UNIVERSITY OF SOUTHERN QUEENSLAND

AN EVALUATION OF REDD+ IN COMMUNITY MANAGED FORESTS: A CASE STUDY FROM NEPAL

A Dissertation Submitted by

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CERTIFICATION OF DISSERTATION

I certify that the ideas, research works, results, discussions and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted to earn academic awards.

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LIST OF PUBLICATIONS AND AWARDS

List of journal papers during the PhD study

1. **Pandey, S.S**., Maraseni, T.N., Cockfield, G. and Gerhardt, K. 2014. Tree species diversity in community managed and national park forests in mid-hills of Central Nepal. *Journal of Sustainable Forestry* 33,796-813 *(Rank "B" Journal in ERA 2010)*

2. Maraseni, T.N. and **Pandey, S.S.** 2014. Can vegetation types work as an indicator of soil organic carbon? An insight from native vegetation in Nepal. *Ecological Indicators* 46, 315-322 *(Impact factor 3.2)*

3. **Pandey, S.S**., Maraseni, T.N., and Cockfield, G. 2014. Carbon stock dynamics in different vegetation dominated community forests under REDD+: A case from Nepal. *Forest Ecology and Management* 327, 40–47 *(Impact factor 2.76; Rank "A" Journal in ERA 2010)*

4. **Pandey, S.S**., Cockfield, G. and Maraseni, T.N. 2014. Dynamics of carbon and biodiversity under REDD+ regime: A case from Nepal. *Environmental Science & Policy* 38, 272–281 *(Impact factor 3.5)*

5. **Pandey, S.S**., Cockfield, G. and Maraseni, T.N. 2013. Major drivers of deforestation and forest degradation in developing countries and REDD+. *International Journal of Forest Usufructs Management* 14, 99–107

Awards/Scholarships during the PhD study

1. *USQ Publication Excellence Awards* for: **Pandey, S.S**., Cockfield, G. and Maraseni, T.N. 2014. Dynamics of carbon and biodiversity under REDD+ regime: A case from Nepal. *Environmental Science & Policy* 38, 272–281

2. *Student scholarship* to attend IUFRO Conference on Forests for People. Traverse City, Michigan on May 19–23, 2013

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Economy". National Institute of Tropical Botany, Rio de Janeiro, Brazil on March 18–22, 2013

List of conference papers during the PhD study

1. Cockfield, G., Dhakal, A., Maraseni, T.N. and **Pandey, S.S**. 2013. Factors influencing carbon sequestration potential in Nepalese forests and agro-forest. In: *International conference on forests, people and climate: changing paradigm.* Institute of Forestry, Tribhuvan University, Departmente of Forest Research & Survey, Government of Nepal and Faculty of Science, University of Copenhagen. Pokhara, Nepal (August 28–30, 2013)

2. **Pandey, S.S.**, Cockfield, G., Maraseni, T.N., and Subedi, B. 2013. Carbon enhancement in community based forestry: A case from early REDD+ project Nepal. In: Burns, R.C. and Highsmith, J. (Eds.) *Book of Abstracts*. IUFRO Conference on Forests for People. Traverse City, Michigan (May 19–23, 2013) p.55
http://www.recpro.org/assets/Conference_Proceedings/ffp_abstract_book_final.pdf

3. **Pandey, S.S**, Cockfield, G., and Maraseni, T.N. 2013. Conservation of the forests with linking livelihood of local communities and REDD+ in Nepal. In: Burns, R.C. and Highsmith, J. (Eds.) *Book of Abstracts*. IUFRO Conference on Forests for People. Traverse City, Michigan (May 19–23, 2013) p.56
http://www.recpro.org/assets/Conference_Proceedings/ffp_abstract_book_final.pdf

4. **Pandey, S.S.**, Cockfield, G. and Maraseni, T.N. 2013. Economic development activities in community forests and REDD+ in Nepal. In: Major groups-Led Initiative in support of the United Nations Forum on Forests (UNFF) under the theme *Forests & Economic Development: Positioning Forests to Contribute to Green Economy*. National Institute of Tropical Botany, Rio de Janeiro, Brazil (18–22, March 2013) jointly organized by Friends of Siberian Forests, International Tropical Timber Organisation, Government of Brazil and Government of Germany.

ABSTRACT

Deforestation and forest degradation contribute between 10 and 25% of total annual greenhouse gas emissions. The REDD+ program for reducing emissions from deforestation and forest degradation and promoting forest conservation, sustainable management of the forests and enhancement of forest carbon stocks is one mechanism developed in an attempt to mitigate greenhouse gas emissions. Various REDD+ initiatives have been trialled in developing countries, including for community forests (CFs), which are an increasingly common form of resource management. Through the program, incentives are provided to community forest user groups (CFUGs) to encourage changes in management practices likely to increase sequestration stocks. There is, however, limited knowledge about the factors responsible for enhancing carbon stocks in CFs, the likely trade-offs within communities and the potential for increasing sequestration stocks.

The overarching goal of this research is to evaluate the impacts and potential of REDD+ projects in CF systems. Results from this study provide information for the design and development of programs to increase sequestration and conservation benefits in developing countries. This study estimated carbon stocks and change in carbon stock, technical potential (maximum stocks), key factors affecting carbon stock and trade-offs between gains in sequestration and other foregone community benefits. The study covered 105 CFUGs operating within five major dominant vegetation types. Annual data of carbon pools comprising above and below ground biomass were used to analyse carbon stocks and stock changes. Where sufficient data and models for key species were available, the potential carbon stock was estimated. Social, economic and management data, including a review of existing relevant documents, key informant survey and focus group discussion were used to identify major drivers of forest carbon stock changes in CFs and added community effort and foregone cost added for REDD+. Total costs of REDD+ participation were compared with the potential carbon benefits to enable trade-offs to be identified.

This study found variations in sequestration rates between CFUGs. Key variables were species type, canopy cover, elevation, age, forest scale, agriculture landholding size, disturbance levels, biomass extraction and the use of alternative energy sources.

In comparing present carbon stock with the technical potential of carbon stock in forests, the study identified significant potential for REDD+ projects to increase carbon stock in CFs.

On the negative side, changes in management practices added costs to communities, either through loss of forest products or through additional REDD+ activities, to the extent that the pilot REDD + projects were generally not economically beneficial for CFUGs. However, they could be made more beneficial with a reduction in the opportunity cost of community engagement (through scheduling) and the bundling of other non-carbon benefits together with carbon benefits. Outcomes could be improved through reducing 'leakages' resulting from a high dependency on forest resources through strategies such as the promotion of alternative energy sources (e.g. improved cooking stove and biogas).

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ABBREVIATIONS

3PG	Physiological Principle Predicting Growth Model
AGTB	Above Ground Tree Biomass
AGSB	Above Ground Sapling Biomass
AFOLU	Agriculture, Forestry and Other Land Use
ANSAB	Asia Network for Sustainable Agriculture and Bioresources
BEF	Biomass Expansion Factor
BGTB	Below Ground Tree Biomass
BGSB	Below Ground Sapling Biomass
DoF	Department of Forests
C	Carbon
CAI	Current Annual Increment
CBA	Cost Benefit Analysis
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CER	Certified Emissions Reduction
CF	Community Forest
CFUG	Community Forest User Group
cm	Centimetre
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
COP	Conferences of the Parties
DANIDA	Danish International Development Agency
DBH	Diameter at Breast Height
DHM	Department of Hydrology and Meteorology
EU-ETS	European Union Emissions Trading System
FAO	Food and Agriculture Organisation
FCPF	Forest Carbon Partnership Facility
FECOFUN	Federation of Community Forestry Users Nepal
FGD	Focus Group Discussion
FSC	Forest Stewardship Council
FullCAM	Full Carbon Accounting Model

g	Gram
GA	General Assembly
GHG	Greenhouse Gas
GIS	Geographic Information System
GoN	Government of Nepal
GPS	Global Positioning System
H	Height
ha	Hectare
HB	Herb Biomass
HH	Household
ICIMOD	International Centre for Integrated Mountain Development
ICS	Improved Cooking Stove
IPCC	Intergovernmental Panel on Climate Change
kg	Kilogram
LB	Litter Biomass
LPG	Liquefied Petroleum Gas
LSU	Livestock Standard Unit
LULUCF	Land Use, Land Use Change and Forestry
MAI	Mean Annual Increment
MFSC	Ministry of Forests and Soil Conservation
Mg	Mega gram
mm	millimeter
MMF	Morgen-Mercer- Flodin
MPFS	Master Plan for Forestry Sector Nepal
MRV	Measurement, Reporting and Verification
MSY	Maximum Sustained Yield
NARC	National Agriculture Research Coulcil
NARMSAP	Natural Resource Management Sector Assistance Programme
NORAD	Norwegian Agency for Development Cooperation
NSCFP	Nepal Swiss Community Forestry Project
NTFP	Non-Timber Forest Products
ppm	Part Per Million

REDD+	Reducing Emissions from Deforestation and Forest Degradation,Sustainable Management, Conservation and Enhancement of Forest Carbon Stock
PES	Payment for Ecosystem Services
R^2	Coefficient of Determination
REL	Reference Emission Level
SBSTA	Subsidiary Body for Scientific and Technological Advice
SD	Standard Deviation
SOC	Soil Organic Carbon
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UN-REDD	United Nations REDD+
US$	United States Dollar
VDC	Village Development Committee