.3 Estimation of biomass.....	18
3.2.3.1 Above ground tree biomass (AGTB).....	19
3.2.3.2 Above ground sapling biomass (AGSB).....	19
3.2.3.3 Below ground biomass.....	20
3.2.4 Total biomass carbon stock.....	20
3.3 Soil Sampling.....	20
3.4 Soil analysis.....	20
3.4.1 Soil bulk density.....	21
3.4.2 Soil organic carbon.....	21
3.5 Soil carbon stock.....	22
3.6 Total carbon stock in forest.....	22
3.7 Statistical analysis.....	22
Chapter 4: Results.....	23
4.1 Basal Area.....	23
4.2 Tree Trunk Volume.....	23
4.3 Biomass.....	24
4.4 Biomass carbon stock.....	26
4.5 Soil bulk density.....	26
4.6 Soil carbon stock	27
4.7 Total carbon stock in the selected sites of the forest.....	28
Chapter 5: Discussion.....	29

5.1 Community forest management.....	29
5.2 Basal Area.....	29
5.3 Tree Trunk Volume.....	30
5.4 Biomass.....	30
5.4.1 Above ground biomass.....	30
5.4.2 Below ground biomass.....	31
5.5 Biomass carbon stock.....	32
5.5.1 Above ground biomass carbon stock.....	32
5.5.2 Below ground biomass carbon stock.....	33
5.5.3 Total biomass carbon stock.....	33
5.5.4 Soil bulk density.....	34
5.5.5 Soil carbon stock.....	34
5.5.6 Total carbon stock in the selected sites of forest ecosystem.....	35
Chapter 6: Conclusion and Recommendation.....	36
References.....	38
Annexes.....
Photo Plates.....

List of Tables

Table No.	Page
Table.1: Number of Seedlings, Saplings and Trees.....	12
Table. 2: Biomass in <i>Dalbergia sissoo</i> and <i>Shorea robusta</i> dominated sites of the forest.....	25
Table. 3: Soil bulk density at different depth (cm) in <i>Dalbergia sissoo</i> and <i>Shorea robusta</i> dominated site of the forest.....	27

List of figures

Figure. 1: Five years (2007- 2011) average minimum-maximum temperature and rainfall of Bhairahawa station.....	9
Figure.2: Map showing study area with reference to Nepal.....	10
Figure: 3. Location map of all the sites of Commuhity forest of karahiya VDC.....	11
Figure. 4: Measurement of tree height by observer using clinometer.....	17
Figure.5. Basal area in <i>Dalbergia sissoo</i> and <i>Shorea robusta</i> dominated sites in forest.....	23
Figure.6: Tree trunk volume in <i>Dalbergia sissoo</i> and <i>Shorea robusta</i> dominated sites of the forest.....	24
Figure.7: Total biomass (Mean \pm S.E) in the <i>Dalbergia sissoo</i> and <i>Shorea robusta</i> dominated site of the forest.....	25
Figure. 8: Total biomass carbon stock (Mean \pm SE) in <i>Dalbergia sissoo</i> and <i>Shorea robusta</i> dominated sites of forest.....	26
Figure. 9: The soil carbon stock (Mean \pm SE) in <i>Dalbergia sissoo</i> and <i>Shorea robusta</i> dominated site of the forest.....	27

Figure.10: Carbon stock in different parts as above ground, root and soil of
Dalbergia sissoo(a) and *Shorea robusta* (b) dominated site of the forest.....28

PHOTO PLATE

Photo 1 : *Dalbergia sissoo* dominated site

Photo 2 : *Shorea robusta* dominated site

Photo 3 : Collection of soil samples.

Photo 4 : Measurement of DBH in sampling site.

ACRONYMES

AGTB	Above ground tree biomass
AGSB	Above ground sapling biomass
ANSAB	Asia Network for Sustainable Agriculture and Bioresources
BA	Basal area
BD	Bulk Density
DBH	Diameter at breast height
CFs	Community Forests
CNSP	Cornell Nepal Study Programme
CO ₂	Carbon dioxide
C Mg/ha	Carbon Metric gram per hectare
GHG	Green House Gases
ICIMOD	International Centre for Integrated Mountain Development
IPCC	Intergovernmental Panel on Climate Change
KCF	Karahiya Community Forest
KP	Kyoto Protocol
LULUCF	Land Use, Land Use Change Forestry
ppmv	parts per million by volume
REDD	Reducing Emission from Deforestation and Forest Degradation
SD	Standard Deviation
SE	Standard Error
SOC	Soil Organic Carbon
TTV	Tree Trunk Volume
UNFCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee