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APFNet Workshop on Forest Rehabilitation and Management

24 July - 4 August 2017 Siem Reap, Cambodia

1. INTRODUCTION

APFNet's thematic workshops

The Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) is established with the main mission of promoting and improving sustainable forest management and rehabilitation in the Asia-Pacific region. One of the main thrust of APFNet is to strengthen the human resource capacity. This is being accomplished through a number of programmes, including thematic workshops aimed to enhance knowledge especially through sharing of experience gained within and outside the Asia-Pacific region.

From 2009 to 2016, APFNet through its Kunming Training Center has organized thematic training workshops on two themes namely (a) Forest Resource Management and (b) Forestry and Rural Development and hitherto 17 such workshops have trained more than 300 professionals from member economies such as Bangladesh, Brunei, Cambodia, Chile, China, Fiji, India, Indonesia, Lao PDR, Malaysia, Mexico, Mongolia, Myanmar, Nepal, Peru, Philippines, Papua New-Guinea, Sri Lanka, Thailand and Vietnam. These training workshops have become important platforms for knowledge sharing and strengthening inter-economy collaboration in promoting sustainable forest management.

In order to further strengthen the implementation of these training workshops, APFNet has developed a five year strategic plan for 2016 to 2020 with the mission of adding green for Asia and the Pacific. Accordingly every year APFNet-KTC will organize two training workshops on the specific themes (1) Forest Rehabilitation and Management and (2) Forestry and Livelihood Development. Both these themes are key priority areas for almost all the economies in the region. After receiving a high appreciation from regional participants for the trainings workshops in 2016, APFNet-KTC is continually organizing the first training workshop on "Forest Rehabilitation and Management" during 24 July to 04 August 2017 in Siem Reap, Cambodia in collaboration with Institute of Forest and Wildlife Research and Development (IRD) of Cambodia Forestry Administration.

Forest rehabilitation and management

Forest degradation, which is defined as "changes within a forest that affect the structure and functions of the stand or site and thereby lowers its capacity to supply products and services",

remains a major problem in many parts of the world in particular the more densely populated areas in the Asia-Pacific region. It is a complex phenomenon influenced by multiple factors – economic, social, political, institutional and cultural.

Although significant efforts are being made to rehabilitate degraded forests, forests continue to decline, undermining their capacity to produce timber, wood fuel, non-wood forest products and a wide array of ecological services including watershed protection, biodiversity conservation, carbon sequestration and amenity values. In many rural areas forest degradation has severely undermined the ability of land to support livelihood of local communities, accentuating poverty. The Global Partnership on Forest Landscape Restoration estimates the extent of degraded lands worldwide as about 2.00 billion hectares. As per an estimate of the International Tropical Timber Organization (ITTO) there are 500 million ha of degraded primary and secondary forests in the tropics. In addition there are 350 million hectares of tropical forest land, which is so degraded that forest regrowth has not occurred and which are mostly occupied by grasses and shrubs. In South East Asia alone about 117 million ha or over 50% of the forest land is considered as degraded.

Most of forest degradation is caused by unsustainable land use practices. Increasing demand for food and other products has led to cultivation of marginal areas, which lose their productivity rapidly and are then abandoned. Vast stretches of grasslands – especially *Imperata cylindrica* (or Aalang alang) – in South and South East Asia is an outcome of shifting cultivation followed by annual fires that prevent the process of natural restoration. Intensive logging and collection of wood and other products have severely reduced the regenerative capacity of forests and once soil is eroded and micro-climate altered, productivity of goods and services declines rapidly. Faulty water management practices have led to salinization leading to loss of productivity.

Efforts to rehabilitate degraded lands have a long history and a wealth of experience has been gained based on the work done during the last many decades. The recently concluded Paris Agreement on climate change has again highlighted the importance of reducing deforestation and forest degradation which will form an important component under the Intended Nationally Determined Contribution for global emission reduction. There is an urgent need to improve the quality of forest restoration/ rehabilitation at the site/ landscape level and to find effective ways to undertake these activities in the context of broader environmental, social and economic needs and interests.

THE WORKSHOP

It is in the above context that the Institute of Forest and Wildlife Research and Development (IRD) of Cambodia Forestry Administration and APFNet Kunning Training Center

(APFNet-KTC) are jointly organizing this workshop to provide a better understanding of how degraded forest could be rehabilitation in a sustainable way at the site/landscape level.

The workshop is designed for forestry policy makers, planners and managers, specifically working on forest rehabilitation and sustainable forest management in the Asia and Pacific economies. Depending on availability of funds, the total number of invited participants will be limited to 15 from APFNet member economies. The workshop will be held from July 24 to August 04, 2017 in Siem Reap, Cambodia.

Objectives

The main objectives of the Workshop are to:

- 1. Analyze the current status of rehabilitation of degraded forests, the main drivers of degradation and future scenarios for forest rehabilitation in the Asia-Pacific region.
- 2. Identify the current challenges and/ or key issues of degraded forest rehabilitation in terms of policy, institutional, ecological, technical and socio-economic aspects in the Asia-Pacific economies;
- 3. Share experience and lessons learnt from forest rehabilitation and management from the Asia-Pacific economies; and
- 4. Enhance knowledge and skills in the formulation and implementation of forest rehabilitation programmes and projects.

Key Issues and Questions

Taking advantage of the vast experience and knowledge accumulated so far the Workshop will attempt to address the following issues/ questions:

- Are the efforts to rehabilitate/ restore degraded ecosystems making any impact and what is the net effect? Are the efforts able to catch up with the pace of degradation?
- What are the major drivers impacting ecosystem degradation and what should be done to counter them? What are the future scenarios in this regard?
- How do we determine the right level of intervention to ensure a process of sustainable ecosystem rehabilitation?
- What should be done to increase the flow of resources in support of ecosystem restoration? How effective are the international initiatives in support of rehabilitation of degraded forests?

- How do we improve the policy, legal and institutional environment for increased investment in restoration and rebuilding the natural capital?
- What are the key governance challenges in undertaking rehabilitation efforts?
- What is the role of forest rehabilitation in climate change mitigation and adaptation?

Debates and discussions during the Workshop will generate more questions and encourage critical thinking and analyses aimed to provide practical solutions to the problems of forest land degradation.

Main Topics/Areas

The Workshop will attempt to provide a broad analytical framework to assess the current state of forest rehabilitation specifically focusing on the following:

- An overview of degradation, deforestation and rehabilitation, including drivers of degradation and how forest transition has been accomplished.
- Policy and institutional aspects of rehabilitation.
- Forest governance and rehabilitation
- Ecological aspects of rehabilitation and the development in the science and technology of forest rehabilitation
- Landscape approach to forest rehabilitation
- Social dimensions of rehabilitation
- Climate change mitigation and adaptation and forest rehabilitation
- Economic aspects of forest rehabilitation.

WORKSHOP STRUCTURE AND TRAINING APPROACH

The workshop structure is designed to provide the maximum learning opportunity to the participants and the entire thrust will be on dialogue, group work, discussions and field observations.

Thematic Lectures:

Invited experts will provide an in-depth assessment of different aspects relating to forest rehabilitation and management focusing on the main themes.

Participant Presentation:

Participants will make presentations which will outline experience in implementing forest rehabilitation at the economy level or at the programme or project level;

Group Work and Discussions:

Group discussions including panel discussions and argument will be an integral component of the workshop and all participants are encouraged to actively *participate* in these. As part of the group work participants will be required to share information about forestry development and management among the Asia-Pacific economies.

Field Trip:

Field trip forms an integral component of the workshop providing the participants an opportunity to see how forests are managed in Cambodia and the ongoing efforts to rehabilitate and sustainably manage forests.

WORKSHOP OUTPUTS

The Workshop is expected to significantly enhance the knowledge of forestry professionals in designing policies and programmes helping to improve the contribution of degraded forest rehabilitation and sustainable forest management. Participant papers will be edited and published as an important information sharing source for future initiatives and development efforts; it will be disseminated on both APFNet and APFNet-KTC websites at the same time. In addition, a synthesis report as another important workshop output with summarized key issues from workshop discussion will also be accessible to a wider audience.

PARTICIPATION REQUIREMENTS AND APPLICATION PROCESS

Eligibility

The Workshop is open to senior policy makers and planners involved in different aspects of sustainable forest management specifically addressing rehabilitation/ restoration of degraded forest ecosystems. Depending on availability of funds a limited number of participants from other tropical regions will be accepted especially to facilitate sharing of experience. To ensure a better gender balance, female participants are welcome.

For the invited participants, APFNet will cover the costs associated with the Workshop including round-trip economy class airfare for international travel, a full board accommodation, costs of field trips and a small amount of per diem to cover sundry expenses. Participants/ sponsoring agencies will have to bear all other costs including costs of domestic travel, visa and personal expenses.

WORKSHOP VENUE

Name: Angkor Paradise Hotel Address: National Road No. 6, Phum Sala Kanseng, Sangkat Svay Dangkoum, Siem Reap Phone: (855) 63760690 or (855) 63965658 E-mail: info@angkorparadise.net Web: www.angkorparadise.net

CONTACT INFORMATION

For further details about the course and the various arrangements please contact:

Ms. Pan Yao

Programme Officer, APFNet-Kunming Training Center

Southwest Forestry University

Bailongsi 300#, Kunming City 650224, Yunnan Province, China

Email: apfnetktc@apfnet.cn

Tel: (+86) 871 63862840 (office) (+86) 13629635716 (cell)

Ms. Norn Navin

Officer, Institute of Forest and Wildlife Research and Development (IRD)

Forestry Administration (FA), Cambodia

Add: Institute of Forest and Wildlife Research and Development, Forestry Administration, #1019, Hanoi street, Phnom Penh City, Cambodia

Tel: 855-92-264326

E-mail: fr.navin@gmail.com

2. WORKSHOP PROGRAMME

PART 1: Indoor Learning Session (24-28 July & 1-4 August, 2017)

(Angkor Paradise Hotel, Siem Reap, Cambodia)

Time	Agenda	Presenter/ Facilitator			
DAY 1: July 24, 2017 (Monday)					
Whole day:	IRD, APFNet-KTC				
DAY 2: July 25,	2017 (Tuesday)				
08:30 - 09:00	 Opening Ceremony and Welcome Remarks ♦ Remarks by APFNet ♦ Remarks by IRD, Cambodia Forestry Administration ♦ Vote of thanks 	IRD, APFNet- KTC			
09:00 - 09:30	Introduction to the course	Ms. Pan Yao			
09:30 - 10:00	Ice breaker - Getting to know each other	Facilitator			
10:00 - 10:30	Group photo and Coffee break	IRD			
10:30 - 12:00	Lecture 1: An overview of forest rehabilitation Discussion: Q & A	Prof. David Lamb			
12:00 - 14:00	Lunch				
14:00 – 15:30 Lecture 2: Involving stakeholders in rehabilitation of wasteland Discussion: Q & A		Dr. Jaap Kuper			
15:30 - 16:00	Coffee break				
16:00 - 16:40	Participant's Presentation 1: Bangladesh	Mr. Md. Oli Ul Haque			
16:40 - 17:20	Participant's Presentation 2: Bhutan	Mr. Prabhat Kumar Mukhia			
17:20 - 18:00	Overview of presentations and discussion	Prof. David Lamb			

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18:30 – 20:00 Welcome dinner		IRD					
DAY 3: July 26,	DAY 3: July 26, 2017 (Wednesday)						
08:30 - 10:00	Lecture 3: Ecological principles underlying forest rehabilitation and restoration Discussion: Q & A	Prof. David Lamb					
10:00 - 10:30	Coffee break						
10:30 - 12:00	Lecture 4: Various approaches of rehabilitation of seriously degraded forest systems Discussion: Q & A	Dr. Jaap Kuper					
12:00 - 14:00	Lunch						
14:00 - 14:40	Participant's Presentation 3: Cambodia	Mr. Seab Kimsrim					
14:40 - 15:20	Participant's Presentation 4: Fiji	Mr. Apisai Rinamalo Vakacegu					
15:20 - 15:40	Coffee break						
15:40 - 16:20	Participant's Presentation 5: Indonesia	Mr. Nehemia Gurusinga					
16:20 - 17:00	Participant's Presentation 6: Lao PDR	Mr. Somsy Frichithavong					
17:00 - 17:40	Overview of presentations and discussion	Dr. Jaap Kuper					
DAY 4: July 27, 2017 (Thursday)							
08:30 – 10:00 Lecture 5: Improving governance in forest rehabilitation and management Discussion: Q & A		Prof. David Lamb					
10:00 - 10:30	Coffee break						
10:30 - 12:00	Lecture 6: Forest Restoration in Cambodia: Lessons from Forest Restoration and Embellishment of Forest Research Facility Project Discussion: Q & A	Dr. Sokh Heng/ Dr. Edward V. Maningo					
12:00 - 14:00	Lunch						

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14:00 - 14:40	Participant's Presentation 7: Malaysia	Ms. Regina Mariah Jong		
14:40 - 15:20	Participant's Presentation 8: Myanmar	Mr. Win Naing		
15:20 - 15:40	Coffee break			
15:40 - 16:20	Participant's Presentation 9: Nepal	Mr. Krishna Datta Bhatta		
16:20 - 17:00	Participant's Presentation 10: Papua New Guinea	Mr. Charles Pakure		
17:00 - 17:40	Overview of presentations and discussion	Prof. David Lamb		
DAY 5: July 28,	2017 (Friday)			
08:30 - 10:00	08:30 – 10:00 Lecture 7: Landscape approach to forest rehabilitation Prof. David Lam Discussion: O & A			
10:00 - 10:30	Coffee break			
10:30 - 12:00	Lecture 8: The use of remnants of natural forest for large scale forest rehabilitation Discussion: Q & A	Dr. Jaap Kuper		
12:00 - 14:00	2:00 – 14:00 Lunch			
14:00 - 14:40	Participant's Presentation 11: Philippines	Mr. Alfredo Bagamaspad Collado		
14:40 - 15:20	Participant's Presentation 12: Sri Lanka	Mr. Weragoda Arachchilage Chandrasiri Weragoda		
15:20 - 15:40	Coffee break			
15:40 - 16:20	Participant's Presentation 13: Thailand Ms. Wiparat Piewsawat			
16:20 - 17:00	Participant's Presentation 14: Viet Nam	Mr. Kieu Phuong Anh		
17:00 - 17:40	Overview of presentations and discussion	Dr. Jaap Kuper		
17:40 - 18:00	Briefing on field trip arrangement	IRD		
Day 6 to Day 8: July 29 - 31, 2017 (Saturday - Monday)				
Field Visit	Project sites of forest rehabilitation and management in Cambodia	IRD		
Day 9: August 01 2017 (Tuesday)				
08:30 - 10:00	Lecture 9: Forest Degradation and Rehabilitation -Theory & Practices	Prof. Zhang Jinfeng		

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	Discussion: Q & A	
10:00 - 10:30	Coffee break	
10:30 - 12:00	 Introduction of group work/assignment: Information sharing about forestry development and management profiles among economies in the Asia &Pacific Region. Group1 : Cambodia, Lao PDR, Myanmar, Thailand, Vietnam Group 2: Bhutan, Bangladesh, Nepal, Sri-Lanka, Group 3: Fiji, Indonesia, Malaysia, Philippines, PNG. 	Dr. Jaap Kuper Ms. Pan Yao
12:00 - 14:00	Lunch	
14:00 - 15:30	 Group work: 1. Profile of Forest and forestry management mechanism, including: Governmental administrative system at deferent levels (local, regional/provincial and national levels); Policy and legal regulation of forest management and forestry development, and; Definition and types of forestland tenure and ownership. 	Dr. Jaap Kuper Ms. Pan Yao
15:30 - 16:00	Coffee break	
16:00 – 18:00	 Group work: 2. Profile of Forest resources and its changing trend (Changes on forest area over last decade), including: Timber logging and its management regime; Forest plantation and rehabilitation; 3. Profile of forestry industry development, including: Total forestry production outputs, The ways of timber utilization and processing. 	Dr. Jaap Kuper Ms. Pan Yao

Day 10: August 02, 2017 (Wednesday)			
8:30 - 10:00	Lecture 10: Cases of Forest Degradation and Rehabilitation in China Discussion: Q & A	Prof. Zhang Jinfeng	
10:00 - 10:30	Coffee break		
10:30 - 12:00	 Lecture Forest tenure reform and forest rehabilitation and management in China <u>Discussion</u>: Q & A 	Prof. Shen Lixin	
12:30 - 13:30	Lunch		
13:30 – 15:30	 Group work: 4. Profile of protection areas and biodiversity conservation, including: Nature reserve or conservation/protection area, protection forests, national park, forest for other special purpose at different protection levels; Protected rare and endangered animal and plant species. 	Dr. Jaap Kuper Ms. Pan Yao	
15:30 - 16:00	Coffee break		
Group work:5. Profile of Forestry Scientific Research Institutions, including forestry research institutions, with main research fields and outstanding achievements;16:00 – 18:006. Profile of Forestry Education Institutions, including independent forestry universities/colleges, or forestry related forestry universities/colleges and professional training agencies etc.		Dr. Jaap Kuper Ms. Pan Yao	
Day 11: August 03, 2017 (Thursday)			
08:30 – 10:00	 Group presentation: Information sharing on forestry development of economies in the Asia &Pacific Region. Group1 GMS Economies Group2 South Asia Economies Group 3: Pacific Island Economies 	Dr. Jaap Kuper Ms. Pan Yao	

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10:00 - 10:30	Coffee break			
10:30 - 11:00	An overview of the Workshop and Course evaluation	Dr. Jaap Kuper Ms. Pan Yao		
11:00 - 12:00	Closing Ceremony Award of certificates; Vote of thanks 	IRD, APFNet-KTC		
12:30 - 13:30	Lunch			
РМ	Free			
18:30 - 20:00Farewell dinnerIRD, APFNet-KTO				
DAY 13: August 04, 2017 (Friday)				
Whole day: Participants departure				

PART 2: Field Trip (29-31 July, 2017)

The field trip will be arranged by IRD of Cambodia. An important component of the workshop is the field trip providing a learning opportunity for participants to visit project sites of forest rehabilitation and management in Cambodia, these field visiting sites including:

- ♦ Khum Ream Forest Research Station
- ♦ Nursery of Khun Ream Research Station
- ♦ Memorial Tree Plantation
- ♦ Research Plots of Forest Rehabilitation
- ♦ Seed Source Area
- ♦ Seed Orchard
- ♦ Community Nursery
- ♦ Forest Rehabilitation Plot
- ♦ Local Livelihoods

PROGRAMME OVERVIEW APFNet Workshop on Forest Rehabilitation and Management (24 July – 4 August, 2017 Siem Reap, Cambodia)

3. LIST OF PARTICIPANTS

No.	Name	Nationality	Gender	Title/Organization	E-mail
1	Md. Oli Ul Haque	Bangladesh	Male	Assistant Conservator of Forests, Development Planning Unit, Bangladesh Forest Department	oliul_1967@yahoo.com
2	Prabhat Kumar Mukhia	Bhutan	Male	Researcher, Forest Research Sub Centre, in Ugyen Wangchuk Institute of Conservation & Environmental Research, Department of Forests and Park Services, Ministry of Agriculture and Forests - Darla, Chukha	himcha70@gmail.com
3	Seab Kimsrim	Cambodia	Male	Deputy Chief, Forest Soil and Wildlife Research Center, Institute of Forest and Wildlife Research and Development, Forestry Administration	kimsrim71@gmail.com
4	Kong Boravuth	Cambodia	Male	Administration Officer, Siem Reap Provincial Department of Agriculture Forestry and Fisheries	kongboravuthfa@citylink.com.kh
5	Apisai Rinamalo Vakacegu	Fiji	Male	Forestry Officer, Divisional Forestry Office, Harvesting and Extension Division, Ministry of Forest	bissrinamalo@gmail.com
6	Nehemia Gurusinga	Indonesia	Male	Forestry Trainer, Regional Environment and Forestry Education and Training Centre in Samarinda	nehemiagrs@yahoo.com
7	Somsy Frichithavong	Lao PDR	Male	Technician staff, Forest Rehabilitation and Management, Department of Forestry	sy85_youtube56@hotmail.com
8	Regina Mariah Jong	Malaysia	Female	Assistant Director of Wetland Forest Management, Forestry Department Peninsular Malaysia	regina@forestry.gov.my
9	Win Naing	Myanmar	Male	Assistant Director, Forest Research Institute, Forest Department	padauk1555@gmail.com
10	Krishna Datta Bhatta	Nepal	Male	District Forest Officer, District Forest Office, Department of Forest, Ministry of Forest and Soil Conservation, Kapilvastu	sapuran.madan@gmail.com
11	Charles Pakure	PNG	Male	Acting Manager-Projects, Papua New Guinea Forest Authority	cpakure@pngfa.gov.pg
12	Alfredo Bagamaspad Collado	Philippines	Male	OIC, Provincial Environment and Natural Resources Officer (PENRO), Nueva Ecija, Department of Environment and Natural Resource, Nueva Ecija	alfbc2001@yahoo.com
13	Weragoda Arachchilage Chandrasiri Weragoda	Sri Lanka	Male	Conservator of Forests, Silviculture and Forest Management, Forest Department	fimdcf@yahoo.com
14	Wiparat Piewsawat	Thailand	Female	Division Chief of Policy Plan and Budget, Forest Industry Organization (FIO)	i_aun59@hotmail.com
15	Kieu Phuong Anh	Vietnam	Male	Chief of Station, Vietnamese Academy of Forest Science	kieuphuonganhtb@yahoo.com.vn

4. PROFILES OF RESOURCE PERSONS

1. Prof. David Lamb (david.lamb@uq.edu.au)

Prof. David Lamb trained as a forester at the Australian Forestry School and subsequently completed a PhD at the Australian National University. Following graduation he joined the Papua New Guinea Forestry Department where he was mainly concerned with reforestation research. The work was carried out in lowland and highland areas and involved a variety of tree species. He eventually left PNG and joined the University of Queensland where he taught ecology and conservation biology until he retired.

Since retirement he has maintained an association with the University as a member of the School of Agriculture and Food Science as well as with the Center for Mined Land Rehabilitation (www.cmlr.uq.edu). He is also a member of the Tropical Forest and People Research Center at the University of the Sunshine Coast (http://jherbohnforestrygroup.weebly.com/people.html). He has also undertaken consultancies across the Asia-Pacific Region with the World Bank, AusAid and FAO.

His research interests include restoration ecology generally but he has a particular interest in find ways of restoring forests across degraded landscapes, especially in tropical areas. This means developing forms of restoration that generate ecosystem services while also improving the well-being of communities living in these areas. Two of his recent books are Regreening the Bare Hills: Tropical Forest Restoration in the Asia-Pacific Region (Springer; 2011) and Large Scale Forest Restoration (Routledge; 2015).

2. Dr. Jacob Hendrik Kuper (jhkuper@wxs.nl)

Dr. Jaap Kuper (1946) graduated in 1974 from the University of Wageningen, the Netherlands, in forestry and nature management. In 1994 he completed his doctor's thesis on the design of a multifunctional forest management model that included rehabilitation of degraded forest.

The first four years of his professional career he worked on wildlife research and management in Zambia and Thailand. Since then he has been in charge of the management of the Royal Forest Estate in the Netherlands until his retirement in 2013. Since 1995 he has executed short-term consultancies on forest rehabilitation, nature conservation and wildlife management in Asia, Africa, South America and Europe.

He has been member of a series of commissions, boards and advisory committees, including the Foundation for Restoration of Ecosystems in Europe, Foundation Trees for All and the State Forestry Enterprise of the Netherlands. The various memberships provide an excellent and extensive network of professionals. For more information see www.jaapkuper.com.

3. Prof. Zhang Jinfeng (zhjf12114@aliyun.com/1910323166@qq.com)

Prof. Zhang Jinfeng completed his first Master in Agroforestry in the University of Philippines at Los Banos in 1994, and then he finished his second Master in Agricultural Systems in Chiang Mai University from 1996 to 1998. In 2010, he completed a PHD in Human Ecology at Yunnan University of China.

Prof. Zhang now works as Director of Arboretum, Yunnan Academy of Forestry (YAF). As the project leader, he has taken charge of 9 international cooperation projects, 2 national science and technology key projects, 2 national forestry technology extension projects, 2 provincial science and technology research projects, 2 provincial forestry technology extension projects, 4 provincial forestry industry development projects; have bred 5 cultivars of Taxus; developed 2 national standards, and participated in the development of 14 local standards.

His major research areas focus on technology development of plantation and management of native tree resources, restoration of degraded forest. Up to now, a total of 34 research papers and 8 books have been published. He also has been reward:

- State Council Special Award, 2014;
- The 2nd prize of Yunnan Provincial Science and Technology Award, 2013;
- Yunnan Provincial Technology Innovation Talent, 2012;
- Yunnan Provincial Expert, 2011;
- The 1st prize of Diqin prefecture Science and Technology Award, 2011;
- The 3rd prize of Yunnan Provincial Science and Technology Progress Award, 2010;
- The 3rd Prize of Provincial Science and Technology Award, 2008;
- Yunnan Provincial Government Special Award, 2008;
- The 1st Prize of Yunnan Provincial Natural Science Award, 2007;
- The 2nd Prize of Yunnan Provincial Science and Technology Award, 2006.

4. Dr. Sokh Heng (sokhhengpiny@yahoo.com)

Dr. Sokh Heng is currently the Director of Institute of Forest and Wildlife Research and Development of Cambodia. He completed a Bachelor Degree in Forest Economics from the University of Forestry and Agriculture of Ho Chi Minh city of Vietnam in 1995. After returning, he joined the Cambodia's Forestry Administration as technical staff. He got a Japanese Government Scholarship to study in Japan and got his Master and PhD degrees in forest management in 2000 and 2003, respectively.

After rejoining the Forestry Administration, his works most related to both international forest policy process and national forest policies. For the last few years, he has led many project management some of which have focused on forestry rehabilitation and management.

5. Dr. Edward V. Maningo (greenmaker27@gmail.com)

Dr. Edward V. Maningo completed a Master in Environment Science at Silliman University in 2001 and then did a PhD in Technology Management in Cebu Technological University in 2004. Dr. Edward, as one of the topnotcher (7th placer) of the national board examination for Filipino Foresters, his research field of interests and skills focus on as followed:

- Technology and community enterprise incubation assistance;
- Impact assessment/Monitoring and Evaluation;
- NRM and watershed management
- With extensive background on research focusing on food security, value chain, environmental science, sustainable resource management and impact assessment; lecturer on impact assessment on community forestry, watershed management, valuation, spatial analysis/land use planning/GIS; more than 9 years of experience in Cambodia working in various capacities (Technical Advisor, Monitoring and Evaluation on Food Security, Impact Assessment, developing policy brief) on Forestry and Environment projects and climate change awareness raising funded by EU, FAO, UNDP, APFNet, KRC and other Donors;
- Former University lecturer with extensive background on applied statistics/econometrics in impact assessment

6. Prof. Shen Lixin (yafslx@qq.com)

Prof. Shen Lixin, as Executive Director currently working for APFNet-KTC as well as faculty of Southwest Forestry University based in Kunming City, Southwestern China. He used to be Executive Vice-Director of Yunnan Academy of Biodiversity from 2011 to 2014 and worked for National Plateau Wetland Research Center at Southwest Forestry University (SWFU) as research professor during 2010 to 2011. Prior to joining SWFU in 2010, Prof. Shen used to be Assistant President of Yunnan Academy of Forestry and director of forests research institute of YAF. He has conducted numerous researches for nearly thirty years on forest resources management, wetlands and protected area management, biodiversity conservation, degraded forest restoration, poverty alleviation and rural livelihood development. In addition, he has worked on international projects for biodiversity conservation through protected area management in Southwest China and Southeast Asia as well as on cross-cultural, cross-border projects involving trans-boundary resources use and conservation.

5. OUTLINES OF KEYNOTE LECTURES

Lecture 1: An overview of forest rehabilitation

--- Prof. David Lamb

What is rehabilitation and how does it differ from the types of reforestation we already know? Most countries have undertaken some form of reforestation in recent years. This has mostly been done to grow timber. But in recent years the global community has begun to think of reforesting degraded land to overcome the problems caused by deforestation. That is, the focus has changed from timber production to improving the supply of ecosystem services. The reason for this changing emphasis is because the amount of degraded land is now very large and it is having a lot of adverse effects (e.g. allowing erosion and river sedimentation). Governments around the world are starting to think of ways this might be dealt with.

The lecture will discuss some of the issues raised by this change including definitions of deforestation, degradation, restoration and rehabilitation (e.g. including the relationship between rehabilitation and reforestation). It will also explore some of the factors making large-scale reforestation/rehabilitation difficult in future as well as those that may make it easier.

Much of any future reforestation/rehabilitation will have to be done by smallholders (=small scale farmers). This means that the current ways of carrying out reforestation/rehabilitation developed to suit industrial scale plantation systems may not be suitable and new forms of reforestation may have to be developed to suit their situation. That is, we need new forms of reforestation to generate more ecosystem services AND that are attractive to farmers.

Lecture 2: Involving stakeholders in rehabilitation of wasteland

--- Dr. Jacob Hendrik Kuper

Far too little degraded forests and wasteland are rehabilitated into proper forests. Obstacles for rehabilitation (land tenure, fire, cattle) often cannot be taken away by the individual who wants to invest in planting trees.

There are two categories of people that benefit from forest rehabilitation:

- Investing beneficiaries (they benefit from the returns through timber, firewood and other NTFP's)
- Anonymous beneficiaries (they benefit from the returns of rehabilitation through soil protection, water regulation, carbon sequestration or biodiversity conservation).

The investing beneficiaries realize the link between investment in forests and the delivery of direct benefits from forests. They will be prepared to invest if returns on investment are expected to be positive and secured. They need the government to guarantee land use rights and often local citizens for protection. They are all stakeholders. They should collaborate together.

For the anonymous beneficiaries (farmers, urban citizens) the link between the (indirect) benefits from the forests and their prosperity is rather fague. As individuals they do not invest in forests because they do not experience the (indirect) quality and quantity of returns in relation to such an investment. Nonetheless they are all stakeholders.

The challenge is to involve the anonymous stakeholders that benefit indirect from forest rehabilitation, such as downstream farmers and urban citizens. This should be possible because of the link between indirect benefits of forests and regional/national development. It is the role of governments to match the two. Governments must take their responsibility in socio-economic development and thus in forest rehabilitation.

Lecture 3: Ecological principles underlying forest rehabilitation and restoration

--- Prof. David Lamb

Reforestation is a form of applied ecology. If we are to develop new forms of reforestation (e.g. rehabilitation or restoration) then we must be aware of the underlying principles. These involve the links between biodiversity and ecological functioning (or capacity to supply ecosystem services), the need to match species to suitable sites (or appropriate ecological niches), ways of managing inter- and intra- specific competition and taking advantage of the capacity of certain species to facilitate or assist the establishment of other species, especially at heavily degraded sites.

But reforestation also requires that ecological principles must be linked with socio-economic factors. Although it might be attractive to restore the original forest that was once present at a site it may not be possible to do this now; there may be ecological constraints (e.g. the topsoil has eroded away) or there may be socio-economic constraints (e.g. it is more profitable to grow an agricultural crop). The presentation will discuss some of the ways ecological principles have been used to guide the development of different forms of reforestation suitable for different situations including encouraging natural regrowth, ecological restoration, farm forestry and rehabilitation after mining.

Lecture 4: Various approaches of rehabilitation of seriously degraded forest systems

--- Dr. Jacob Hendrik Kuper

Estimates of the extent of the worldwide wasteland vary between 2000 and 3000 million hectares. The surface of degraded systems is still growing. How can we bend that trend?

The surface of "rehabilitated" (plantation) forest covers only 300 million hectares. These plantations are expensive, vulnerable to pests and diseases and often fire prone. They are not the proper answer

for large scale rehabilitation of forests. The solution must be found in making rehabilitation cheap and robust.

Make rehabilitation cheap

Most rehabilitation objectives require only limited numbers of saplings per hectare. That makes it much cheaper than the traditional, high tree density, plantation forests.

Cheap rehabilitation can be achieved through natural regeneration, seed source planting or open stand planting. Each method has its own costs, advantages and disadvantages.

Make rehabilitation robust

Forest can be made ecologically and physically robust by planting mixtures of the indigenous broadleaved tree species. Such forest will provide the product mix that will serve local communities and at the same time protect soil, regulate water, and build up biodiversity and carbon.

Lecture 5: Improving governance in forest rehabilitation and management

--- Prof. David Lamb

Increasing forest cover and making changes in the ways that land is being used has political consequences. This is especially the case when governments wish to persuade landholders (or other land users) to change the ways they are managing their land (e.g. to reforest existing farmland). It can involve questions such as what are the rights and responsibilities of landowners? Who has the right to make decisions? How can costs and benefits of these land use changes be shared between landowners and the broader community? All of these matters involve systems of governance. Governance can be defined as the rules, practices policies and institutions that shape how humans interact with their environment.

There is a change taking place in many countries in the ways forest landscapes are governed and reforestation takes place. In the past the process was largely controlled by the state and decisions concerning how forests were managed and how reforestation would be undertaken were largely controlled by state forestry agencies. In recent years there have been moves to decentralize the process and involve other actors including landholders, non-government organizations and other members of civil society. The process is now becoming more 'bottom-up' and not just 'top-down'. This means we will have to rethink what are the most appropriate policies, institutions and laws to make reforestation more attractive so that national forest cover can be increased.

<u>Lecture 6</u>: Forest Restoration in Cambodia: Lessons from Forest Restoration and Embellishment of Forest Research Facility Project

--- Dr. Sokh Heng / Dr. Edward V. Maningo

Experimental trials of different restoration techniques were conducted in the experimental forests in Khun Ream, Siem Reap, Cambodia. The experiments are part of the activities of the project funded by Korea Green Promotion Agency and SK Forest Consortium Project. The six experiments conducted were: (1) Effects of fertilizer on growth performance of Dalbergia cochinchinensis under plantation conditions; (2) Provenance trial (effects of seed sources on growth performance) of Dalbergia cochinchinensis in Siem Reap province; (3) Enrichment planting (line planting); (4) Screening candidate species; and (5) Assisted natural regeneration. In addition, a non-formal experiment was conducted to test other alternative techniques of forest restoration by interplanting various crops in between the Dalbergia plantation. Experiment 1 showed that D. alatus performs better compared to A. costata when used as enrichment planting. Performance is best achieved when the species is treated with 50 gms. of organic fertilizer and 100 gms. of DAP. In Experiment 2, indicates that Cassia siamea and Peltophorum ferrugineum offers potential in planting degraded deciduous forest and in degraded evergreen forests. The result of Experiment 3 indicates that Shorea siamensis, Diospyros pilasonthera and Lagerstroemia offers an opportunity for planting using ANR. In Experiment 4, fertilization has no effect on the growth of the plants. The Siem Reap provenance showed better performance compared to other provenances. The result of Experiment 5, indicates that there is no effect of fertilization on the growth of Dalbergia cochinchinensis. There is an indication that D. cochinchinensis can grow in sites even without fertilizer application. The interplanting and restoration trials showed the potential of Interplanting cassava and rice in the planted Dalbergia cochinchinensis. However, involving the community to plant cash crops in the planted seedlings was not very successful.

Lecture 7: Landscape approach to forest rehabilitation

--- Prof. David Lamb

How might we expand the scale at which reforestation is undertaken? Do we just do more of what we have always done before? The change in emphasis towards undertaking reforestation to improve the supply of ecosystem services means we have to view reforestation from a broader landscape scale and not just from a site perspective. This is because many ecosystem services are only generated at a landscape scale (e.g. watershed protection). The problem then becomes one of knowing how to intervene in landscapes and redesign the existing landscape mosaic (which may contain farm land, natural forests, important biodiversity reserves, disputed land ownership boundaries, sites close to - or distant from - markets, etc.).

There are three key questions. First, what type of reforestation should be done at a particular site (monocultures or mixtures? commercial timber production or for plantings for protection?)? Second, how much reforestation must be done across the landscape to generate the ecosystem services we require (and should this be in only one large location or can it be done at several places)? And, finally, where in the landscape should this reforestation be done to generate ecosystem services? Where are the most strategic locations to reforest?

In recent years this process of large scale reforestation has become known as Forest Landscape Restoration. New institutional arrangements are likely to be needed to involve all the relevant stakeholders in order to answer these three questions and make the trade-offs that are likely to be needed.

Lecture 8: The use of remnants of natural forest for large scale forest rehabilitation

--- Dr. Jacob Hendrik Kuper

Large scale rehabilitated forests require to be ecologically robust and sustainable. Forest that are composed of mixtures of the indigenous broadleaved species are the answer to that.

Seeds and seedlings of indigenous tree species can be collected for free from natural forests, or remnants of it, as well as samples of topsoil that contain the necessary mycorrhiza complex that is needed for proper tree growth.

The collected seeds or seedlings can be raised to saplings. This could be done in farmer nurseries.

Completely destroyed forests, in fact waste land, can be rehabilitated by planting low numbers of such indigenous tree saplings: 400 - 500 saplings per ha is sufficient. An important effect of the planting is that competing grasses and weeds will be shaded out. Once the main competing vegetation has diminished, fire risk has been reduced and the (rather open) forest will develop further through seeds that are brought by birds and mammals from the natural forest.

Seriously degraded forests might still contain natural tree saplings. These should be released for survival and improved growth. If such natural saplings are not present, or insufficient, the rehabilitation can be reached by executing enrichment planting with saplings raised in farmer nurseries from seeds or seedlings from natural forests.

Successful examples of such rehabilitation approaches exist, both on small and large scale. However, many more demonstration plots are needed.

3. READING MATERIALS

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Attached Files: PPT Slides of Keynote Lecture Lecture 1: An overview of forest rehabilitation --- Prof. David Lamb





Look out for some potentially confusing terms

- 1. Deforestation
- 2. Degradation
- 3. Reforestation
- 4. Rehabilitation
- 5. (Ecological) restoration



2. Degradation Most clearing for agriculture is successful But sometimes not - land is under-utilised or abandoned Reason Land should not have been cleared (too steep, too infertile etc.) Wrong agricultural methods used Markets change Droughts, diseases, wars etc



Defining "Degraded"

- Not all cleared land is degraded
 e.g. Some farmland 'marginal' but still usable
- "Degraded land" is difficult to define depends on viewpoint?
 - e.g. Compare ideas of a farmer and a wildlife conservationist
- Definition: changes causing a reduction in capacity of land to supply goods and services
- Difficult to define boundaries and map

3. Reforestation

- Not all degraded land available for reforestation
 - Perhaps still (poorly) used

 Even if not used - owners unwilling to allow others to reforest

- Estimates of degraded land <u>available</u> for reforestation vary
 - 2,000 to 3,500 mill ha*
 Equivalent to 2 China's
 - Equivalent to 2 china s

*Laestadius et al 2011 Unasylva 62 (238); Benetiz et al 2007 Ecological Economias 60: 572

Reforestation in 20th Century

- Large-scale reforestation begins in early 20th century (mainly only small trials before then)
- Objectives
 - Šupply timber
 - Improve employment in rural areas
- Mostly done by government Forestry Departments (but later private corporations)
 - Research on species and silviculture
 Reduce risks and make reforestation more attractive to private companies

Reforestation in 21st Century?

- Likely to involve smallholders as well as State and Corporate groups
- Production (or Goods)
- Pulpwood
- Sawlogs
 NTFPs
- BUT ALSO Ecosystem services
 - Soil protection
 - Provision of clean water
 Habitats for biodiversity conservation
 - Carbon storage
 - Pollination
 - Recreation

Types of reforestation in 21st century

1. Reforestation for industrial purposes

- Single species (mostly Pinus, Eucalyptus, Acacia, Poplar, Tectona)
- Establish as seedlings
- Density around 1100 tph
- Heavy early weed control
- Fixed rotation (5-80 years)

2. Reforestation for smallholders

- Different silviculture methods needed?

Smallholders important as well as industrial growers

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Area of productive plantations in 2005 (x1000ha)

	Public	Corporate	Smallholder	Other (NGOs?)
Global	77,352	27,176 ┥	+ 49,980	492
SE Asia	6,758	636	2,302*	65

* May be under-estimate

• Indonesia and Myanmar classify all plantations as publicly owned • Thailand same except rubber

(Source: FAO, 2006, Planted Forests and Trees, Working Paper FP38)



Country	Scale (m ha)	Date and Purpose
Korea	3	1950s; originally production, but later ecosystem services
Vietnam	5	1998; 3 m ha production, 2 m ha for protection
China -	32*	1999; protection forests (* this just in Sloping Land Conservation Program)
Brazil	15	2009; Ecosystem services; Atlantic Forest Restoration Pact; >80 species
India	(5)	2010; Ecosystem services
Philippines	1.5	2011; National Greening Program; protection (and some production?)

The changing emphasis - international agencies and organisations

Event	Activity
Convention on Biological Diversity	Restore 15% degraded ecosystems by 2020
UN Convention to Combat Desertification	Achieve zero net land degradation by 2030
UN Environmental Program	Restore degraded ecosystems
UN Conference on Sustainable Development (Rio+20)	Facilitate forest restoration
Asia-Pacific Economic Cooperation	Increase forest cover by 20 mill ha by 2020
European Union	Restore 15% of degraded ecosystems by 2020
Bonn Challenge (IUCN)	Restore 150 mill ha by 2020 15

The changing emphasis - international agencies and organisations

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Convention on Biological Diversity	Restore 15% degraded ecosystems by 2020		
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UN Environmental Program	Res New York Declaration		
UN Conference on Sustainable Development (Rio+20)	Fac September 2014 150 mill ha by 2020		
Asia-Pacific Economic Cooperation	Incression milling by 2030 ha by 2020		
European Union	Restore 15% of degraded ecosystems by 2020		
Bonn Challenge (IUCN)	Restore 150 mill ha by 2020 16		

Are these plans realistic?	
Reforestation more difficult?	Reforestation easier?
 Rural poverty Uncertain tenure Populations increasing Need more agricultural land for food Uncertain impacts of climate change - On location of agricultural retorestation methods 	Improving land tenure Increased interest in environmental protection Increased interest in combatting climate change Rise in markets for ecosystem services as well as goods Urbanisation (agricultural land being abandoned?)
	17















Summary of definitions

- Deforestation
 - forests replaced by other land uses (mostly agriculture)
- Degradation

 changes causing a reduction in capacity of land to supply goods and services
- Reforestation

 All forms of tree growing on deforested areas
- Rehabilitation
 Reforest using some but not all original species
- (Ecologi cal) restoration

 Seek to re-establish "original" forest ecosystem
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Where are we now? We can be pleased because:

- Can reforest 'degraded' land
- Have methods to manage these forests
- Have greatly improved the productivity of these (monoculture) plantations
- Have made reforestation into a potentially financially attractive land use

Where are we now? But we should be unhappy because:

- Still use very few genera or species
- Mostly use monocultures
- · Have not developed good silvicultural methods to suit smallholders

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 Don't know best methods to generate (particular) ecosystem services?

Some future risks?

- 1. "Land grabs" customary land owners displaced
- 2. Plantation replace natural forests (rather than using degraded land)
- 3. Diverse, heterogeneous agricultural landscapes replaced by a extensive plantation monocultures
- 4. Reforestation will deplete ground-waters
- 5. Exotic plantation species may become invasive?

Take-home message

- Need to clarify terms: definitions of deforestation, degradation rehabilitation and ecological restoration
- Increased interest in reforestation but:
 - Some places more difficult
 Other places easy
- •
- Reforestation is changing and in future – greater role for smalholders more emphasis on reforestation for ecosystem services and not just timber products
- This means will need new forms of silviculture needed
- Reforestation is not always beneficial can sometimes have • costs

Questions to ponder

- 1. Who owns the world's degraded lands (state? private owners?) What are implications for reforestation?
- 2. How to balance the need for more food production and the need to restore forests?
- 3. Do international concerns over forest restoration make any practical difference on the ground?
- 4. Reforestation can be financed when trees are being grown for timber - but how to pay for reforestation to provide ecosystem services? 34

Lecture 2: Involving stakeholders in rehabilitation of wasteland --- Dr. Jacob Hendrik Kuper



Who benefits from existing forests?



Who suffer most from forests degradation?

- Local/poor communities (firewood/timber/NTFP's)
- Downstream agricultural communities (water supply, erosion)
- Downstream urban citizens (drinkingwater, floods/draughts, charcoal)
- The regional/national society (water, electricity forest products, landslides)
- > The global society (climat, rainfal pattern, timber, biodiv)



Who suffer most from forests degradation?

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- > The global society (climat, rainfal pattern, timber, biodiv)

..... mainly local communities and the **indirect** beneficiaries! (not the timber producers)

jaap H. Koper

Broad interests in rehabilitation

- Many different benefits and beneficiaries
- Basis for improvement of land tenure, protection and investing



Broad interests in rehabilitation

- Many different benefits and beneficiaries
- Basis for improvement of land tenure, protection and investing

Why look mainly at traditional timber production/producers for forest rehabilitation?



Beneficiaries of forest rehabilitation:

- 1. agriculturalists : soil protection
- 2. w ater users : water regulation
- all : biodiversity conservation
- 4. all : carbon sequestration
- 5. timber producers/users
- 6. firewood/NTFP producers/users

Indirect benefits Anonymous beneficiaries Unknown value



*
Quantifying benefits

- How much are the specific returns (direct + indirect) from inv estment in forest rehabilitation on wasteland?
- Calculate returns on investment per rehabilitation objective/method
- Benefits (returns) are shared by direct and indirect beneficiaries. How to share the investment costs?





Who will invest?

Types of investors

- A. "Money" investors (private individuals or companies)
- B. "Livelihood" investors (local communities/individual farmers)
- C. "Development" investors (National/regional society through Government institutions)





#



Money investments

Initiatives with expected profitable financial returns on investment (timber, firewood, biomass = direct products/benefits)

Money investments

Initiatives with expected profitable financial returns on investment (timber, firewood, biomass = direct products/benefits)

Option for enhancement: Improved protection and controle through partnerships between investors and local stakeholders/communities

PL Sage H. Kuper



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Livelihood investments

Initiatives with livelihood-returns on investment (firewood, fodder, NTFP's= direct products/benefits)

Livelihood investments

Initiatives with livelihood-returns on investment (firewood, fodder, NTFP's = direct products/benefits)

Options for enhancement :

- 1. Improved land use rights
- 2. Partnership with government on sustainability of land use



Development investments

Initiatives with profitable anonymous returns for the society at large

Development investments

Initiatives with profitable anonymous returns for the society at large

Options for enhancement :

Partnerships between all beneficiaries

- 1. Institutional improvement (land tenure, land use contracts)
- 2. Facilitation of partnerships of stakeholders
- 3. Coordination among gov ernment departments
- 4. Providing funds for indirect benefit rehabilitation

PL SHOP M. KNOPT



Development investors

Who represents the full society?

> Who represents the anonymous beneficiaries?

Development investors

- Who represents the anonymous beneficiaries?
- Who represents the full society?

The regional and national governments

and the forestry institutions







#

Di. Jaap H. Koper

How can governments help?

- Asses the advantage of anonymous benefits to the macro economy and socio-economic development
- Facilitate (institutional, technical, financial) low cost forest rehabilitation
- Facilitate all kinds of relevant partnerships
- > Provide government funds for creating indirect benefits

*

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Role of forestry institutions

In the past : focus on regulating forest use

Now: focus on solving and facilitating rehabilitation (institutional, financial and silvicultural)



Role of Forest Departments

- Quantify benefits of forest rehabilitation
- Bring stakeholders together
- Coordinate among gov ernment departments
- Provide government funds for rehabilitation
- Develop and facilitate silvicultural solutions
- Support rehabilitation in the field

Other government stakeholders

Forest rehabilitation contributes to socio-economic development:

- Department of Forestry
- Department of Economic Affairs
- Department of Poverty Alleviation
- Department of Water, Electricity,
- Department of Transport



Potential partnerships of stakeholders



Matching demands and opportunities

- Investors provide funds, local communities protection
- Government guarantees land use rights, local communities plant sustainable forests
- Downstream societies provide funds, local communities plant and protect trees



Needs of mountain communities:

-Fire wood -Construction materials -Fodder/grass -Other NTFP's Desires of the (regional) authorities:

-Erosion control -Water regulation -Economic development



Conclusions 1

- The anonymous benefits from forest rehabilitation are broadly shared
- > The anonymous benefits need to be quantified
- > Specific rehabilitation measures could be profitable



Conclusions 2

- "Indirect" stakeholders should contribute to forest rehabilitation
- Many forms of partnerships are possible to support forest rehabilitation
- Government institutions should play an active role in this



Conclusions 3

Government institutions should play an active role:

- > quantify problems and solutions
- facilitate partnerships between stakeholders
- Involve and coordinate all needed government departments
- provide funds to cover rehabilitation investment costs to gain the anonymous benefits of rural development



*

#

Exercise

You are the government

- Budget \$ 100,000
- > Enhance budget impact by involving stakeholders / partnerships

What partnerships can help?

How to devide budget over the rehabilitation objectives and regeneration methods?

How many ha's can be rehabilitated?

Objectives of rehabilitation

- 1. soil conservation
- 2. water regulation
- 3. biodiversity
- 4. carbon seq.
- 5. firewood/NTFP's
- 6. timber supply



Regeneration methods

Natural regeneration	(0 saplings planted)
Seed source planting	(50 saplings per ha)
Planting open stand	(500 saplings)
Plantation planting	(5000 saplings)

Exercise

- > 20 minutes discussion within groups
- > 5 minutes writing conclusions on paper
- ▶ 5 minutesplenairy presentation each group
- Short comment by audience (1 strong, 1 weak point)





Di. Jaap H. Kuper

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Lecture 3: Ecological principles underlying forest rehabilitation and restoration

--- Prof. David Lamb



Questions

- What types of reforestation will be attractive -
 - for smallholders?
 - to supply ecosystem services?
- How do we develop these? What are the underlying ecological principles?



Choosing which approach to use

- Ecological restoration
 - To re-establish original species and forest ecosystem Target based on nearby natural forest reference site or historical records _
- Rehabilitation
 - Used where
 - ecological restoration not possible
 - Need to generate an income from production
 - Aims to restore original function but not necessarily biodiversity
 - Method (and species used) depends on objectives and extent of site degradation

Some 'ecological' principles for reforesting "degraded" lands

- Keep what is left

 Conserve remaining patches of natural forest (as seed sources and for seed dispersers)
 Intervente

 Take advantage of natural regrowth
- 2. Use multiple species (encourage diversity) to reduce ecological (and economic) risks

3. Reduce competition

- From grass use tree densities of 2-3,000 trees/ha
- Between trees of same species - Between species in mixtures (look for complementary species)
- 4. Choose species to suit site conditions (ecological niches)
- Recognise that species choices will vary across landscape
- $5. \ {\rm Recognise}$ that at some degraded sites original species may need help to re-establish
 - use (tolerant) "nurse" trees to modify environments

Some different approaches **Ecological restoration** 1. Natural regrowth 2. The 'Framework Species Method' Rehabilitation 3. Forest rehabilitation ("Eco-forests"?) 4. Farm forestry 5. Rehabilitating mine sites

1. Ecological restoration - natural regrowth

- Principle: protect capacity for natural regeneration
- Possible if
 - Site not too heavily used (stumps and soil seed still present)
 Patches of natural forest 'nearby'
- Protect site











Natural regrowth - some questions

- What is acceptable seedling density? (when to give up on natural regrowth and plant seedlings?)
- What if only a few of original species prsent (what if mainly weeds)?
- What if too patchy?
- What is minimum seedling height (vs weeds)?

2. Ecological Restoration - the Framework Species Method

- Principle: take advantage of natural regeneration processes
- Best at sites "near" natural forest
- Plant up to 20 species able to tolerate site
 Include
 - Fast growing short-lived pioneers (30% species)
 - Species with fruit and able to attract seeddispersers
 - Poorly dispersed species (e.g. large fruit)
- Plant at about 2,500-3,000 trees/ha

Ecological Restoration - the Framework Species Method

- Intime
 - Short-lived pioneers die
 - These deaths create gaps/canopy openings
 - Allow colonists to establish
 - Allow seedlings of slower-growing species and colonists to grow into canopy
 - Changes from even-aged to uneven-aged forest







3. Forest rehabilitation

- Principle: ecosystem services are linked with diversity
- Need some diversity but cannot restore all original species

- too degraded?
- don't know original species
- cannot get seed of all of these
- QUESTION: how many species?
- QUESTION: which species?
- QUESTION: what proportion of each?







4. Rehabilitation - farm forestry

- National objective is to restore some diversity to generate Ecosystem Services
- Principle: match species to sites
- But also need to generate an income for landholder
 - Commercially attractive species
 - Variety of products
 - Therefore variety of markets
 - Early cashflow

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Example 1: using 'nurse' trees Vietnam Natives fail when planted on these sites

- Plant Acacia monoculture
- Shades out grasses, improves soils
- Thin stands after 5 years -sell thinnings for firewood
- Under-plant with natives
- Use profit to plant more land
- Gradually thin out more of Acacia to release natives
- Question when to thin?



Example 2: a farm forestry design - Philippines					
Product	Time (y)	Number of species	Tree density		
Firewood	6 - 10	3 - 5	450		
Poles	8 - 12	2 -3	200		
Fast growing timber	14 - 18	3 - 5	250		
Slow growing timber	20+	3 -10	200		
TOTAL		11 - 23	1100		
Nguyen et al 2014, PLOS One e98600, doi:10.1371 22					

Ecological principles?

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- Matching species to sites
- Managing competition
- Doing so in ways that recognize economic needs

5. Rehabilitation - mine sites

- Different types Open cut Underground
- Can be left with
 - Big hole??
 - "new" soils that are stony and infertile Waste rock dumps
 Tailings dumps
 - Toxic materials (heavy metals, acid, saline)
 - Unstable topography
 - Toxic leachates pollute groundwater and rivers













Mine rehabilitation "best practice"

- Anticipate problems
 - undertake pre mine survey
 - if toxic materials present design mine so these will be buried afterwards
- Conserve resources
 - Remove and store topsoil (<6 months)
 - This saves organic matter, nutrients, seed, mycorrhiza
- Mine
- Create stable topography
- Replace topsoil
- Establish plants (maybe using tolerant exotics)

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Monitor

Principles involved

- Multiple species needed to restore Ecosystem Services
- · Need to match species to sites
- Recognise that sometimes exotics needed because some (many?) natives cannot tolerate site conditions





What is "success"?

- Ecological restoration
 - Establish mainly native species
 - Establish successional trajectory towards being self-sustaining

Rehabilitation

- Improved functioning (i.e. provides ecosystem services)
- Benefits livelihoods
- Minesites are safe, stable, self-sustaining

Take home message

- Designing new reforestation methods requires ecological knowledge
- Ecological restoration a good target but not always possible
- Rehabilitation can be done in many ways and involves more trade-offs
- Both approaches more difficult than timber plantation monocultures
- We are still learning how to do these

Questions to think about

- How do we make more use of native species?
- Can we still get all the seed we need?
- How many species should we use in rehabilitation?
- How do we do the necessary research and who does it?
 - Forestry department research stations? Universities?
 - By farmers on farms?

Lecture 4: Various approaches of rehabilitation of seriously degraded forest systems

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--- Dr. Jacob Hendrik Kuper

Facts

- > There is much degraded forest in the world
- There is a great need to rehabilitate degraded systems
- It appears to be not simple to rehabilitate degraded systems on a large scale
- The area of degraded systems is increasing



Facts

- > There is much degraded forest in the world
- There is a great need to rehabilitate degraded systems
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- > The area of degraded systems is increasing





- Presentation on "Various approaches"
- Exercise in small groups
- Short presentations of outcomes



Basic conditions for rehabilitation

- 1. Right of use of the land
- 2. Protection against: Fire Cattle People
- 3. Rehabilitation methods





Basic conditions for rehabilitation

- 1. Right of use of the land
- 2. Protection against:
 - Fire Cattle
 - People
- 3. Rehabilitation methods

This presentation deals with rehabilitation methods.















Degraded systems

- More or less degraded forests : ?
- Completely degraded = w asteland : 2 3 billion ha

Degraded systems

- More or less degraded forests : ?
- Completely degraded = w asteland : 2 3 billion ha
- Replanted forests: 300 million ha







Current forest rehabilitation

- Most rehabilitated forests are timber plantations
- Timber plantations are <u>expensive</u>
- Timber plantations require long investment periods for returns

Current forest rehabilitation

Most timber plantations are:



- Monocultures: vulnerable for diseases
- Conifers/Eucalyptus: fire prone











Current forest rehabilitation

Most tim ber plantations are:

- Monocultures: vulnerable for diseases
- Conifers/Eucalyptus: fire prone



Do we want large scale vulnerable forests?





Conclusions on current rehabilitation

- Current rehabilitation methods are <u>expensive</u>
- > The rehabilitated forest are <u>vulnerable</u> for diseases, pests and fire





Conclusions on current rehabilitation

- Current rehabilitation methods are expensive
- The rehabilitated forest are <u>vulnerable</u> for diseases, pests and fire

Large scale rehabilitated forests should be cheap and robust





Develop tools that fit the needs and that are applicable : cheap and robust



Needs/objectives of rehabilitation

Needs/objectives of rehabilitation

- 1. soil conservation
- 2. w ater regulation
- 3. biodiversity
- 4. carbon seq.
- 5. firew ood/NTFP's
- 6. timber supply

Needs/objectives of rehabilitation

- 1. soil conservation
- 2. w ater regulation
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- 6. timber supply

Do all require the same rehabilitation method?

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soil conservation

water regulation

biodiv ersity

carbon seq.

firewood/NTFP's

timber supply

4

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Consequences for forest rehabilitation



Regeneration methodsRegeneration characterNatural regeneration (0 saplings planted)Natural regenerationcheap (0 saplings/ha), SlOWSeed source planting (50 saplings per ha)Seed source plantingcheap (50 saplings/ha), SlOWPlanting open stand (500 saplings per ha)Planting open standmoderate (500 /ha), quickPlantation planting (5000 saplings per ha)Plantation plantingexpensive (5000), quick

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Match regeneration method with rehabilitation objective



Make rehabilitated forests robust

- Low risks of pests, diseas, fires
- Sustainable system
- Self rejuvenating





Make rehabilitated forests robust

- > Low risks of pests, diseas, fires
- Sustainable system
- Self rejuvenating

By using :

- multiple broadleaved species
- better : multiple indigenous broadleaved species





Conclusions

 Different rehabilitation objectives require different investment levels (this reduces costs of forest rehabilitation)





Conclusions

- Different rehabilitation objectives require different investment levels (this reduces costs of forest rehabilitation)
- Regeneration can be cheap (this provides opportunities for large scales and for local farmers/communities)





- Different rehabilitation objectives require different investment levels (this reduces costs of forest rehabilitation)
- Regeneration can be cheap (this provides opportunities for large scales and for local farmers/communities)
- Indigenous broadleaved species keep risks low and support sustainability (only one time investment)





Exercise

- You are the government
- Budget \$ 100,000
- One sapling planted costs \$ 1 (all inclusive) (suppose land rights and protection are no issue)





Exercise

- You are the government
- Budget \$ 100,000
- One sapling planted costs \$ 1 (all inclusive) (suppose land rights and protection are no issue)

How to devide the budget over the mentioned rehabilitation objectives and regeneration methods?

How many hectares will be rehabilitated?

Will be renabilitated?



- 1. soil conservation
- 2. w ater regulation
- 3. biodiversity
- 4. carbon seq.
- 5. firew ood/NTFP's
- 6. timber supply



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Regeneration methods

Natural regeneration (0 saplings planted)

Seed source planting (50 saplings per ha)

Planting open stand (500 saplings per ha)

Plantation planting (5000 saplings per ha)





Exercise

- > 20 minutes discussion within groups
- ▶ 5 minutes writing conclusions on paper
- 5 minutes plenairy presentation each group
- Short comment by audience (1 strong, 1 weak point)



Lecture 5: Improving governance in forest rehabilitation and management --- Prof. David Lamb



What is the problem?

- Suppose a national government wishes to expand forest cover
 - Who decides what areas should be reforested?
 - Who decides which areas deserve priority
 - How to decide how to share costs as well as the benefits?
- What role do private landholders have to play in reforestation?
- Should governments be able to <u>insist</u> that reforestation takes place in certain places?



Governance

Definition

- The rules, practices, policies and institutions that shape how humans interact with the environment (UNEP)
- The ways and institutions through which individuals and groups express their interests, exercise the rights and obligations, and mediate their differences (Guariguata and Brancalion 2014)

Governance and reforestation involves:

- · Policies to encourage reforestation
- Laws and regulations concerning how it is done
- Institutions to implement these policies and enforce laws



Often worked - but sometimes did not

- · Worked if creating state-owned timber plantations
- But sometimes did not when trying to establish a national reforestation program for Ecosystem Services (ES).
- Example:

Government pays villagers to plant trees on land owned by government (but ownership claimed by traditional owners)

- No follow up or weed control
 No benefit to community so they ignore seedlings Trees all die
- In one case same site reforested 4 times!

A rethinking underway

- · Governments cantalways do everything
 - Worlds forests continue to shrink despite government efforts
 - Governments don't always have enough land for reforestation
 - Don't know local issues or reasons for degradation?
- Should some kind of de-centralisation take place?
 - Include reforestation on privately owned land?
 - Allow others to be involved in decision making?
 - Involve those most affected by decisions?

The changing role of the private sector

State Forestry Departments

- Did the research develop silvicultural methods
- Establish state-owned timber plantations · To create new timber resource
- To provide rural employment
- Later sell plantations to corporate sector

Corporate plantation owners

- Begin to develop own timber plantations mostly short
- rotations
- Later purchase state-owned plantations

Farmer/smallholders

- Become interested in reforestation
- Some become out-growers for corporations OR joint ventures with State plantations

Smallholders likely to play an important role in future national reforestation plans

Area of productive plantations in 2005 (x1000ha)

	Public	Corporate	Smallholder	Other (NGOs?)
Global	77,352	27,176	49,980	492
SE Asia	6,758	636	2,302	65
				10

Different types of decentralisation concerning smallholders

- Passive participation

 People told what has been decided about reforestation

 Reforestation done whether they agree or not
- · Participation by consultation
 - People consulted by being asked questions;
 BUT don't share in decision-making
- · Participation in reforestation because of incentives
 - Not involved in planning
 Contractors work for food
 - Contractors work for cash
- Interactive participation reforest their own land
 - Jointly involved in planning and decision-making Participation is a 'right' not just a way of achieving goals
- Self mobilisation reforest own land (prompted only by market),

Each of these have different forms of governance

- In all cases must balance national goals (which now include supplying ES) against local needs ٠
- But differ in ways they share
 - knowledge
 - decision-making
 - costs of and benefits of reforestation
- · A gradual international trend towards interactive parti cipation and self mobilisation (?)

Some principles of good governance

- 1. Information is shared
- 2. Stakeholders participate in decision making
- 3. Process is open and transparent
- 4. Decision-makers are accountable for their decisions legal protection is available
- 5. Process is responsive- able to respond and adapt to feedback (and complaints)
- 6. Process is fair not dominated by politically strong
- 7. Process is effective and efficient-it works and is quick (may need capacity building?)
- 8. Process allows for a strategic vision (e.g. concerning goods and services?)



Decentralisation is controversial

- · Some government officers reluctant
 - Claims the non-government sector does not have technical skills?
 - Will lose capacity to maintain national vision (e.g. for FLR)
- How to achieve participation
 - How to chose stakeholder representatives?
 - How to make decisions?
 - How to settle disputes?



Policies to encourage reforestation Make reforestation more popular - remove disincentives e.g. subsidies for cropping, even on steep land Grant tenure and harvest rights Empower communities to make decisions (species, locations) Use (or create) community committees; choose representatives for regional bodies Use financial incentives (for reforestation or reforestation at certain sites) Cash for seedling, planting Use non-financial incentives

- Provide technical knowledge
- build roads for market access
- Provide marketing assistance
 Develop new markets (e.g. PES)

Types of tenure

- Over what time?
 - Permanent?
 - leased for a set period?
- What rights?
 - Own trees and can sell timber?
 - Can clear forest and use land for crops?

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- Can sell land?
- Children inherit?

• Who has access?

- Open access to all?
- restricted to group members?



- compensation to former landowners
 Regulations to protect out-growers
- Need for enforcement
 - E.g. that tenure is protected
 - E.g. That reforestation /rehabiliation is done



Special case: mine site rehabilitation

- Problems include:
 - Companies depart without doing any rehabilitation (or site is sold)
 - Rehabilitation is delayed till mining ceases and then company claims is cannot afford rehabilitation
 - Rehabilitation is poor quality
- Bonds
 - Money deposited with government to cover costs of rehabilitation?
 - But how much \$ is needed?
 - What standards must be met? When to assess?

Institutions

- Institutions are bodies designed to enable collective action
- National

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- Plan reforestation to achieve national (and international?) goals
- Balance reforestation and food production
- Decide funding support
 Undertake research
- Regional
 - Advise on land use planning
 - Advise on need for incentives, compensation
 - Extension services (spread knowledge)
 Undertake research?
 - Underlake researc
- Local (existing or new)
 Settle conflicts
- Serie conflicts
 Make trade-offs
 - Share knowledge (silviculture, markets)





How would you know if governance systems are effective?

- 1. Monitoring systems are in place
- 2. Forest cover is increasing because reforestation is seen as an attractive land use
- 3. Private nurseries are being formed
- 4. There are industries using plantation timbers
- 5. Market prices are high enough to persuade landowners to plant trees or protect Natural Regeneration
- 6. Institutions are active and meet regularly
- There are few disputes community accepts the 'system' is fair MORE? 25

Take home message

- Increasing forest cover means changing current land use patterns
- A large number of stakeholders = diversity of interests
- We need to balance these interests involves defining rights and responsibilities
- 'Governance' describes the way we do this
- Forms of governance involve <u>policies</u>, <u>laws</u> and <u>institutions</u>
- These likely to change and evolve over time

Questions to ponder

- Who owns the worlds degraded forests and lands? Who is responsible for overcoming degradation?
- How far should (must?) governments decentralise responsibility for reforestation?
- If government funds are used for reforestation how to get value for money?
- How to share the costs as well as the benefits of reforestation? What policies, laws and institutions are needed?

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• Draw attention to atlantic forest and herbohn

Lecture 7: Landscape approach to forest rehabilitation --- Prof. David Lamb



Questions

- How do we scale-up and expand forest cover?
- Do we simply do more of what we have done in the past?
- Or do we have to be smarter and more strategic?

Role of forests in helping overcome degradation is well-known

- Reduce soil erosion
- Reduce air pollution
- Improve soil organic matter and 'quality'
- Improve water quality
- Improve water yields in dry season
- Increase area of wildlife habitat to allow populations to increase
- Improve connectivity between patches of remnant forest
- Store carbon
- · Improve people's livelihoods

But what is the <u>scale</u> at which reforestation generates benefits?

- Some achieved at any (small) site
 E.g. carbon storage
- Some only achieved when <u>strategically chosen</u> sites reforested
 - E.g. erosion control on steep lands (rather than revegetating flat lands)
- Some only achieved if <u>'large' areas</u> of degraded landscape reforested
 - E.g. wildlife habitats, watershed protection, creation of a new timber resource

What is a landscape?

Many definitions

"the area over which a manager may have to work to balance trade-offs in order to improve livelihoods and achieve conservation outcomes"



This means

- Need planning and strategic interventions not random choices
- In some can reforest single large areas
- · In others will have to be many small areas
- Will involve changes to existing land use activities

 $-\operatorname{Not}$ all land owners will be happy with this

Forest Landscape Restoration

Definition of FLR

- 'a process to regain ecological integrity and enhance human well-being in deforested and degraded landscapes'
- Hence
 - <u>Does not</u> mean whole landscape must be reforested
 - Is planned and not by chance
 - It involves trade-offs
 It involves stakeholders (especially landholders) in decision making
 - decision making — Seeks multiple benefits (food, forest goods and ES)



1. How much reforestation needed?

- Depends on opportunity costs of reforestation (compared with alternative land uses)

Depends on

- Markets for forest products and ecosystem services

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- Funds available for incentives and subsidies
- Need to exceed a threshold

Thresholds - the minimum area needed to generate ...

Economic benefits

- A <u>single small</u> isolated plantation is likely to be uneconomic
- But how big must it be (and one large or many small)?
- Environmental benefits
 - How much to generate hydrological benefits?
 - How much to limit erosion?
 - How much to generate conservation benefits?
 - How much to achieve carbon storage?



BUT big is not always better - trade-offs needed?

- Forests or agricultural land? - (Might forests help make agriculture sustainable?)
- Forests for carbon storage or erosion control use more groundwater?
- Production forests or wildlife habitats?

2. Where this should be carried out?

- Economic
 - Best locations are sites with good soils near markets or transport (same as for agriculture?)
- Environmental
 - 1. Degraded lands BUT
 - Where are priority areas?
 - Should we first tackle the most degraded locations or only moderately degraded sites?

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Where this should be carried out? Economic Best locations are sites with good soils near markets or transport (same as for agriculture?) Environmental Most degraded locations or only moderately degraded sites? Sites with wind and soil erosion Hills Riverine strips Sites for wildlife conservation In association with natural forest patches still containing biodiversity

















Take home message

- Effects of degradation can only be overcome by working at a landscape scale because this the scale at which many processes operate
- This means changing the way we think about reforestation
 - How much?

 - Where?What type?
- Often involve trade-offs
 - These easier to make at landscape scale
 - Means may have different types of reforestation in different locations

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Questions to ponder

- How much is enough?
 - Should we have targets?
 - Should there be subsidies? (what sort? how much?)
 - Should we leave it to the "market"?
- What sites should be prioritised?
- How to coordinate stakeholders to implement Forest Landscape Restoration? •



Lecture 8: The use of remnants of natural forest for large scale forest rehabilitation --- Dr. Jacob Hendrik Kuper

The use of remnants of natural forest for large scale forest

棘

Dr. Jaap H. Kuper

rehabilitation

Current forest rehabilitation

Most are timber plantations :

- Monocultures: vulnerable for diseases
- Conifers/Eucalyptus: fire prone

Do we want to promote vulnerable large scale forests?



We need low risks, high sustainability

Robust forest systems Sustainable systems Self rejuvenating forests

Consisting of:

broadleaved species

• better: multiple indigenous broadleaved species

Such as the natural forests











Use (remnant) natural forests

- > These provide free seedlings,
- of many robust / low risk species
- > and the mycorrhiza-complex.

The ecological knowledge is still available



Two levels of degradation

- Completely destroyed forests
- Seriously degraded forests





Two levels of degradation

Completely destroyed forests
 Full surface mixed species planting



Seriously degraded forests
 Release of wildings plus enrichment



Completely destroyed forests



Completely destroyed forest

- Collect seeds or seedlings from natural forest
- Add forest topsoil with mycorrhiza
- Raise in nursery





Completely destroyed forest

Treatment to saplings at large nursery



Completely destroyed forest

.... or at farmer's nursery



Completely destroyed forest

Line planting, in low numbers



Let saplings make a flying sta

- Add natural forest topsoil
- Acclimatise well
- Proper planting hole
- Intensive weeding at the start
- Use pioneers in pioneer conditions



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Completely destroyed forest

Weeding



Completely destroyed forest



中 01. joap H. Saper Completely destroyed forest







Completely destroyed forest

Small scale demonstration in Yunnan, China

Completely destroyed forest

... and large scale in Uganda









Completely destroyed forest

Completely destroyed forest

After some time



Completely destroyed forest

After some time



Completely destroyed forest

Needed action:

- 1. Collect seedlings or seeds and topsoil
- 2. Treatment in (-æ{ ^¦q) nursery
- 3. Wide spaced mixed planting
- 4. Release three/four years from weeds.





Seriously degraded forests



01. Joop H. Raper

Seriously degraded forests





Seriously degraded forests

- Release of wildings
- Plus enrichment planting with raised seedlings from the natural forest





Seriously degraded forest

Release wildings in degraded forest





Seriously degraded forest

Knowledge to recognise species and opportunities

Seriously degraded forest

If wildings are absent or insufficient:









Seriously degraded forest

Indigenous seedlings for free



Seriously degraded forest

Planted as enrichment in the degraded forest





Seriously degraded forest

Large scale experience in Sabah, Malaysia





Seriously degraded forest

... large scale experience in Sabah, Malaysia





Seriously degraded forest

... large scale experience in Sabah, Malaysia



Seriously degraded forest

Needed action:

1. Release wildings in the degraded forest

If not sufficiently present:

- 1. Collect seedlings/seeds in the natural forest
- 2. Temporary treatment in a farmer's nursery
- 3. Plant as enrichment in the degraded forest
- 4. Release two/three years from competition.



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Conclusions

 Remnants of natural forest provide ecological sound seedlings and the necessary mycorrhiza complex : for creating robust new forests.

Conclusions

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- Rehabilitation is possible through low cost silvicultural treatment, and at all scales.




Conclusions

- Remnants of natural forest provide ecological sound seedlings and the necessary mycorrhiza complex : for creating robust new forests.
- Rehabilitation is possible through low cost silvicultural treatment, and at all scales.
- Successful examples exist, but many more demonstration plots are needed



Conclusions

- Remnants of natural forest provide ecological sound seedlings and the necessary mycorrhiza complex : for creating robust new forests.
- Rehabilitation is possible through low cost silvicultural treatment, and at all scales.
- Successful examples exist, but many more demonstration plots are needed
- With the disappearance of natural forest appropriate tree species, the mycorrhiza complex and knowledge of it will get lost.

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Exercise

- You are the government
- Budget \$ 100,000
- How to start the rehabilitation process and where?

Exercise

- > 20 minutes discussion within groups
- > 5 minutes writing conclusions on paper
- 5 minutes plenairy presentation each group
- Short comment by audience (1 strong, 1 weak point)





Forest Degradation and Rehabilitation --Theory & Practices (1)



The situation:

- · Presently ca. 12 mio. ha of forests are lost per year
- Mainly in sub-/tropical regions
- Final stages are devasted lands or forests
 Afforestation measures can not compensate forest loss

The consequences:

- Timber supply is jeopardized
- Biodiversity is reduced
- · CO2 is released and climate change increase
- · Productive land is turned into infertile sites
- Loss of environmental services
- Living conditions of rural dwellers deteriorate



Degradation

- A loss of forest structure, productivity and native species diversity.
- A degraded site may still contain trees, but it will have lost its former ecological integrity.
- changes within a forest that affect the structure and function of the stand or site and thereby lower its capacity to supply products or services. (FAO)

Measuring Degradation

- degraded primary forest (resulting from excessive and damaging timber exploitation);
- secondary forest (naturally re-growing on land that had been largely cleared);
- degraded forest land (too degraded to make forest regrowth and occupied by grasses and shrubs).

Approaches to Overcome Degradation

- : to recreate an ecosystem as close as possible to originally existed at the site in terms of *species*, *structure and productivity*;
- the original *biodiversity* is regained but original productivity or structure is not;
- *"productivity or structure* is regained but biodiversity is not.

Different forms of forest degradation





A点



C点



Richness of Biodiversity



D1—D2





Ecological Theory for Rehabilitation of Degradation

1. Theory of Ecological Succession

- Succession: A sequence changing process of species and structure of forest community and environment over time in a certain direction.
- · A community replaced by another gradually
- A predictable process
- interaction result of forest community and environment
- Rehabilitation means should match current succession
 stage
- Plant species appeared in later stage can be used for rehabilitation.

2. Theory of Territoriality

- Geographical difference result in diversified ecological environment (climate, landform, soil, hydrology)
- Native species developed in local environment
- · Species selected in light of principle of site adaptation
- Appropriate exotic species can be introduced
- Seriously degraded forest accompanied by soil degradation. Daught tolerant plants, hardy plants and N fixation plants is recommended as mixed species to improved soil fertility.

3、 Niche Theory

- Niche: the total physical space within which the individuals of a species survive, grow, and reproduce.
- Ecological niche characterizes the position of a species within an ecosystem, comprising species habitat requirements as well as its functional role
- Niche Differentiation in time and space for plant species (root system) need to be taken into account.
- To avoid overlaps of niches and competition for deferent plant species





3、Niche Theory (Cont.)

• In rehabilitation practice

- Deep root×shallowroot
- Broad leaved × coniferous
- Shade tolerant × light demand
- Evergreen × deciduous
- Cmbination of trees, shrub and grass
- Effectivly use light, heat, water, soil nutrient in the system
- Promote energy transfer and productivity

4. Symbiosis Principle

• Partial symbiosis

- Epiphytes is typical symbiosis (Any plant growing upon or attached to another plant)
- e.g. Lichen, moss, fern, orchid attached on trees so as to gain more light and space resources.

4. Symbiosis Principle

- Mutualism
 - Root nodules and mycorrhizae are typical mutualism.
 Nodules are mutually beneficial symbiosis between nitrogen fixing bacteria and legumes roots
- Legumes are recommended in tree plantation
- Mycorrhiza is a symbiosis of fungi and the roots of higher plants
 - fungi absorb carbohydrates and other organic matter from higher plant roots, and
 - supply nitrogen and minerals to higher plant
 - Extended hyphae enlarged the root absorption area by 60-120 times
 - Stress resistance increased(disease, insect damage, drought, cold)





5. Density Effect Principle

- High density may result in
 - exceed environment capacity
 - individual competition
- self-thinning
- Low density
 - under utilization of natural resource;
 - low productivity.
- Appropriate plantation density
- Cultivation target, goal
- local social, economic condition
- Characteristics of tree species

6. Limiting factor theory

- Liebig's law definite limiting factors from inorganic nutrition (N, P, K);
- plant adaptability to environmental factors (light, temperature, water, humidity, etc.)
- Limiting factor: "The survival of organisms depends on the overall environmental conditions. Any situation that is close to or beyond the limits of tolerance is the limiting
- The dominant factor on plant growth is the limiting factor, which dominate plant growth .

6. Limiting factor theory (Cont.)

- According to the theory of limiting factors, to determine dominant factors limiting biological productivity;
- A region, a factor that is a limiting factor for a tree species, but not necessarily a limiting factor for another tree
- Through the analysis of site factors, select the appropriate category, in order to change the limiting factors of the constraints, improve productivity

7 S Biodiversity Principle

- Biodiversity is the basis of ecosystem stability
- · biodiversity is built on the basis of plant diversity
- Plant diversity will lead to community complexity, means:
 - more vertical layer of canopies
 - more horizontal patch patterns
 - more complex root system
 - more organisms in different habitats
- In rehabilitation of degraded forest:
 - Introduce key species to restore biodiversity
 - Rebuild the vegetation system and food chain

7 Biodiversity Principle (Cont.)

- · Avoid single species monoculture
- · More species :
 - Interrelationship
 - Interacting
 - Changing forest internal environment conditions
 - Making pathogens, pests, lost the appropriate living conditions
 - attracting variety of natural enemies of pests

8、 Edge Effect Principle

- An transitional area between two or more communities is called an ecotone.
- The ecotone a tense population competition
- The number of species, population densities and productivity in a community are larger than adjacent communities (Edge effect)
- Applying edge effect principle to increase productivity by creating more ecotone and edge length



9. Biological Invasion Theory

- Biological Invasion: Exotic species entered the areas not distributed in modern history and bred to extend population.
- Serious ecological consequences
 - Endangering human and animal health
 - Influence economic activity
 - Influence the structure and function of ecosystem
 - Influence Maintenance and restoration of local biodiversity

9. Biological Invasion Theory

Positive impact

- nitrogen fixation, tolerance to drought, rapid growth (Acacia spp.)
- intercropping Castanopsis sp., Schima sp. and other native species after 3-4 years.
- shortening recovery period and save cost
- Native species have a greater advantage
 - more adapt to local condition
 - greater potential in breeding and dissemination
 - easier to integrate with the remaining natural communities into larger landscape units

9. Biological Invasion Theory (cont.)

- Lack of co-evolution between exotic and local species, likely lead to the collapse of the local ecosystem;
- Use indigenous species as possible; pay attention to alien species invasion in planting, management, evaluation and monitoring
- Concerning potential impact of reintroduced native species on local communities
- use of native species as much as possible in forest rehabilitation

Approaches and Means

1. Biodiversity Restoration

1) Passive restoration

protecting the site from further disturbances

 Suitable for less extensive degradation, residual forest patches remain, forest re-growth is present, slight disturbances

2) Enrichment planting

reintroducing certain key species to hasten the process of natural recovery

3) Direct seeding

deliberately reintroduce the seed (sown seeds by hand, by aircraft) $% \left(\frac{1}{2} \right) = \left(\frac{1}{2} \right) \left(\frac{1}{2} \right$

Approaches and Means

4) Scattered tree plantings

planting small numbers of scattered, single trees or clumps or rows of trees to attract seed- or fruitdispersing fauna into the degraded landscape

- Close-spaced plantings using limited numbers of species
 - 1000 trees per ha, even more
 - tolerant (pioneer) species are chosen
 - maintenance is needed

Approaches and Means

2. Interventions providing biodiversity as well as productivity benefits

1) Managing secondary forests

- simply protect
- harvesting management
- foster the growth of certain tree or plants
- 2) Enrichment plantings
 - enhance commercial productivity while maintaining the sites as essentially "natural"
 - plant fast-growing and commercially attractive species

Approaches and Means

Approaches and Means

3. Socio-economic considerations

Adopted measures have to match the interests of different stakeholders .

4. Natural regeneration

- Availability of seed trees
- Sufficient seed production
- Adequate soil conditions, soil preparation
- Adequate light conditions, canopy opening

Shelterwood System



Group Selection System



Strip Cutting System

Tree Species selection for Plantation

Forest rehabilitation measures:

- Natural succession
- Enrichment planting
- Afforestation as mixed or pure stands
- Agroforestry



Key question for successful forest rehabilitation and afforestation is the identification of appropriate tree species!

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Tree Species selection for Plantation

Criteria for tree species identification:

- Site conditions
- Protection or production objective (valuable timber vs. fuelwood)
- Management goal (pure vs. mixed stands)
- Exotic vs. indigenous species
- •
- Seed/plant sourcesLabour availability
- Labour availability
 Legal aspects
- . Liga

Criteria for tree species identification

Site conditions

- · Soil (nutrients, rooting depth, soil water,
- Topography
- Climate (temperature, rainfall,
- Flora and fauna (disadvantages,





Criteria for tree species identification

Production objective

- Commercial roundwood (long rotation)
- Fuelwood (short rotation)
- Non-timber forest products
- •
- Local level



Criteria for tree species identification

Exotic versus indigenous species

- Exotic tree species can
 - have higher yield
 - cause sanitary problems
 - have sometimes unpredictable death risks
- have acceptance problems by people
- become inversive plants
- badly influence biodiversity

· Indigenous tree species may

- bear a great number of positive characteristics

Criteria for tree species identification

Management goal

- Single species stands (easier mgt. but higher risk)
- Mixed species stands (evtl. difficult mgt., more attention, work required, tending operations are ambitious)
- Multifunctional approach (agroforestry, communal forestry)







Criteria for tree species identification

Expectations (yield, environmental services ...)

- · Important factors can be
 - growth rate
 - biodiversity aspects
- CO₂ sequestration
- erosion control
- environmental services (water catchment protection, recreation etc.)

Criteria for tree species identification

Seed/Plant Sources

- Genetically reliable origin of seeds and seedlings?
- Random trial field tests necessary when new species introduced
- Nursery capacity sufficient?
- Seedling transport safeguarded?
- Mykorrhiza available when pine is used?



Criteria for tree species identification

Labour availability

- For site preparation
- For planting (container seedlings, cuttings, bigger plants)
- For weeding
- For beating up
- For thinning
- For pruning
- Are workers skilled?
- Adequate equipment (machines, tools, herbicides...) available?
- Maintenance of machinery safeguarded?

Criteria for tree species identification

Legal aspects

- Is species allowed to be introduced?
- Does it have a potential to be come inversive?
- Can it hybride with native flora?

People's acceptance

- · Do the species meet the expectations of
- stakeholders?
- · Have people been involved in decision process?
- Is the species generally accepted?
- Do local people benefit from tree species?

Thank You for Your Patient

Lecture 10: Forest degradation and rehabilitation --Theory & Practices (2) --- Prof. Zhang Jinfeng









Yunnan

- One of 31 province of mainland China
- Situated at 21 degrees north latitude and 97-106 degrees east longitude
- 390,000 square kilometers
- 76.4 6740 m
- Abounds in mineral resources
- Tobacco and sugar production are in the first places in China.
- Agricultural products: rice, rape, sugarcane, tobacco, tea, rubber, banana and medicinal herbs

Physical Condition

- from north to south:
 - 3 climatic zones-- temperate, sub-tropical, tropical
- from low to high terrain
 - 6663.6 m difference
 - 100m up, 0.6 °C down
 - tropical, subtropical plateau, cool temperate mountain, and snowy mountain

characterized by

- small seasonal change in temperature(10-15 $^{\circ}{\rm C}$)
- great difference in daytime temperature(12 20 $^\circ\!\mathrm{C}$)
- contrast between dry and wet seasons (June-August 60%)

Climate

- mean annual temperature 7°C- 22°C
- mean annual precipitation 750-1,750 mm.
- wet season

from May to October (83% of the annual precipitation)

Kunming

Item		Average values in the last 20 years										
month	1	2	3	4	5	6	7	8	9	10	11	12
average temperature												
Highest temperature on the average (centigrade)	15	17	21	24	25	24	24	24	23	20	18	15
Lowest temperature on the average (centigrade)	1.0	3.0	6.0	9.0	14	16	17	16	11	11	7.0	3
rainfall (mm)												
largest amount of rainfall (mm)	24	41	47	35	95	85	88	110	85	85	42	36

Shangrila (Diqin)

Item		Average values in the latest 20 years										
month	1	2	3	4	5	6	7	8	9	10	11	12
average temperature												
Highest temperature on the average (centigrade)	6	6.0	10	13	17	19	19	19	18	15	11	-3
Lowest temperature on the average (centigrade)	-12	-8	-5	-2	3.0	8.0	9.0	9.0	7.0	0.0	-7	-12
rainfall (mm)												
largest amount of rainfall (mm)	15	14	24	28	33	35	72	56	34	40	22	24

Jinghong (Xishuangbanna)

Item	Average values in the latest 20 years											
month	1	2	3	4	5	6	7	8	9	10	11	12
average temperature	16	18	21	24	26	26	25	25	24	23	18	16
Highest temperature on the average (centigrade)	25	28	32	33	33	31	30	30	31	29	26	24
Lowest temperature on the average (centigrade)	11	11	13	17	21	22	22	22	21	19	16	12
rainfall (mm)	18	11	20	51	130	186	216	246	137	99	51	26
largest amount of rainfall (mm)	68	50	86	42	141	90	111	152	126	66	50	38







Baima Snow Mountain Vegetation Distribution





Vertical Distribution of Forests

Background

- Ecological Importance of Forest in Project Area
 - 63.8% land is forestry area
 - 39.36% stand volume of province
 - The only dark forest (Spruce and Fir) zone in Yunnan
 - Upper stream of 4 famous river in Asia (Yangzi, Mekong, Salween and Drung).
 - Affecting 2.93 million $\,km^2$ and 0.5 million residents in down stream.
 - Regeneration of degraded forest has great significance after the "Three River Parallel" Word Nature Heritage has been approved

Background

- Great significance for bio-diversity protection
 - Special topography, climate and frequent dynamic change /evolution of the earth made the northwest Yunnan become
 - shelter for some antique plants
 - exchange channel between north and south
 - Differentiation center of life-form
 - one of the bio-diversity center

Forest Degradation

- Treated as Commercial logging area
- Forest fire, Felling for farm land, shifting cultivation, Free grazing
- 43.45 % of forestry land (184.49 million Ha²) is degraded as fallow, low quality secondary forest, shrub forest, fire plots, and logging plots
- frequent landslide, mud-rock flow and flood threatening the people and development in downstream.

Types of Degraded Forest Land







Types of Degraded Forest Land



Types of Degraded Forest Land





4. Disturbed plots

Types of Degraded Forest Land





5. Secondary forest



Commercial Logging



Cause of Degradation



Forest Fire





Cutting +fire









Impact of Browsing





Road Construction

Problems faced in forest regeneration

- 1) Singularity of tree species in reforestation spruce, larch and pine
- 2) Singleness of silviculture model monoculture of coniferous forest– low biodiversity and heavy forest pests
- 3) Lack of awareness of landscape which make against tourism industry construction
- 4) Free grazing block forest natural regeneration
- 5) Neglect the local needs and interests-- lack of participation of local community

Project Activities

- 1. Tree selection and seedling raising technology
- 2. Establishment of mixed plantation
- 3. Promoted Natural regeneration
- 4. Animal prevention in new plantation
- 5. Researches
 - Soil seed bank and Seed rain
 - Alpine vegetation succession
 - Decomposition of litters
 - Tibetan culture and biodiversity protection
- 7. Training and extension

Project Implementation & Results

1. Selection of the project site

- Wasteland
- Grass land + bush forest
- Fire plot



Site selection

Farmer interview







Bush forest





Fire plot



Project Implementation

- 2. Project experiment design
- 3. Inventory and analysis of current situation in the project sites
 - Inventory of vegetation
 - Soil test
 - Soil and vegetation investigation in primary forest





Soil profile



Soil test

Vegetation research



Project Implementation

4. Collection of propagation material and seedling raising

Cupressus chengiana, Populus adenopoda, Acer spp., Betula utilis, Betula platyphylla, Sorbus spp., Ulmus spp., Rhododendron spp., Crataegus chungtienensis, Malus rockii, Amygdalus mira, Hippophae rhamnoides, Rosa sp.

Selection of species

- In accordance with management objectives
- Site adaption must be guaranteed
- Mixed species stands preferred
- Broadleaved species promoted
- Available propagation materials
- Wildlings from same site preferred
- Quality of plant material must be secured
- Container or bare-rooted plants?

Criteria for Tree Selection

	Characterist	
Purpose		Eco- Characteristics
Regeneration of degraded eco- system	Deep root large biomass more litter, fast decomposition nitrogen fixing, easy seed collection	Pioneer species light demanding drought tolerance resistance better sprouting regeneration ability long life
Water and soil control	Developed rooting system large canopy fast growing self fertilization, fast decomposition, seed accessible	Wide adaptability drought/wet tolerance to adverse condition resistance ever green better sprouting long life
Mountain Reforestation	Developed rooting system vigorous branches fast growing self fertilization, seed accessible	Wide adaptability resistance ever green better sprouting long life

	Characterist	ics of the Trees
Purpose	Bio-Characteristics	Eco- Characteristics
Urban greening	Flourished canopy fast growing elegant shape	Wide adaptability resistant to CO ₂ 、 SO ₂ and dusts, ever-green changes with seasons
Gardening	Visual value on canopy, trunk, branch, leaf, flower and fruit easy planted	Resistance to adverse condition changes with seasons

5. Construction of nursery



Project Implementation

6. Seedling raising experiment (by cutting and seed)





Seed collection time, mature characteristics, treatment, pregermination for 6 tree species

川滇 长尾 槭	9-10月	修枝	翅果由绿色 变为黄褐色	晒2-3天,揉 去果翅,水洗 去除杂质和不 饱满种子,晾 干	低温 (5℃) 干藏	用50℃温水浸种10分钟。 然后加冷水浸一昼夜, 捞出后置于背风向阳处; 每天用温水冲洗一次, 至有50%的种子裂开, 再低温润沙层积值芽。
白桦	9月下旬- 10月	修枝	果穗转黄色, 有少量种子 开始飞幕	揉搓果穗,用 簸箕轻轻簸出 种子	容器中 密封低 溫贮存	不需要催芽。
西南花楸	9月下旬- 10月	收集球 果	种子变为深 红色或粉红 色,易掉落	用脚将球果外 皮踩烂,放入 水中漂洗,除 去果皮杂质, 晒干	暹沙贮 戴	用高锰酸钾溶液浸种3- 5分钟后用清水冲洗干 净。然后种砂1:3混合 室温层积催芽。每3-5 天翻动一次,约120- 150天开始发芽。

Seed collection time, mature characteristics, treatment, pregermination for 6 tree species

丽江山 荆子	9-10月	收集球 果	果实变为 深红色, 易掉落	堆积沤烂后, 漂洗去杂,晾 干	干藏或 湿沙贮 藏	湿沙层积催芽。
光核桃	6-7月	收集果 实	果肉变软	浸泡搓去果皮, 在水中漂洗晾 干	千載	播种前浸泡2天,湿沙层 积催芽约10天至种子有 1/3篇白时。
中甸山楂	9-10月	采集球 果	果实变为 深红色, 果肉变软	用水离搓去除 果肉和杂质, 漂洗干净	低 <u>温</u> 干 藏	用2-3倍开水 燙种4-5分钟, 凉水降温。浸泡一昼夜, 第二天曝晒,晚上再浸泡 水中,反复至有70%- 80%的种子親开时,低温 沙蒙做非穷第二2月彩,第二2月彩 室温沙藏做芽至种子屬白。

Seedling growth rate in 4 growing mediums

	Crataegus		Sorbus		Be	tula	Amyg	Amygdalus	
Medium	н	D	н	D	н		н	D	
loess (70%) +sand (30%)	34.21 aA	0.44 aA	28.39 aA	0.34 aA	42.00 aA	0.60aA	108.12 aA	1.12a A	
loess (50%) +top soil (50%)	38.65 bB	0.56 bB	30.25 aA	0.36 aAB	48.30 aB	0.62aA	120.00 aA	1.18a bAB	
loess (40%) +topsoil (40%) +sand (20%)	42.36 cC	0.60 bB	30.57 aA	0.37 aAB	55.30 bC	0.71bB	140.45 bB	1.3ab BC	
loess (40%) +burned soil (40%) +topsoil (20%)	40.53 bcBC	0.58 bB	32.04 bB	0.39 aB	47.50 aB	0.63aA	146.87 bB	1.33b C	

Capital letter - significant in 0.05 level Small letter - significant in 0.01 level

Seedling growth rate in 3 container

Container	Crata	egus	Sort	bus	Bet	ula	Amygdalus	
			н				н	
8cm×15cm	36.60aA	0.54aA	30.22aA	0.36aA	45.30aA	0.57aA	105a A	1.14 aA
11cm×15cm	40.50bB	0.63bB	35.30bB	0.38bB	53.64bB	0.61bB	127.2 1bB	1.21 abA
15cm×18cm	41.20bB	0.64bB	35.41bB	0.38bB	56.00bB	0.65cC	142.3 6cC	1.32 bB

Capital letter - significant in 0.05 level Small letter - significant in 0.01 level

Fertilization response of seedlings

	A		Sor		Crataegus		Malus		Betula			
		D	н	D								
1	34.7	0.65	29.5	0.37	36	0.56	58.3	0.62	50	0.62	121	1.18
2	45.6	0.76	35.2	0.42	38.4	0.57	73.3	0.75	51.3	0.60	156	1.32
3	35.5	0.70	29.5	0.38	36.5	0.56	62.5	0.68	65.2	0.68	126	1.20
4	36.2	0.72	33.4	0.40	40.2	0.60	63.4	0.68	54.6	0.63	142	1.28
5	43.5	0.73	34.6	0.42	38.7	0.58	68.5	0.72	55.7	0.63	165	1.40

1) Control ; 2) 0.5% urea; 3) 0.5% phosphorus; 4) 0.5% potassium ; 5) 0.5% compond

Rooting rate of cutting stocks

					Amygdalus
Control	93	40	0	0	0
100ppmABT1 (16h)	96	80	0	0	0
200ppmABT1 (16h)	95	72	0	0	0
500ppmABT1 (30 min)	94	68	0	0	0
1000ppmABT 1(dipping)	92	70	0	0	0

6个树种苗木分级表

	出票									
		苗高 /cm	地 径 /m	形态	苗 高/em	地 径/em	形态	苗高/em	地 径/em	形态
川演长尾 幕	1	≥34	≥0.62	多侧枝, 根系发达	20.0-339	0.34-0.61	多分枝, 根系较发达	≤19.9	≤0.33	多分枝, 根系不发达
白榉	1	≥40	≥0.58	多分枝, 根系发达	25~39.9	0.35-0.57	多分枝, 根系较发达	≤24.9	≤0.34	少量分枝, 根系不发达
西 南花楸	1	≥28	≥0.34	多分枝, 根系发达	15~27.9	0.26-0.33	多分枝, 根系较发达	≤14.9	≤0.25	多分枝, 根系不发达
副江山荆 子	1	≥60	≥0.63	不分枝, 根系发达	38~59.9	0.40-0.62	多分枝, 根系较发达	≤37.9	≤0.39	多分枝, 根系不发达
光核桃	1	≥100	≥1.20	多分枝, 根素发达	60~99.9	0.8~1.19	多分枝, 根系较发达	≤59.9	≤0.79	多分枝, 根系不发达
中旬山楂	1	≥36	≥0.56	多分枝,根 菜多	20.0~35.9	0.36-0.55	多分枝, 根系较多	≤19.9	≤0.35	多分枝, 根系较少

Project Implementation

7. Land preparation, and transplanting



Land preparation

Seedling





Transplanting





Transplanting





Transplanting





Constructed Fence



Project Implementation

8. Demonstration of natural regeneration



Fenced natural regeneration plot



9. Maintenance of plantation (replanting, fertilizing, pests management)



increment of trees

trees	20		20	05		
			Hight (cm)			
Pinus	14.60	0.92	32.26	0.96	95.25	2.95
Amygdalus	57.62	1.03	74.92	1.08	120.40	2.06
Picea	41.59	1.46	53.36	1.90	75.18	4.76
Ulmus	154.62	2.34	156.00	2.42	191.65	3.36
Populus	195.02	2.80	198.02	2.65		
Hippophae	39.96	0.99	56.46	1.31	135.90	2.59
Malus	77.38	1.24	94.72	1.37	136.00	1.46
Sabina	41.54	0.71	43.00	0.93	75.10	1.66
Sorbus	17.82	0.33	22.60	0.42		
Betula			12.40	0.09	20.30	0.15
Crataegus			62.9	0.92	91.20	1.19

1. uneven-aged stands

- Ordinary (2 years) + middle (5-8 years) + large (10-15 years)
- Fast landscape reconstruction •
- High costs

2. Evergreen + Deciduous

- Needle tree (spruce, pine) + other broad leave trees
- Keep forest land green color through a year

3. Seasonal aspect change

- based on seasonal change of canopy, trunk, leaf, flower, and fruit
- Spring flower (Malus, Crataegus 、 Amygdalus)
- Autumn leaf (Populus, Betula, Acer, Ulmus)
- Autumn fruit (Sorbus, Crataegus, Hippophae)

4. Close to nature

- Aimed to regain *biodiversity*
- Keep existing plants as much as possible
- Enrichment planting missing species

5. Give attention to both production and ecology

- Broad leaf + conifer
- High ecology function : Sorbus, Ulmus
- High productivity: Pinus, spruce
- Good for both: Acer, Betula

Artificial promotion of natural regeneration

- - Hill closure (ability or potential for self regeneration)
 - Maintaining young trees (scarifying, fertilizing)
- - Fencing, limiting disturbance
 - Sawing treated seeds (pine, Hippophae)
 - Plant Sabina and pine in rocky area





Vegetation recovery

		grass (1×1m²)	Shrub (1	0×10m²)
Plots	Year	FW (g) FW (g) 1662 5925 6087 2180 5140 75249 41200 51400 71466 8760 51038 71114	DW (g)	Height cm	Crown D m ²
	2003	1662	657	37.34	5.70
1	2005	5925	2138	55.34	15.10
	2007	6087	2374	60.34	16.10
	2003	2180	736	120.75	6.46
2	2005	5140	2408	140.25	9.88
	2007	5249	2476	169.25	11.88
	2003	1200	227	45.54	64.00
3	2005	1400	345	65.51	65.71
	2007	1466	365	82.51	67.71
	2003	760	301	23.00	23.61
4	2005	1038	450	29.48	34.65
	2007	1114	477	35.48	38.65

Vegetation recovery

		grass (1×1m²)	Shrub (10×10m ²)		
Plots	Year	FW (g)	DW (g)	Height cm	Crown D m ²	
	2003	680	318	74.37	72.39	
5	2005	975	363	80.44	84.55	
	2007	1078	396	108.44	86.55	
	2003	375	169	18.72	30.53	
6	2005	805	355	27.16	46.46	
	2007	867	389	48.16	48.46	
	2003	540	232	13.19	39.67	
7	2005	738	328	17.3	41.03	
	2007	793	341	25.30	44.03	

Supporting researches

1) Soil seed bank and seed rain

- 5 plots
- 45 sample sites for seed bank (30×30×20cm³)
- 25 sample sites for seed rain (80×80cm²)

Seed bank species in different degraded forest

	PF	SF	OF	BF	BL
Species No.	17	23	15	8	12
Tree	1				
Shrub	4				
Perennial grass	9	13	8	5	4
Annual Grass	3	10	7	3	8

PF-primary forest SF- Secondary forest OF- Open forest BB- Burn blank BL- Bare



Soil collection for seed bank research





Seed rain collection

2) Succession of degraded forest vegetation

 degraded forest were sorted into 5 degradation levels. The vegetation and soil nutrient changes were studied by means of quadrate investigation

De	egradation level	Vegetation Type
I	荒草坡	读蔬芽+大狼毒+ 蒲公英Ass. Erianthus rockii + Euphorbia nematocypta+ Taraxacum mongolicum
п	灌丛地	灰背栎-囊状嵩草 Ass. Quercus senescens- Kobresia fragilis
ш	疏林灌丛地	白择-西南枸子-东俄洛棠吾Ass. Betula platyphylla-Cotoneaster franchetii- Ligularia tongolensis
IV	次生林地	大果紅杉-大白花杜鹃+米饭花-硬枝点地梅 Ass. Larix potaninii-Rhododendron decorum+ Lyonia ovalifolia - Androsace rigida
v	近原生林地	黄背栎.大白花杜鹃.硬枝点地梅Ass. Quercus pannosa- Rhododendron decorum- Androsace rigida

3) Traditional Tibetan culture and forest ecosystem conservation and rehabilitation

- Species No. (47), Simpson index (0.585), Shanon-wiener index (0.4775), and Pielou evenness index (0.3544) in holy mountain are all higher than ordinary mountain (36, 0.533, 0.4482, 0.327).
- Less human disturbances in holy mountain result in a high species diversity and community structure.
- Respect and practice local culture and religion to minimize human disturbance, to promote regeneration of degraded vegetation.
- Holy trees in holy mountain are excellent forest genetic and germplasm resources

Holy mountain = seed orchard Holy tree = mother tree



Restoration under different disturbance



AttackFreides:

PPSLidceffBarticiPpnaenstentations

Bangla Aktewshalyosffiise lelv neelle værmæleffect i voefsneelse soctoe-om an ag oe mog ærmig ærmiz aint

Cox SbazDairstrict







WELCOME TO FOREST DEPARTMENT MINISTRY OF ENVIRONMENT AND FOREST BANGLADESH











Co-management of protected areas in Bangladesh has been progressing considerably in biodiversity conservation as well as livelihood development of landscape population.

Rehabilitation of degraded forests through creating alternative livelihoods for the forest dependent communities may be considered a good means.

The study incorporates investigation on the relevance and effectiveness of two co-management organizations in Bazar District.

These are Himchari National Park(HNP) and Inani Protected Forest Area(IPFA).



The study revealed a remarkable difference in implementation of co-management approach between these two initiatives, particularly on livelihood development model and function of CMOs (Co-management Organizations). Regarding livelihood program, Inani model made a comprehensive progress due to its saving initiative of forest user groups coupled with revolving fund which is not significant in HNP.





Himchari CMC is more proactive and functional as a result of adequate sensitization and institutional support from project as well as local administration, compare to Inani CMC (Comanagement Committee).

Co-management approach for restoration, conservation and management of protected areas has shown high potentiality. It made a comprehensive progress and is gaining acceptance from a large segment of stakeholders.



The protected areas (PAs) in Bangladesh are under constant pressure and have already been significantly been degraded and fragmented. This situation is threatening the value of these PAs as habitat for biodiversity and for provision of vital environmental services.

There is an urgent need to reduce or reverse the detrimental impact on forest biodiversity and maintain resource sustainability through improved management and creating alternate livelihood opportunities for people dependent on forest resources onsidering the alarm

Considering the alarming situation in forest degradation in the country and the commitment to national and international community.Bangladesh Forest Department has given special emphasis to restore the degraded through creating Alternative Income Generating Activities for forest dependent communities.

BFD has taken some social forestry activities to develop the degraded condition of forest and involved local people to reduce their poverty in both the PAs.



Main objective:

The overall objective of this study is to examine the effectiveness of CMO in two protected areas of Bazar to improve the livelihoods of local inhabitants. More precisely, the objectives of this study are:

- y To assess popular perceptions and credence of the CMOs.
- y To measure impact on enhancement of livelihood of the participating community.
- y To assess issues and challenges of institutional sustainability. Long term

Restore/rehabilitate the degraded forest through implementing co-management.



y impact on enhancement of livelihood after the intervene of comanagement system etc.

0

P

Event wise respondent number for both the research sites

Site Name	Type of Event	Total Responde nts	FD	AF (SHED)	IPAC (CODEC)	CMC Office Bearer	Forest Dependent Community People
HNP	FGD	31	2	-	2	2	25
	KII	6	2	-	1	3	-
	HHS	6	-	-	-	-	6
IPFA	FGD	27	3	3	-	1	20
	KII	4	-	2	-	2	-
	HHS	4	-	-	-	-	4



The indicators responded to: 1. Achieving expectation from CM 2. Achieving expectation from CM 2. DK (a. 21 21 21 21 20 20 20 20 20 20 20 20 20 20 20 20 20	O (Committee) (Grt)up O (Council) (Grt)up
Solution Solution	•) v Geljn,∞ Ce(}veet ~ Ce)µ™∞ nce of CMC (Ga9)µp ng (Gra9)µp wood collection (Gra9)µp s£µp s£µ
10.Increased wildlife (Group) 11.Improved tree coverage (Group)	Group1: Forest Department, Arannayk Founda and IPAC personnet Group2: CMO representatives and office beare Group3: Forest Dependent Community People

Group discussions

- ‡ 5 villages in HNP
- ‡ More than 95% of the total populations are dependent on forest
- \ddagger 2,000 households under the umbrella co-management out of $6{,}381$
- ‡ Alternative Income Generation(AIG) and Landscape Development Fund (LDF) support to only 800 families (12%)
- ‡ Illegal felling is reduced to 25% and
- Fuel wood collection is reduced about at 40%. Encroachment is still a major problem there.



y6 villages in IPFA

- y About 13,800 HHs are directly or indirectly dependent on the IPFA. Only 1,008 people/HH are the member of village level forest dependent groups (7.3%)
- v Revolving fund support to 336 members (2.43%)
- y Encroachment is reduced to about 50%.



During FGD and HH Survey opinions from local people:

- **‡** Forest conditions have improved after launching the CM Approach.
- ‡ Encroachment of forests by elites is due to the absence of wide participation of local stakeholders.



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Name	Major Trade	Previous	Income after	% of	Mode of AIG
of PA		Income	Intervention	increase	
		Tk./Year	Tk./Year		
HNP	Handicrafts(7)	879	1168	33	In Kind
	Weaving(4)	525	975	86	In Kind
	Others(1)	3000	3750	25	In Kind
IPFA	Nursery Raising			147	Revolving
	and Homestead				Fund
	Gardening(9)	725	1792		
	Small Scale			144	Revolving
	Business(2)	495	1208		Fund







- y At VFDG level, the participants created a saving scheme where they save Tk 10 to 50 per month
- y The amount decided by the participants on their voluntary consensus.
- y VFDG keeps savings in govt. scheduled bank.
- y The participating members use to get interest free loan from this fund on need and utilized in AIG activities/ Conservation-focused livelihood opportunities, such as eco-tourism, nursery development, growing of medicinal plants, homestead management, and non-timber based small enterprise.
- y This initiative is playing an important role to reduce their dependency on forest as well as to reduce their poverty



Issues and challenges of institutional sustainability:

- yFD and CMC are not yet complimentary to each other. There is scope for further integration.
- yMember of CPG are unable to provide volunteer service.
- yCMC activities are not monitored in a systematic and organized way at all.

Percentage of respondents and their level of perceptions (FD/AF/IPAC Personnel)

SI.	Indicators		HNP (n=6)		IPFA (n=10)				
No.			Rai	Rank			Rank			
		High	Moderate	Medium	Low	High	Moderate	Medium	Low	
1	FD's role and coordination with CMO satisfactory		84%		16%		90%		10%	
2	IPAC/AFs role and coordination with CMO satisfactory		84%		16%		80%		20%	
3	Member of CPG satisfied with their job			50%	50%				100 %	
4	CMO's activities monitored regularly		17%	16%	67%		50%		50%	
5	Performance of CMO's activities(as perceived by the respondent)	16%	50%	17%	17%		60%	40%		

There is scope to develop community awareness and participation in conservation. The institution developed has given a basic platform for co-management.

				-				-	
S1.	Indicators		HNP (n	=7)			IPFA (n	=7)	
No.			Ran	k			Rank		
		High	Moderate	Medium	Low	High	Moderate	Medium	Low
1	CMC representatives are aware about their responsibilities	86%			14%	100%			
2	Stakeholders are performing their responsibilities	14%			86%	57%			43%
3	How much the CMC get support from the community		29%	71%		71%	29%		
4	Financial strength (Revolving Fund Savings, Donation, Project Support) is necessary	100%				100%			
5	Performance of CMC is satisfactory		100%				86%		14%
6	Any threats to NR within the PA	43%			57%	100%			



Percentage of respondents and their level of perceptions (Forest Dependent Community People)

			HNP (1	1=16)		IPFA (n=12)			
S1.	Indicators	Rank				Rank			
No.		High	Moderate	Medium	Low	High	Moderate	Medium	Low
	Facing obstacles to collect forest products from PA after CMO		100%				100%		
	Involvement in	44%	31%	12.5%	12.5	67%	16%	17%	
	programs and decisions				/0				





Strength and weakness of CMCs (as perceived by the respondents)

During FGDs and interviews of key informant and forest dependent community people, the major threats to the effective functioning of the CMOs have been identified as :

- ‡ Food scarcity
- ‡ Lack of manpower
- ‡ Problem in CMC management
- [‡] Obstacle from elite group
- ‡ Encroachment
- ‡ Illegal activities of timber business
- **‡** Political threats etc.

Strength Weakness x FD and local administration x Lacking in linkage between CMC recognized the CMC, Socio-cultural recognition for the CMC, representatives are democratically elected from stakeholder on forest, community, x CPGs are formed and they are

- active in protection activities, x Participatory decision making
 - process,
- representatives and the grass root stakeholders who are real dependent x A major portion of forest dependent people are yet beyond supports for livelihood,
- x Encroachment,x Land use change,
- x CMC lacks in financial ability,
 x CMOs are still immature.



Effective co-management of PAs is of immense importance to conserve biodiversity and forest land management. During study it is found that most of the people in and around PAs know or are broadly aware of the main objectives of co-management.

Most of them share this information with others, motivating them to participate in various co-management activities.

In terms of livelihood development program, interest free revolving fund supported conservation-focused activities made significant contribution to a very small segment of the landscape dependent population.

active involvement of forest users in co-management activities is one of the major pre-condition to make a co-management organization effective.

To ensure an effective CMO, adequate livelihood development program, coordination amongst all relevant stakeholders and especially supports from other Government agencies are required



Based on the study findings, the following recommendations are made

- y A massive afforestation program is required to restore biodiversity, create forest resources and also create employment opportunity for local forest dependent community people.
- y There needs to involve a large population from PA landscape and also to extend community awareness.
- y To restore degraded forest/conserve PAs at national level, the Government can provide revolving fund from banks to respective CMOs for AIGAs of the local poα. This will accelerate the poverty reduction program of the Government included in Sustainable Development Goal.



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Siem Reap, Cambodia

BHUTAN

CHINA

Prabhat Kumar Mukhis (Email Id: hincha70@gmail.com, pmukhis@ Non Wood ForestProducts and Agroforestry Technology Sub Centre

Ugyen Wangchuk Institute for Conservation and Environmental Research - Darla Department of Forests and Park Services, Ministry of Agriculture and Forests, Chukha Bh

Outline of the presentation Overview of the country · Sustainable development philosophy Overview of the forest policy, legislation, and strategy Legitimacy pertaining to development of Community Forest Procedure for selection and establishment of Community Forest Area in Brief Legitimacy pertaining to development of Non Wood Forest Products (NWFP) Management Group > Procedure for selection and establishment of NWFP Management Group Area in Brief Observation on the performance of CF and NWFP resources Case 1 (a) and (b): Performance of Community Forests > Case 2 (a) and (b): Performance of NWFP Farmers Group Conclusion · Lesson learnt from CF and NWFP Farmers Group

Overview of the country

INDL

- Altitude: 150 to 7,700 metres asl
- ➡ Land coverage: 38,394 Km²
- ➡ Population: 768,577 (NSB, 2016)
- ➡ General literacy rate: 63% (NSB, 2012)
- Dependent on agriculture farming: 69%
- ➡ Poverty: 12% (BPAR, 2012)
- ➡ Rural urban migration rate: 0.60% (Tenzin, 2012)
- ➡ Poverty line: Nu. 1,704.84 per person per month [USD 28.414] (BPAR, 2012)
- Population growth rate: 1.09% (World Fact-book, 2017)
- ➡ GDP per Capita: USD 2,719 (RMA, 2016)
- ➡ GDP real Growth rate: 6.50% (RMA, 2016)

Overview of the country (Continue)

- ➡ Constitutional mandate to conserve forest: 60%
- ➡ Forest coverage: 81.27% (Ca.70% tree & Ca.11% shrubs & others) [DoFPS, 2017]
- Protected areas coverage along with biological corridors: <+51% of the total</p> geographical land area
- ➡ Contribution to GDP Growth rate by Forestry Sector (2008-2015): 0.075% (RMA, 2016)
- Arable land: Ca. 8% (1960s) but now (2010 onwards) it is only ca.3% (62% dry-agriculture land, 28% wetland, and 10% horticulture land)
- ➡ Degraded areas: 0.54% (BSER, 2016)







Overview of the Forest Policy, Legislation, and Strategy

- ✓ National priority: Conservation of environment.
- ✓ Prior to 1960s, people used to enjoy wild forest resources with no or modest intervention from government side.
- ✓ In 1961, the policies and rules began evolving for the management and utilization of natural resources when first developmental activities plan started.
- \checkmark Thence, natural resources became a centralized programme for the government.
- The 1969 Forest Act (FA), and 1974 National Forest Policy (NFP), has been accorded as the first legislation and policy statements emphasizing protection rather than the conservation and sustainable utilization of forest resources.
- ✓ Later, FA 1969 has been replaced by Forest and Nature Conservation Act (FNCA) of 1995 which had devolved the management of natural resources to the grass-root level urging local communities to participate.

Overview of the Forest Policy, Legislation, and Strategy (Continue)

- ✓ The 1995 FNCA, included the chapter of Social Forestry and Community Forestry that gave access to the use of natural resources legally and sustainably.
- ✓ In 2000 Forest and Nature Conservation Rules (FNCR) promulgated, subsequently revised in 2003 and 2006.
- ✓ FNCR facilitated the creation of community and private forests.
- ✓In 2011, NFP of 1974 had been revised and called as National Forest Policy of Bhutan (NFPB), 2011.
- ✓ The revised NFPB, 2011 allows sustainable harvesting of Non Wood Forest Products (NWFPs) through a management guideline or plan.
- ✓ Prior to NFPB, 2011, an Interim Framework for the Collection and Management of NWFPs, 2009 has been developed to ease the sustainable harvesting and management of NWFP species
- \checkmark In January 2017, FNCR again revised and amended and called as Forest and Nature Conservation Rules and Regulations 2017 .
- ✓ FNCRR 2017 provided people with friendly opportunity to participate in sustainable management of forest and forest products, NWIP resources, biodiversity conservation so that equitably and economically benefitted to them.

Legiunacy pertaining to development of Community Fores	
National Forest Policy of 1974 emphasized protection rather than cons	ervation and
sustainable utilization of the forest resources.	

- ✓ In 1979 Royal Decree accorded to recognize Social Forestry with the statement participation is a key to conservation and utilization of forest
- ✓ With promulgation of FNCA 1995, Community and Private forest legitimized.
- ✓ In 1996 Community Forestry Guidelines developed.
- ✓ In 1997 First Community Forest established.

~

- \checkmark In 2004 a manual developed for Community Forest (CF) establishment procedure.
- ✓ FNCR 2006 included chapter for Social, Community, and Private Forestry.
- ✓ In 2010 National CF strategy developed.
- \checkmark In 2016, guidelines for monitoring and evaluation of CF was developed.
- ✓ As of March 2017, country has 682 CF covering an area of 75,705 hectares and benefited to 28,453 households.
- ✓ CF occupies about 2.8% of the total forest area.
- ✓ DoFPS targeted to cover at-least 4% of the total forest area.

Procedure for selection and establishment of Community Forest Area in Brief
Selection of area to establish Community Forest
✓ State Reserved Forest Land (SRH.) which is degraded or barren and located very close-by to human settlement
✓ Site should be suitable for control and management by Community Forest Management Group (CFMG)
✓ SRFL is traditionally used by the community
✓ Each household is allocated minimum area of 3 hectares and maximum to 5 hectares
✓ CFMG is must to form comprising of at-least 5 residents households



Legitimacy pertaining to development of NWFPs Management Group

- ✓ NFP (1974) emphasized protection the forest resources.
- ✓ Collection of NWFP(s) used to consider by DoFPS on case by case basis.
- ✓ In 2006, government and DoFPS recognized economic importance of NWFP and organized National Workshop for Development of NWFP programme.
- ✓ In 2008 developed national strategy for development of NWFP resources.
- ✓ In 2009, formulated Interim Framework for Management and Marketing of NWFP(s)
- ✓ Interim framework of 2009 granted access to harvest 41 NWFP species.
- ✓ Interim Framework of 2009 has been revised in 2011 and added 19 more NWFP species totaling 60 species which are allowed to harvest for sale.
- ✓ FNCRR 2017, included a section on NWFP resources.
- ✓ As of 2016, 128 NWFP Farmers groups formed and approved.
- ✓ NWFP Farmers Groups benefitted to 5080 households.
- ✓About 40% of the total rural households taken advantages of communitybased management of the forest resources.

Procedure for selection and establishment of NWFP management Group area in Brief

Selection of area to establish NWFP management Group

- ✓ State Reserved Forest Land (SRH.) which is located very close to human settlement
- ✓ Site should be suitable for control and management by Community or individual household
- ✓ SRFL is traditionally used by the community or by individual household
- ✓ Individual farmer or more number of household can form NWFP management group



NWFP resources include

- · Wild medicinal and aromatic plants
- ← Wild fungus / edible mushrooms
- Wild green vegetables
- · Wild edible fruits and nuts
- · Barks and fibres of the wild trees and plants respectively
- Naturally grown wild fodders
- Wild oil seeds and nuts
- · Wild decorative flowers
- Wild bamboos and rattans
- Wild incense plants
- Wild orchids

Till date recorded + < 400 NWIP species out of which 60 priority species are allowed to harvest.



pation in conservation and protection activities by CF members in percentage							
Activities	Community Forests Area						
	Waku Damchi	Lumsum	Yargay	Mangizingkha	Average		
	(n=42)	(n=29)	(n=20)	(n=17)	(n=108)		
Attending CF meetings	90	90	100	88	92		
Conservation of wildlife	60	52	70	76	65		
Forest fire control	100	100	100	100	100		
Patrolling of CF	90	86	85	100	90		
Protection against illegal harvesting	100	100	100	100	100		
Protection of fresh water	100	100	100	100	100		
Re-plantation	100	100	100	100	100		













Distribution in Bhutan

Pemagatshel





Conclusion

- Decentralization of some government function is one of the viable strategies for development and sustainable management of forest and NWIP resources.
- ☑ It is crucial to empower grass-root people.
- Rural people are the best possible means to manage any natural resources.
- Sustainable participatory management of community forests and functioning of NWFP Farmers Group can generate self employment opportunity generating off-farm income.
- \boxtimes At-least rural people in Bhutan eam 0.3% of the total household income from such off-farm activities.
- Participatory community forest management is one of the ways to safe-guard forest from fire outbreak, against illegal harvest, protect fresh water degradation, and re-plantation.
- ☑ Sustainable management of community forests also take cares the sustainable economic utilization of the NWIP resources.
- Forestry and allied natural resources activities at times of lean agricultural farming season can alleviate poverty economically to some extent.
- Participatory approach of managing community forestry has potential to conserve, revive state of biodiversity, and restore the depleted forests ecosystem.

Lesson learnt

- GNH principle is quite appropriate and applicable at times of formulating policy, strategy, and plan for developmental activities
- Policy should be dynamic and holistic
- Roadmap, strategy, and regulation should be the driving tools for sustainable development
- Rural centric participatory management and action plan, and guidelines need to develop for implementation of any policy
- Collaboration among relevant multi-stakeholders is crucial in issue of sustainable management and development programme
- Willingness and participation of the community group is must so that an ideal situation will be created for conservation of any natural resources
- Rural marginal communities are at bay and easily motivated to take-up activities for the sustainable management of any natural resources
- Above all good governance is must in order to achieve the sustainability of forest resources or to rehabilitate the degraded areas. Such governance can definitely help to reduce poverty of the country





THANK YOU ALLAND TASHI DELEK



Content

Country Profile

Generation Resource Management Institutions

Generation Forestry Administration

Generation Forest Resources

Drivers of Deforestation and Degradation

- Government Policy & Measurement
- Challenges



Forestry Administration

- A government authority under Ministry of Agriculture, Forestry and Fisheries (MAFF), in managing forests and forest resources according to the National Forest Sector Policy and Forestry Law
- Streamline order structure for the whole country, and divided into the Hierarchical level: central, regional inspectorates, cantonments, divisions, and triages




Photos of Forest Types



Drivers of Deforestation and Forest Degradation

- ➤ Illegal logging and Hunting
- Economic Land Concession
- ➤ Migration
- > Forest Land Encroachment
- $\blacktriangleright A gricultural Land Expansion$







Government Policy & Me		*	-574-
Law/Legislation(s) Law on Forestry: Endorsee National Forest Program(a #Rectangular Strategy Phase	d by RGC, 2002 NFP), 2010 e III, RGC	ម្នាច ផ្លូក ថ្ងៃព្រះឈើ	HATIONAL FOREST PROGRAMME 2010-009
#REDD+ Roadmap, 2010 ‡Guideline on Community Forestry 2006)	DITECT PART Providence of the state of the	anderspectra de presentados encontra querrantes y esteren encon- contra de la contra de la place encontra encontra de la place	

Measurement

National Forest Program (2010-2029)

- Increase Forest Cover 60% by 2029
- Protected Forest 3 M.ha
- Community Forestry 2 M.ha
 Boundary Demarcation 120,000 Km
- Planted High Value Species 500,000 ha



‡REDD+ Roadmap

- Cambodia REDD+ Taskforce and its Secretariat
 4 Technical Teams (Benefit Sharing, MRV/REL, Demonstration, Consultation and
- Safeguard)
- 2 pilot projectsCAM-REDD, UN-REDD, FCPF, etc.





- Strengthening Forest Law Enforcement
- Forestry Law Awareness Raising
- \succ Strengthening collaboration FA-authority
- Banned new ELC, 2013
- Reduce duration of ELC from 99 to 50 years
- Clarify the responsibilities of MAFF & MoE
- Integrated FA-Cantonments, divisions, & triages with provincial department of agriculture, forestry and fisheries



Challenges

- > Limited Human Resources
- \succ Limited Participation of local communities and stakeholders
- \succ Limited commitment of local authority
- > Government has limited budget



Fiji: Forest rehabilitation and management



PRESENTATION OUTLINE

- **‡** Brief for Fiji
- ‡ Forest Cover
- ‡ Roles of the Forestry Department
- **‡** Department Organization Structure
- **‡** Section Organization Structure ‡ Area of Responsibility
- **‡** Challenges
- ‡ Way Forward
- ‡ Causes of Deforestation
- **‡** Expectation
- ‡ Conclusion



Map of Fili



Brief Description of Fiji

- [‡]Land Massof 18,376km²
- **‡**Population of 837,271
- **‡**GDP per capita (8619.70 USD in 2015)
- **±**Main Income Earner Tourism, Sugar, Agriculture Products
- ‡Land Use Open grazing for Sugarcane, Agriculture, cattle grazing, beef farming, plantation forest and etc.
- Land Tenure System (86% owned by indigener unit, 5% by the state and 9% freehold.



Forest Cover

- **±** Total Forest cover is 1,014,000 hectares
- ‡ Accounts 55% of the total land mass
- **‡** Forest Cover (Native Forest - 739,340ha(73%) and plantations -177,000ha(17%)



Roles of the Ministry of Forest

- **‡**Implementation of the Forest Policy 2007 **‡**Administer and enforce Forest Legislation
- **±**Ensure conservation, sustainable utilization and management offorest resources
- **‡**Approve and issue forest related licenses
- **‡**Provide training, extension services and research
- [±]Coordination with key stakeholders including
- forest resource owners





Section Organization Structure



Area of Responsibility

- **‡** Harvesting Section
- \$\$ Assistant Divisional Forestry Officer (Central / Eastern)
- The core responsibility is to oversee the implementation of all forest operational activities
- ‡ It also coordinates all core business or functions undertaken by all sectors that include the Timber Production, Forest Extension, and Timber Utilization in line with the business plan and strategic directives from the DFO
- the monitoring of the harvesting activities and coordination of the reforestation and afforestation



Challenges

- **‡** Land tenure
- ‡ Illegal removals of timber and logs
- ‡ Lack of knowledge by resource owners towards SFM
- ‡ Weak Land Use Policy in Fiji
- ‡ Shifting Cultivation
- **‡** Forest Fire
- ‡ Lack of Resources
- ‡ Not enough Research and development
- ‡ Time Management ‡ Outdated monitoring system



Way Forward – Action needed to balance agriculture development vs

Forest Sustainability ‡ Effective legal and institutional framework

- Coordinated forest, agriculture, food, land-use and rural development policies
- **‡** Secure land tenure and regulation of land use change
- ‡ Inter-sectoral collaboration on research, development and extension.
- ‡ Adequate funding and investment to increase agriculture productivity and manage forest sustainably.
- \$ Stronger involvement of local communities and smallholders
- ‡ Agro-forestry and stronger farm forest links







Expectation & Interesting Topic

- **‡**To recognize and reorganize the current situation of participanting countries and to formulate Final Reporting (including Action Plan) for the solution of the solution
- ‡Learning new concepts regarding forest rehabilitation and management and try to adopt the best



Concluding Remarks

- ‡ The long term benefits of the forestry industry to the landowners needs to be foreseen in order to make them more interested to take part in forestry investment.
- [‡] The importance of restoring the degraded area in terms of watershed protection, biodiversity conservation, climate change mitigation and importantly will improve standard of living
- [‡] The success of the forest rehabilitation and sound management will depend on the active participation of landowners and communities



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"A forestry trainer "



East Kalimantan (Areal Condition)





















Conclusions



Initial Findings - Productive Collaborations

Land rehabilitation Model - Education and training purposes

Balanced reports
- For future findings







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National Biodiversity Council (NBC) > 3XUYLHZ PSDHWWHDULVQLQJWRELRGLYHUVLW\PD





Forestry Legislations and Other Related Land Use Legislations

Peninsular Malavsia

- ‡ National Forestry Act, 1984 (amended 1993) ‡ Wood-based Industries Act, 1984
- Water Enactment, 1935 ±
- ‡ Land Conservation Act, 1960
- Environmental Quality Act, 1900
 Environmental Quality Act, 1974
 Protection of Wildlife Act, 1972
 National Parks Act, 1980

- ‡ Aboriginal Peoples Act, 1954

(m) ne FOREST COVER IN PENINSULAR MA LAYSIA 5.80 million ha (44.0%) tateland Forest and Alienated Forest (5.0%) d Fors Wildlife Reserve & Bird Sanctuaries (10.0%) (PRFs) (85.0%) Under Sustainable Forest Management (SFM) Practices























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		5.0 CONCLU	SION		
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Ministry of Natural Resou	rcesand En viranmental Conservation
Content	
 Introduction Background information about forest Main causes of deforestation Forestry sector reform Restoration and rehabilitation progra a. Goal b. Objective c. Expected Outputs d. Project period e. Project Area f. Implementing Agencies g. Supervision Agencies 	ry sector of Myanmar mme in Myanmar h. Project activities i. Zoning of the project j. Manpower k. Budget l. Reporting m.Monitoring and evaluation
 Financial and technical needs Conclusion 	9

Ministry of Natural Resources and Environmental Conservation.					
1. Introd	uction				
> Acco	ding to FRA 2015, M	lyanmar was the a	country of third	highest defo	restation
rate a	mong countries in th	e world. Defores	ation was due to	the politica	l, social
and	economic	mixed	factors	of	the
natior	S. a ao aoo ao aoo aoo ao aoo				
≻ Large	scale reforestation an	nd rehabilitation is	urgently needed	in order	to
increa	se forest cover, and t	o compliance with	the international	ag	reement
relate	d to climate chan	ge mitigation and a	daptation.		
10000000					000000

6.	Ministry of Natural Resources and Finsknewstal Conservation
2. Backgro	ound information
Backgr	ound information of Forestry Sector in Myanmar
1.	My anmar has been managing its forest resources on a sustainable basis.
	Myanmar Selection System was started in 1881 to achieve the sustainable yield.
2.	Silvicultural operations are carried out to improve the quality of the forests. Forest plantations are also established in the degraded forest areas for various purposes.
3.	Forests are managed through 10 years District Forest Management Plan















Sector State and State and Backwood Parity and Can section	Ministry of Distances Recourses and Environmental Conversion
3. Main Causes of deforestation	3. Deforestation and Main Causes of deforestation
Direct Causes of deforestation	Indirect Causes of deforestation
1. Over Exploitation	1. Poverty and limited job opportunity
2. Illegal logging	2. High market demands of forest products
3. Fuel wood extraction	3. Lack of Land use policy in the past
4. Agricultural land expansion	4 Weak monitoring and assessment in natural resource
5. Shifting Cultivation	4. weak monitoring and assessment in natural resource
6. Mining	management
7. Hy dropower/irrigation Dam Construction	5. Limited budget
8. Urban Development	6. Weak Law Enforcement
9. Fish and Shrimp farming/ponds in Mangrove	7. Ever increasing population
area	8. Weak coordination among stakeholders
10. Natural Disaster such as Cyclone, forest fire	9. Corruption
etc	10. Weak political support

Ministry of Natural Resourcesan

4. Forestry Sector Reform

After the Workshop on Natural Resources Management on June 2016, the following results of the workshop were come out and some of the results already had

been implemented as the reform process in the forestry sector;

a. Outcomes of Workshop

- To implement the logging ban of Teak and Hardwood in the 2016-2017 fiscal year and to reduce the extraction of Teak and Hardwood below the AAC in the coming fiscal years
- 2. To eradicate the corruption in accordance with the notification of President Office
- To reduce the process of some procedures, rules and regulations through coordination of line Ministries
- To develop a plan to fulfill timber demands and needs of the local community
- To promote coordination among the line ministries in order to cont the illegal logging and trade effectively

Ministry of Natural Resources and Environmental Cons

4. Forestry Sector Reform (Cont;)

- a. Outcomes of Workshop (Cont;)
 - 6. To increase transparency of timber selling system
 - To promote the export of value added products while banning the export of primary wood products within the certain period of time
 - To consult with the line Ministries for the reduction of tax and revenue from the import of timber to be able to keep the momentum wood based industry
 - To scaling up the international cooperation for the development of forestry sector including production of efficient cooking stoves

14

4. Forestry Sector Reform (Cont;)

b. Implementation of outcomes of the Workshop

- 1. Banning the extraction of timber in 2016-2017 across the country
- Banning the extraction of timber in Bago Yoma Region for 10 years starting from 2016-2017
- Revising Community Forestry Instruction (CFI) 2005 and issued as CFI 2016.
- 4. Selling the timber to the Governments of States and Regions by Myanma Timber Enterprise (MTE) for the development activities especially in natural disaster affected areas and the areas where timber is needed urgently.

4. Forestry Sector Reform (Cont;)

b. Implementation of outcomes of the Workshop

- Regarding the imported timber, consultation with the Ministry of Planning and Finance for the amendment of the section in the Union taxation hav 2017 to fulfill the needs of wood based industries
- 6. Conducting the survey about the capacity of wood based industries and related agency to realize the actual the capacity of investors in the wood based industries and to promote the export of value added products

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4. Forestry Sector Reform (Cont;)

c. Outcomes of WS to be implemented

- 1. The timber will be extracted below AAC to fulfill the domestic timber demands
- Extraction of timber will be allowed only to MTE and concession with private sector for contract logging will not be allowed.
- Revised forest law (1992) to be enacted as a new forest law and revised wildlife law (1994) have been submitted to the Parliament in order
- In order to maintain and increase the existing forest cover (4292% of total country's area), the restoration and rehabilitation project will be implemented for 10 years period (2017-2018 to 2025-2026).
- To implement the production and distribution of the efficient stove for the development of the forestry sector with the aids of the domestic and international agencies.

5. Restoration and Rehabilitation Programm<u>e in Myanmar</u>

Goal

- To bring back the virgin ecosystem with rich biodiversity by restoring the natural forest
- 2. To mitigate the impacts of climate change
- 3. To support the socio-economic development of the nation
- 4. To support the sustainable forest management

S. Restoration and Rehabilitation Programme in Myanmar (Cont;) Objectives 1. To restore and rehabilitate the forest with the appropriate methods 2. To strengthen the investment of large- and small scale private plantation 3. To support the community forestry and agro-forestry practices

- To formulate the plantation policy through consultation with relevant stakeholders
- To encourage the participation of all relevant stakeholders in restoration and rehabilitation programme

Ministry of Natural Resources and Environmental Conservation

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

3. Expected outputs

- 1. Formulation of Forest Plantation Policy
- 2. Establishment of (352,438)Acre of forest plantations owned by the State
- 3. Establishment of (285,104) Acre of private plantations
- (818,538) Acres of Assisted Natural Regeneration in the Production Forests
 Conservation of (500,000)Acre of remaining natural forests in Central Dry Zone
- 6. Establishment of (770,332)Acre of Community Forests
- Reservation of (1610)square mile (6.19 5% of country area) to fulfil the national target of 30% of PFE in accordacne with Myanmar forest policy 1995.

1

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

3. Expected outputs

- Supporting the development of socio-economic condition of the local communities through the creation of job opportunities for the (0.25) million people annually.
- Building the capacity of the local people and staff members (about 38,120 people) through the reforestation prgramme
- 10. Mitigating the impacts of climate change through the establishment of plantations, restoration of forests, reservation and protection of biodiversity with the active participation of people

- Phase II _ 2022-2033 to 2o26-2017 (5 years)
- 7 Thuse II _ 2022 2000 to 2020 201

5. Project Area

Reforestation will be implemented in 68 Forest Districts in 15 States and Regions

6. Implementing Agencies

- Forest Department
- > Dry Zone Greening Department





Ministry of Natural Resources and Environmental Conservation							
5. Restoration and Rehabilitation Programme in Myanmar (Cont;)							
8. Activities to be implemented							
No	Activities	Count	Project Phase I	Project Phace II	Total		
1	Forest plantation policy						
2	Assisted Natural Regeneration	Acre	437,755	380,783	818,538		
3	Protection of remaining natural forests	Acre	250,000	250,000	500,000		
4	Establishment of Government Forest Plantations	Acre	179,228	173,210	352,438		
5	Establishment of private Forest Plantations	Acre	175,107	109,998	285,104		
6	Community Forestry	Acre	464,037	306,295	770,332		
7	Agro-forestry	Acre	8,791	7,923	16,714		
8	Maintenance of old forest plantations	Acre	61,467	49,890	111,357		
					25		

Ministry of Natural Resources and Environmental Construction

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

8. Activities to be implemented (Cont;)

No	Activities	Count	Project Phase I	Project Phace II	Total
	Seedling Distribution	Mil no. trees	48.83	48.25	97.09
	Cleaning and Pruning	Acre	50,440	35,959	86,399
	Thinning	Acre	101,357	73,153	174,510
	Establishment of SPA	Acre	2,627	1,651	4,278
	Seed and seedling production Center	number	8	0	8
	Reservation	Sq-ml	11,649	4,511	16,160
					26

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

8. Activities to be implemented (Cont;)						
No	Activities	Count	Project Phase I	Project Phace II	Total	
	Water resource development					
	Construction of small ponds	Number	105	105	210	
	Check Dam	Number	608	600	1208	
	Tube Well	Number	14	12	26	
	Digging small ponds	Number	51	15	66	
	Special Greening	Mil no of trees	11.21	13.30	24.52	
	Village supply planting for rural development	Mil no of trees	12.93	13.30	26.23	
	Training(Public/Gov Staff)	person	18,190	19,930	38,120	
					2	







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5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

Establishment of SPA -Seed Production Area





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Ministry of Natural Resources and Environmental Construction

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

10. Manpower

- Required staff members for implementation of the project 46 Officers and 1410 Staff (Total 1456)
- Existing staff members in States and Regions will be assigned in order to implement the other restoration activities.
- 3. Need to reinforce the structure of FD for the effective conservation of forest resources

MaintenalResummentalConversion 5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

10. Manpower (Cont;)

* Extension the current structure and number of Staff in Forest Departmen

No	Structure/number of division	Maximum number of staff to be appointed	Current	Proposal to extend the number of staff to be appointed	To extend the current
	Structure of FD	15449	8129	17946	2497
	Director General Office, 12 divisions	2816	946	3106	290
	Management Unit of PAS, 39	1573	478	1949	376
	States and Region Office, 15	11060	6705	12891	1831
					•

et en her berg	Ministry of Natural Resources and Environmental Conversation.					
5. Re	storation and Rehabilitation Program	mme in Myann	nar (Cont;)			
10. N	10. Manpower (Cont:)					
No	Statement	Officers	Staff members	Total		
1	Current number of offices/staff in organizational structure of FD	538	14911	15449		
2	Proposed Number of staff members in organizational structure	800	17146	17946		
	Extended number to the current number of officers/staff of organizational structure	262	2235	2497		

in the	Ministry of Natural Resources and Environmental Conservation				
5. R	estoration and Rehabilitation Programme in	n Myanmar (Cont	;)		
11	. Budget				
	(589.196) billion Kyats/million US\$ (497.2	212)			
No	Statement	Kyat(billion)	US\$ (million)		
1	Machinery and others	25.213	21.277		
2	Nursery and Office Building	10.374	8.755		
3	13 Forestry Operations (activities)	505.132	426.272		
4	Salary	47.897	40.419		
5	Capacity Building Training	0.580	0.489		
	Total	589.196	497.212		

Exchange rate = 1 US\$ = 1185 Kyat

2016-2017 fiscal year(2nd period of Plantation - 6 months)

Union (million Kyats) States and Regions Total (million International Supports To (million Kyats) (million) (million) USD To	
(million Kyats) Regions Total (million USD (million Kyats) Kyats) (million)	tal
221,631,960 164,252,56 385,884,520 203,311,250 171,571 589	195.770

Ministry of Natural Resources and Environmental Conservation

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

11. Budget (Cont;)

To implement the annual target of project (20300 Acre of Economical and Watershed plantations and 14060 Acre of Enrichment planting) in 2017-2018 fiscal year, 2158.960 million Kyats (1931.917 million Kyats for Plantation and 227.043 million Kyats for Enrichment planting) will be required.

No.	Statement	Kyat(million)
1	Preliminary preparation of 20300 Acres of plantations (Union Budget)	1,931.917
2	Preliminary preparation of 14060 Acre of Enrichment planting (Union budget)	227.043
	Total Budget needed	2,158.960

Ministry of

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

11. Bud	get (Cont;)	
No.	Statement	Kyat(million)
1	Preliminary preparation of 20300 Acre of plantations (Union budget)	1,931.917
	Union budget alloted for the annual target of FD (Already approved)	334.662
	Required amount of budget to add the approved Union budget	1,597.295
2	Adjustment mount of Union budget for 14060 Acre of Enrichment planting	227.043
	Union budget alloted for the annual target of FD (Already approval)	137.411
	Required amount of budget to add the approved Union budget	89.632
	Total amount of required budget (Union)	1,686.927

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

11. Budget (Cont;)

(9.801) billion Kyats is required to implement the project activities in 2017-2018 fiscal year

No.	Statement	Kyats(billion)
	Current	5.106
	Capital	4.695
	Total	9.801
		40
		8

news Contraction of Min.

5. Restoration and Rehabilitation Programme in Myanmar (Cont;)

13. Reporting

- Monthly progressive report of the station-based unit and project implementation unit at the township level to regional level project supervision unit
- Monitoring and assessment of the project progressive report with work plan and time schedule by the district level project supervision unit
- Submission of the monthly progressive report by the Regional level project supervision unit to the Central Project Supervision Unit.
- Central Project Supervision Unit assess the progressive reports and hold quarterly meeting to review and discuss these project progressive reports



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- 1. To get the approval for the implementation of annual target of the project activities
- For 497.212 million US\$ (589.196 billion Kyats) to implement the project,
 to support (385.884)million Kyats (the required budgets) in the allocation of Union budget as Loan/Grant and
 - to facilitate to get the additional budget of 171.571 million US\$ (203.311 billion Kyats) from the international aids.
- To allocate (1597.295 million Kyats) for the implementation of project target activities in 2016-2017 fiscal year (2nd period of Plantation – 6 months).

Ministry of Natural Resources and Environmental

6. Clarifying the program with the financial and technical needs

- 4. To get the approval of required budget (9.801 billion Kyats) for the implementation of annual target of the project activities in 2017-2018 fiscal year from the allocation of Union budget
- 5. To allow the reinforce of the structure of FD extended (800) Officers, (17146)Staff/subordinates (Total- 17946) to the current structure for the establishment of plantations, the restoration of natural forests and biodiversity conservation.

7. Conclusion

- a. Implementation of the reforestation and rehabilitation will contribute not only to the people of Myanmar but also to mitigate the impact of climate change in the ASEAN Region.
- b. With the financial and technical supports of national and international organizations, the activities related to forestry and environmental conservation will be implemented with the participation of all stakeholders.
- c. The project activities will be successful with the active coordination, technical and financial supports of the national and international organizations.



Nepal: Status of Forest in Nepal

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Forest & Shrub Cover and Its Changing Tren



To	otal area of Shrub La	forest: 5.9 nd:0.65 Mi	5 Million Ha Ilion Ha.	а.
Category	1979	1986	1994	2016
Forest	38%	37.4%	29%	40.36%
Shrub	4.7%	4.8%	10.6%	4.38%
Total	42.7%	42.2%	39.6%	44.7%
Source: DFRS				
Out of the toal ;	forest area1.03	million ha. (17,	28%) is undrer	PAs

· About 60 % of the total forest area composed of mixed types

Profile of Protected Areas





Land Degradation

- About 28.24 % land under the process of desertification
- Nearly 36 % (2.1 million ha.) of forest land, 10 % of agricultural lands, 37 % of pasture/range land are in degrades condition
- Forest degradation rate : 0.5 % (1.3 % in Terai & 0.2 % in hills)

Causes of degradation

- population, steep slope cultivation, encroachment
- heavy & unmanaged extraction of firewood, fodder & timber
- over/unregulated grazing practices
- over use of chemical fertilizers & pesticides
- land slide/flooding/natural hazards
- forest fire
- land use change pattern
- pollution & solid waste
- invasion of alien species (Mikania macrantha, Lantana camara etc.)

Forest restoration & rehabilitation initiatives

Master plan for forestry sector : Peoples participation

- Policy : Peoples participation approach of
- resource management • NGOs/CBOs were motivated, trained &
- mobilized • Donor coordination : bi & multilateral
- institutions • Plantation of degraded & denuded forest lands
- Evacuation of encroached forest lands and plantation
- Soil conservation measures (engineering/bioengineering)
- Forest management research & extention







to age

Experiences of land rehabilitation



Participatory Management Modality outcomes

Forest Category	Number	Area (Ha.)	HHs Involved	
Community Forest	19361	1813478	2260688	
Collaborative Forest	26	67758.86	553262	
Leasehold Forest (Pro-Poor)	7509	43375	75021	
Leasehold Forest (Business)	22	640		
Private Forest	2458	2360		
Religious Forest	36	2056		
Protection Forest	8	133685	275124	
Protection Forest (Proposed)	8	141439		
Bufferzone Community Forest	677	198550	677000	

Forest Management System

- Most of the forest are managed under traditional system (Protection oriented to fulfil the forest products demand)
- Since 2011 scientific forest management has been practiced in collaborative forest, Community forest and block forest
- Adopted Silviculture System: Irrigular Shelterwood System



Scientific Forest Management under Irrigular Shelterwood System at Tilaurakot CF, Kapilvastu District

Total Blocks : 5

云

Total compartments : 13 Sub-compartments : 13*8 = 104

Working period= 10 years

Rotation = 80 years

Regeneration felling in one sub-

compartment of each compartment = 10







Some activities at a glance





Timber Production Vs Demand and Supply

Post Disaster Reconstruction: What we are Doing

Timber Requirement for Reconstruction



Imported Timber

Year	Quantity (Cubic meter)
2013/014	13,823
2014/015	13,526
2015/016	5,786
Total	33,135
Average/ Year	11,045
Av. Cubic feet /Year	386,575

ana Depu ent of Forents, 201

Timber Import Trend in Nepal.....

 Major countries: Myanmar, Malaysia, Indonesia, Singapore, Laos, Camron, Vietnam, China, Ghana, USA

• Major species: Shorea laevis, Selangan batu, Terminalia alata, Dipterocarpus spp. etc.







Carved Wooden Door



Forestry Education and research system

Key Challenges of Forestry in Nepal

Forestry Education Instututions

✓ Political instability :



APFNet Workshop on Forest Rehabilitation and Management

24th July - 04th August, 2017

Prepared and presented by :

CHARLES PAKURE (Acting Manager - Projects Papua New Guinea Forestry Authority)

Topic INTRODUCTION TO REDUCED IMPACT LOGING (RIL)

Presentation Outputs:

- Identify Sustainable Forest Management' tools
- Compose a Reduced Impact Logging definition



Output: 1 Identify Sustainable Forest Management tools Selective logging PMCP SFM RIL Forest Certification













2.2.4 Wasteful (or no) utilization policiesProcedures for waste assessmentWaste usage measure





2.3.4 Management structure and procedures

Image: Ima

2.3.5 Deviation procedures in place

Alternative measures to address loop holes in forest management standards should be in place. This would give options to rectify problem areas and minimize operation time and improve monitoring and evaluation efficiencies of operational projects. Many of the country's SFM tools have these but need to more inducted to staff due to the changes taking place in the global forestry trend move towards the new millennium periods.



3. Summary

In this presentation, you have learnt how to;

Identify Sustainable Forest Management' tools

and

Compose a Reduced Impact Logging definition



?





PHILIPPINES



Forest Management in the Philippines







– 10.2M Hectares




Executive Order No. 23 dated February 1, 2011, moratorium in the harvesting of timber within the natural and residual forest



1.1.1





In 2014, 22 sawmills, 65 mini sawmills, 67 veneer plants and 37 plywood plants operating with authority

Illegal logging hotspots reduced by 88%, from 197 to 23 hotspots







Tenurial Instruments

TenurialInstruments	Number	Area Covered (Hectares)
Community-Based Forest ManagementAgreement (CBFMA)	1,888	1.6M
Integrated Forest Management Agreement (IFMA)	140	1.0M
Socialized Integrated Forest Management Agreement (SIRMA)	1,529	32,217 hectares
Forest Land Grazing Management Agreement (FLGMA)	195	58,620 hectares
Forest Land Agreement (FLAg)	32	3,516 hectares
Timber License Agreement (TLA)	3	

Annual Reforestation Data from 1960-2010 (50 years) 200.000 → Year 1990 - 191,663 ha 180 ,000 160 ,000 140 ,000 (eu) 120 ,000 AREA PLANTED 100 ,000 80,0 00 60,0 00 40,0 00 20,0 00 hillinni YFAR The total area reforested in the past 50 years (1961-2010) is only 1,939,749 hectares or an annual average of 38,795 hectares

At an average of **38,000 hectares** reforestation accomplishment per year... it would take **210** years to reforest/rehabilitate the **8 M hectares of unproductive,** open, denuded or degraded areas



NATIONAL GREENING PROGRAM

The National Greening Program (NGP) is a massive forest rehabilitation program of the government established by virtue of Executive Order No. 26 issued on February 24, 2011. It seeks to grow 1.5 B frees in 1.5 M hectares nationwide within a period of six years, from 2011-2016

NGP AREAS FOR DEVELOPMENT



⊉rotected Areas and Mangrove



NATIONAL GREENING PROGRAM

The National Greening Program (NGP) is a massive forest rehabilitation program of the government established by virtue of Executive Order No. 26 issued on February 24, 2011. It seeks to grow **1.5 B trees** in **1.5 B trees**





Annual Reforestation Data from 1960-2016



	‡
An overview of Forest	‡
rehabilitation and management in	+
Sri Lanka	+
	‡
W.A.C. Weragoda	
Sri Lanka	
	‡
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Land areas under forest restoration









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		Number of	Number of
Species	Common Name	individuals / ha in	individuals / ha in
		2014	2016
Gmelina arborea	Demata	0	14
Ochna laceolata	Malkara	9	91
Blachia umbellata	Goda ratmal	0	6
Phoenix sylvestris	Indi	11	123
Carissa carandas	Karamba	6	6
Memecylon rostratum	Kuratiy a	23	34
Croton lacciferrus	Kappettiy a	14	20
	Total	63	294

Species			Number of Species			
		20	2014		2016	
	Local Name	DBH >5 cm	DBH<5cm	DBH >5 cm	DBH<5cm	
Vitex altissima	Milla	9	6	9	23	
Grewia rothii	Boradaminiya	17	6	17	6	
Azadirachta indica	Kohomba	6	0	6	9	
Chloroxylon swietenia	Burutha	3	6	3	6	
Lannae coromandelica	Bathhik	11	17	11	40	
Eucalyptus camaldulensis	Camaldulensis	17	0	17	0	
Tamarindus indica	Siy amb ala	3	0	3	9	
	Panderu	3	0	3	0	
Bauhinia racemosa	Maila	6	3	6	9	
Syzygium cumini	Mad an	0	0	0	11	
Cassia fistula	Ahala	0	0	0	6	
	Porawapalu	0	6	0	6	
Haldina cordifolia	Kolon	6	0	6	0	
Memecylon angustifolium	Korakaha	6	0	6	9	
	Galseru	3	0	3	0	
	Asbadda	3	0	3	0	
		91	43	91	131	

Thank You



Visions

"Be leader in Sustainable Economic Forest Management to upgrade Forest Industry"









During 43 years, the forest area of Thailand decreased by 36,325,893 million rai with an average annual decrease of 844,788.21 rai. (6.25 rai=1 acre)

Royal Forest department, 2015

The important problems that have the impact on forest land management, deforestation and degradation in Thailand .

- 1. Proportion of forest area is not appropriate, There is a downward tendency and lack of unity.
- 2. Forest land conflicts are more violent.
- 3. Watershed areas have been compromised and exploited accordingly.
- 4. Wildfire is a major cause of forest degradation and air pollution.
- 5. The forest land is not effectively used, the distribution of land occupation is not appropriate and fair.
- 6. The forest management system is not as effective as it should be.
- 7. The budget for forest management/maintenance is insufficient
- 8. Inadequate public awareness and cooperation on forest conservation.

Major causes of Deforestation and degradation

% DVHG RQ LPSRUWDQW SUREOHPDW DQG WKH LPSDFW RQ WKH PDQDJH 7KDLODQG ZH FDQ WKHQ DQDO\]H GHIRUHVWDWLRQ DQG IRUHVW GHJUC To move forward and to conserve and restore forest resources by the government alone is not able to resist the increasing pressures and threats, so one of the factors listed in the master plan in order to fix the destruction of forest resources, the invading forest land and resource and its sustainability, the government has then appointed The Internal Security Operations Command (ISOC) with the Ministry of Environment and Natural Resources to collaborate, to set the strategies and to raise awareness of the country's forests. The working group has determined the incentives scheme for the ecosystem or Payment for Ecosystem Service: PES to boost economic incentives for those who have forest resources conservation and management roles, use of forest resources and also those affected by changes in forest ecosystems

PES is based on an idea of Beneficiary-Pays Principle together with Polluter-Pays Principle which should take into account in proper context such as economic and social aspects of the people where people is ready, willing and has the capacity to pay for environmental management. For the case of Thailand, report says that Thai people seems to be ready and is willing to pay the fee in exchange for the services of natural forest ecosystems in order to have sustainability natural resources management in the long run.

PES project study areas

The pilot project of Provincial Waterworks Authority, Chiang Mai branch.

that pays the incentives as per PES to Hua Lao villagers, Toonglor watershed area, PaPae, Mae Taeng that they take care of the watershed area of Mae Taeng and Mae Ping. The project was awarded "Thailand PES Award 2015" from the Biodiversity-Based Economy Development Office(Public Organization) as the best pilot project for implementation of PES, reforestation, building and maintaining a weir, preserving ecosystems and the ecological. The pilot project of Doi Inthanon National Park Conservation Fund for sustainable management and development budget in the management of protected areas by using PES to raise funds with various supports from community leaders, small group studies, private entrepreneurs, NGOs, academics and representatives of the villagers.



Conservation Trust Fund for Doi Inthanon is only the pilot establishment of conservation in protected areas in Thailand. It then takes time for other private sectors to understand the conservation park while the operation with parks that has strict rules may cause Fund's lack of mobility, Superintendents migration may also affect the level of cooperation to support the implementation of the fund, the future activities then focusing on the business or tourism matters in national parks than other needy activities.



Strategy 1: Protect the remaining forest area keeps it sustainable

The government has then set an immediate policy of maintaining the security of the resource base and balancing conservation with sustainable use in order to accelerate the protection and recovery of forest and wildlife conservation areas.

Due to the National Forestry Policy, The 11th National Economic and Social Development Plan sets the target of forestarea to achieve 40% of the country's land area, or about 129.41 million rai, with 25% of the total forest area and 15% of the economic forest area within a period of not more than 10 years.

The situation of forest resources	Trends in the last 5-10 years
Forest area	Decrease
The number and area of community forest	Inconclusive
ntruded forest area	Increase
Wildfire (the area that was attack by forest fire)	Increase
a a	Ý.

FOREST REHABILITATION AND MANAGEMENT IN VIETNAM

Vietnamese Academy of forest science

NATURAL CONDITIONS OF VIEINAM

- Viet Nam covers an total area of 330.123 km² and a north to south length of 1650 km

- The country is characterized by two main basic top ographies: coastal plains and highland.
- Vietnam's climate is tropical monsoon
- The annual average temperature is 21 degree Celsius in the north and 27 degree Celsius in the south.
- The average national rainfall is 1300-3200 mm
- The total population of Vietnam was nearly 93 million and an average population density of 276/ km² in 2016. Over half of that earn their living on forestry and agriculture sectors
- Three-quarters of the total population live in rural areas

STATUS OF FOREST IN VIETNAM

PERIOD OF TIME	FOREST AREA(million hectare)	TOTAL FOREST COVER(%)
1943	14,3	43
1990	9,04	27,2
1995	9,31	28
2004	12,2	36,7
2017	13,3	40

Main causes of deforestation: -Devastation by war -Forest fires -Poor management capacity of the forestry sector -Fuel wood and timber over-harvesting -Land conversion for farm land

FOREST TYPES IN VIET NAM

Forest categories	Function	Total area (As of 2017)
Special-use	 Nature conservation Protection of historical and cultural relics Tourism Environmental protection 	2.08 million hectares
Protection	 Water streams and soils protection Soil erosion prevention Natural disasters mitigation 	4.56 million hectares
Production	 Non-timber forest products supply Timber supply 	6.75 million hectares

LAND TARGETED FOR FOREST REHABILITATION

- -Unproductive or abandoned agricultural land
- -Deforested grasslands
- -Brushlands,
- Scrublands
- -Barren areas
- -Degraded forests



Land-use types and management objectives, in relation to forest rehabilitation

Land-use types and management Quantity of regenerating material objectives

A. Timber tree 1. Deforested areas due to excessive logging 2. Uncultivated land with forest land

characteristics 3. Grass, shrub, small trees, soil thickness over 30 cm

B. Bamboo 4. Rehabilitation after exploitation or

shifting cultivation

critical areas 5. Remote areas that cannot be afforested within the next 10 years.

Each category must have 1 of the 3 following conditions: -Generated young trees over 50 cm of height, 300 trees/hectares -Coppice regenerated mother stem distributed equally: 150/hectares -Natural seeding mother trees distributed equally: 25 trees/hectares or from neighboring forest

-Bamboo stands with a coverage of more than 20 percent, equally distributed

C. Protection forest in critical and very -Vegetation formation with shrub or grass more than 40 percent, over 1 m high

The measures taken for the defined

intervention levels

Intervention	Measures
Low level	-Cattle grazing is forbidden. -Forest fire-control measures undertaken, for fire sensitive areas. -Cuting the regenerating target ree is forbidden. -Harvesting of non-desirable trees and non-forest products is allowed under technical guiddires. -Planting industrial cropsby local people.
High level	Removal of Iams and shubs to facilitate the development of taget trees. -Pling up soil by to facilitate germination. -Adjusting the density of argit trees by faining. -Sowing additional seeds or planting target trees in open areas larger than one-tenth hectare. -Trimming the stumps and tending copices. -Production forest: Removal of back stems, maximum of 3 coppices are kept. -Pling up soil around stumps and newly planed trees 1-2 times per year for 2.3 years. -Removing poor, diseased trees and con-target trees in stands that are too dense. -Bamboo forest: Forbrid collection of bankoo shoots wihin restoration period. Cut and make use of all the diseased, broken, topless trees.

Household incomes from agriculture , forestry and fisheries (%)

Regions	Income from agriculture	Income from forestry	Income from fisheries
Northwest	73.7	23.0	3.3
Northeast	82.3	11.7	6.0
Red River Delta	94.1	0.2	5.7
Northern Central	77.1	7.2	15.7
Southeast Central	59.0	5.2	35.8
Highland	90.6	7.4	2.0
Southeast region	82.2	2.0	15.2
Mekong Delta	75.9	2.1	22.0

MEASURES OF REHABILITATION

NATURAL RECOVERY	NATURAL REGENERATION	PROTECTION	PLANTATION
Direct seeding planting seedlings in legraded primary or secondary forests	- Weed control on degraded lands and marginal agricultural sites	-Forest fire -Grazing - Erosion control	-Native trees or promising exotic plants(single-specie or mixed-species) - Agroforestry
		and the second sec	Southern and South and Southern and the same



Rehabilitation method	Prod	Prot	SpU	Total
Natural regeneration	3	15	7	25
Natural regeneration & enrichment	3	4	1	8
Enrichment		4	2	6
Protection	1	7	2	10
Plantation with natural regeneration	1	2		3
Plantation, replanting	8	22	7	37
Agroforestry, intercropping	2	15	1	18
Grand Total	17	62	18	97*

MAJOR PROGRAMS OF FOREST REHABILITATION

	Period of implementation	Achievement	Fund
Program 327	1993- 1998	 Forest enrichment of 700.000 ha Plantation of 640.000 ha Generating 466.678 jobs Building 5.009 km of rural roads Constructing 86505 m2 of schools and 16.755 m2 of medical stations Supplying safe water for more than 20.000 households 	213 million dollars
Five Million Hectare Reforestation (661)	1998 - 2010	 Reforesting 5 million ha of land Creating employment for 2 million people Increasing incomes of people in forest areas 	

Main project funding sources

Funding agency	Prod	Prot	SpU	Total
Vietnamese government funding				
GoV ±661	3	22	4	26
MARD		2	1	3
Central Northern Forest Production & Science	1			1
Center and other members				
Loan National Support Fund	1			1
Vietnamese private funding				
NFORIMEX II	1			1
NISSHOIWAI Corporation	1			1
Vietnam Forestry Company	1			1
Foreign funding				
German funding	3	1	1	1
Japan government	1			1
Korea government	1			1
BADC		1		1
ZSCSP			1	1
Total	13	26	7	46

MAJOR CAUSES OF POOR PERFORMANCE

- Shortage finance

- -Technical methods on research field are inadequate
- Difficult working conditions

PRIORITIES FOR FOREST REHABILITATION IN THE FUTURE

- Enhancing people's self-awareness of protecting forest through practical programs
- Concentrating on research field and wood material
- Applying modem technologies in producing environmentally
- potential power sources(solar energy, wind energy....) Prioritizing tourism development connected closely to forest
- benefits with establishment of national parks biosphere reserves

RELEVANT POLICIES, PLANS, PROGRAMS

- State Forest Enterprises
- Forest Land Allocation
- Forest Land Contracts
- Investment and Credit Policies
- Policies on Benefit Sharing and Tax Reductions

Land categories		Households,	Foreign and joint	
	Total	individuals	venture companies	
Total	3 768 783	3 7 5 8 5 1 8	10 265	
Forested land	2 7 2 3 5 4 4	2 715 580	7964	
Naturalforest	1 718 449	1 718 414	35	
Plantation forest	974 681	966 754	7929	
Nursery gardens	421	421	0	
Unused land (barren land and denuded hills)	1 037 275	1 034 974	2301	



Forest rehabilitation project objectives

Objective of rehabilitation	Prod	Prot	SpU	Totals
Catchments protection/biodiversity conservation	6	40	12	58*
Restore forest cover	5	7	4	16
Poverty, rural development, employment	6	21	2	29
Promoting tourism	1	3	3	7
Production	6	8		14
Knowledge & technology creation	1	3	1	5
Others	3	2	1	6
Totals	28	84	23	135

Beneficiaries of forest rehabilitation projects

Beneficiaries	Prod	Prot	SpU	Total
Local people	9	26	7	42
Companies, enterprises	6			6
Non local/public	4	26	6	40
Tourists/tour operators		3	3	6
Executors	3	1		4
Total	23	60	16	99

