



**“PRINCIPLES AND PRACTICE OF FOREST RESTORATION
WORKSHOP FOR CAMBODIAN GROUP”
1 – 11 NOVEMBER 2005,
FORRU, CHIANG MAI, THAILAND**



**BY THE FOREST RESTORATION RESEARCH UNIT (FORRU)
SPONSORED BY DARWIN INITIATIVES, U.K.**

- Title** “Principles and Practice of Forest Restoration
Workshop for Cambodian Group”
- Date:** 1 – 11 November 2005
- Venue:** FORRU nursery and demonstration plot in Mae Sa Mai
Chiang Mai University, Chiang Mai, Thailand
- Media:** English and Khmer
- Sponsored by:** Darwin Initiatives
- Organised by:** The Forest Restoration Research Unit (FORRU)
- Joint Organisation:** The Forestry Administration (FA), CAMBODIA

Introduction

In September 2004, Laotians and **Cambodian delegates** involved in forest reforestation projects with DANIDA visited FORRU. Subsequently, in 2005, with support from the UK Government’s Darwin Initiative, FORRU, together with Wildlife Landscapes and East Malling Research in the UK, started up a project to facilitate restoration of forest Ecosystems for biodiversity recovery in Indochina, by transferring skills and proven technologies to key forest stakeholders in China, Laos, and Cambodia. This project will assist these countries to design research tree nurseries and experimental plots to adapt the technique to local ecological and socio-economic conditions, and demonstrate it to local people. This knowledge and skills transfer will be achieved through a series of workshops, both at FORRU’s demonstration sites in Thailand, and at participating organizations. The workshop “**Principles and Practice of Forest Restoration Workshop for the Cambodian Group**” is the 3rd of the three workshops hosted by FORRU in Thailand, and included 2 visitors from the EDEN Project, U.K. The workshop contents covered the principles and practices of the framework species method to accelerate biodiversity recovery in planted forests. In addition, a review of FORRU’s protocols and results, particularly nursery techniques and logistic planning were presented. Furthermore, the project outputs, particularly i) organization of the workshop in Cambodia, ii) input into Forest Restoration and Research Project Establishment Manual and iii) adaptation and translation of “How to Plant a Forest” were discussed.

Objectives

1. To pass on the concepts and research protocols developed by FORRU-CMU to enable the participants to establish an effective FORRU in Cambodia.
2. To prepare the participants to run a workshop to plan a FORRU in Cambodia.
3. To plan adaptation and translation of forest literature into Cambodian.

Participants – Total 17 participants

- | | |
|-----------------------|---|
| 1. MR VANN SOPHANA | Head, Northern Tonle Sap Lake Inspectorate |
| 2. MR NHEK SUNNARY | Head, Takeo Division |
| 3. MR SO THEA | Vice Head, Forest and Wildlife Science Research Institute |
| 4. MR ENG POLO | Staff, Forest and Wildlife Training Center |
| 5. MR KETH NANG | Staff, Forest and Wildlife Science Research Institute |
| 6. MR CHHAY SARAN | Vice Head, Koh Kong Cantonment |
| 7. MR NHEB SARIN | Head, Tram Kak Triage |
| 8. MR SAUTH ON | Head, Sihanouk Cantonment |
| 9. MR NOUN PEOVRATANA | Vice Head, Steung Treng Cantonment |
| 10. MR VORNG SOKSEREY | Head, Steung Treng Division |
| 11. MR HENG KAMICH | Vice Head, Krayear Triage |
| 12. MR CHEA PHALLY | Head, Sandan Division |
| 13. MR CHEA BUNTHA | Vice Head, Kampang Chhnang Cantonment |
| 14. MR CHHOEUNG KUN | Head, Krauch Chhmar Triage |
| 15. MR SENG CITARUNN | Head, Samaki Meanchey Triage |
| 16. MR TIM GRIGG | Horticulture and Nursery Division, EDEN, UK |
| 17. MS DINA GALLICK | Manager of Humid Tropical Biome, EDEN, UK |

PROGRAM

PRINCIPLES AND PRACTICE OF FOREST RESTORATION WORKSHOP IN CHIANG MAI, THAILAND ON 1 – 11 NOVEMBER, 2005

Day	Date	Time	Subject	Location	Facilitator(s)
Tuesday	01/11/05		Arrive and book into UNISERV	Airport	Sudarat
Wednesday	02/11/05	Morning	Objectives of the workshop. Introduction to FORRU and the framework species method. Why are FORRUs needed?	CMU	Dr. Steve and Dr. Suthatorn
		Afternoon	Presentations by participants about their own views/experience of tree planting.	CMU	Kunakorn
Thursday	03/11/05	Morning	Framework species plots - what can be achieved	BMSM	Dr. Steve
		Afternoon	Community motivation for forest restoration - session with BMSM natural resources committee.	BMSM	Kunakorn
Friday	04/11/05	Morning	Phenology and seed collection in natural forest	Doi Suthep	Cherdsak
		Afternoon	Herbarium Visit Phenology data analysis and genetic considerations of seed collection	CMU	Max Steve Greuk
Saturday	05/11/05	Morning	Germination, monitoring seedling growth and nurturing wildlings in the nursery	Doi Suthep	Cherdsak
		Afternoon	Continue and Wat Pratat temple visit	Doi Suthep	Sudarat and Kunakorn
Sunday	06/11/05	All day	FREE DAY		
Monday	07/11/05	Morning	FREE MORNING		
		Afternoon	Analysing seed experiments, Dormancy, Seedling growth, Production schedule	CMU	Sudarat Steve
Tuesday	08/11/05	Morning	Monitoring tree performance. Weeding/fertilizer performance	BMSM	Tidarach and Maxwell
		Afternoon	Vegetation monitoring - field work. Direct seeding..	BMSM	Maxwell Panitnart
Wednesday	09/11/05	Morning	Planning - time, labour and costs Role Play Scenario for Community A and B	CMU	Sudarat and Kunakorn
		Afternoon	Analysing field data. NTFPs, Selecting Framework Species	CMU	Steve Kunakorn
Thursday	10/11/05	Morning	Final discussion - planning exercise to set up your own FORRU - location design admin staffing funding	CMU	Steve & Suthatorn
		Afternoon	Other project components - organizing the in-country workshop,	CMU	Steve & Sudarat
Friday	11/11/05		Departure		Sudarat

REPORT ON EVENTS

Welcome Remarks and Introduction on Wednesday 2nd November 2005

Welcome remarks were presented by Dr. Narit Sitasuwan, Head of Biology Department, to welcome all participants to the workshop in Chiang Mai. Later, Dr. Steve Elliott described the objectives of the workshop and why Forest Restoration and Research Units will be so valuable in Cambodia. In addition, forest restoration techniques from FORRU experiences were presented, such as Accelerated Natural Regeneration (ANR) and the Framework Species Methods.

Discussion from Floor

Question: Dr. Steve: What level of organization is “cantonment?”

Answer: Before 2004 The Forest Administration had a central organisation and 24 provincial organisations. Now there are 4 large inspectorates covering 15 cantonments. There are 55 divisions among the cantonments and the smallest areas are the 170 districts.

Question: Why do we need FORRU in Cambodia?

Answer: Steve: We need FORRUs in other countries because:

- Most of the current research focuses on economic forestry
- Most “non-commercial” species have never been studied
- Even though there is no guarantee of future values for teak or rubber the research money still focuses on plantations
- Observation of community forestry reveals that overall forest diversity is gradually reduced and replaced with common economic species
- It is easier to import trees and research from developed countries without looking at the characteristics of the native trees.
- For the purpose of restoration, all species are equally valuable and important until research proves otherwise.

Two levels of research appropriate for new FORRUs:

- Ecosystem Level: mechanisms of natural forest regeneration
- Species Level: more specific ecology and horticultural information for nursery work.

Question: Regarding Green Restoration: Does this mean an exact replica of the previous forest...do you need to plant the same tree species in the same place?

Answer: Steve: No, it is impossible to replicate the forest. You should go to the nearby forest and look for a model structure. We are trying to recreate the same level of biodiversity...not an identical make-up of tree locations as before. Luckily, we don't need to plant all the tree species. As you will see, planting 20-30 species will encourage effective regrowth.

Question: Have you tested direct seeding?

Answer: Steve: The two plots in BMSM showed good results

- Burying seeds proved effective against predation
- Carefully selection tree species for planting increase effectiveness
- DS trees grew faster than planted saplings

Question: How big are the testing plots?

Answer: Steve: FORRU is in the business of producing information not forest volume. We only plant 10 Rai per year. (1Rai = 1,600 m² and 1 Ha = 6.25 Rai.)

Question: Does the FWS method include only pioneer species? Are short-term economic values a consideration for selection?

Answer: Steve: FWS can be both pioneer and climax spp. Some climax species do grow well in deforested areas. Only 30-50% trees need to be pioneer species to be effective. It is not necessary for all species to meet all characteristics all the time to be selected.

There is not such thing as a “non-economic” species. Ask local villagers for uses of possible framework species, on average there are 6 uses per “non-economic” trees. Look for values beyond market price.

- Medicinal products
- Edible fruits
- Leaves for forage
- Spiritual value

Presentations by Participants on Wednesday 2nd November 2005

1. The EDEN Project by Ms. Dina Gallick and Mr. Tim Grigg

What is the Eden Project?

The EDEN Project is located in Cornwall England. The site consists of 2 large biomes reaching 50 m high. These are living theaters to tell stories about plants and the people who use them. EDEN and FORRU share the goal of restoring the landscape. It started with the restoration of a China clay mine with no level ground, no soil and a 60 m pit.

Outside the Biomes:

- displays of plant systems from around the world (temperate climate) that serve human needs
- combine art and music to tell the stories
- Building erected using plastic generated from maize
- Examples of sustainable living

Tropics Biome

- Largest tropical forest outside the tropics
- Architecture based on nature
 - The hexagons represent insect eyes and honey comb
- They represent all areas of tropical rainforest such as Southeast Asia, Africa
 - Each of the three areas has specific sites reserved for crops
 - Sugar cane, coconut, rice, maize, and soy
- Support for genetic modification foods: Rice hybrid in Africa
- Some problems similar to FORRU
 - Trees not safe to climb: must use machinery to reach
 - Use air-balloon for pruning, research and monitoring
 - Planted some large trees- not good practice
 - Inside the biome trees with grow quickly on top but develop weak root systems
 - Trees fall
 - Better to source tree planting to nursery then move to Biome to establish better root growth
 - Weed competition exhibition

Nursery

- 6m high and 2000 square m in area
- Housed 1,000 plants before many were moved to biomes
- Has 3-month quarantine for plants from overseas.

Discussion from Floor

Q: Why do trees fall if they are healthy and growing well?

A: Because of poor root growth.

2. Forest Plantations in Cambodia Organization of Forestry Administration by Mr. Eng Polo

Administrative Organisation

Head of Forestry Administration (FA)

-Administration office -Planning -Forest extension	-Federal management -Watershed -Industry, development and commerce	-Reforestation -Community Forests -Legislation and Litigation -Wildlife	-Forest and wildlife Science and research
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Background

In 1970: 73% forest coverage

In 2002: 62.7% forest coverage and only 20% of forests are evergreen

Causes of forest degradation:

- Logging
- Encroachment
- Agriculture
- Fire
- Land grabs
- Speculation

Objectives of FA:

- Poverty Alleviation
- Environmental Protection
- Economic Development

Areas for planting: 14,000 Ha total planted 1984-2004 in;

1. Degraded forests and shrub lands under the control of the Forest Administration
2. Community Forest
3. Farmland: reclaimed for forests

Seed Sources:

- Purchased from locals – low quality
- Imported internationally, including Thailand
- Produced in labs

Seed Users:

- Nurseries
- Private sector
- Domestic and international NGOs
- Local communities
- Temple and Sacred Places
- Families

Seed Quality:

Lack of education about proper harvesting techniques make the seed quality low when purchased from local people.

Results:

- 11,174 ha planted 1995-2004 by DFW, PFO and FA with imported *Acacia* and *Eucalyptus* seed from Thailand
- 1,052 ha planted by Cambodia Military 2002-04
- 931 ha Arbor Day plantings 1985-2004
- 309 ha planted by NGOs such as Concern 19885-04

Species planted:

- *Acacia* spp.
- *Eucalyptus* spp.
- *Dipterocarpus alatus*
- *Hopea odorata*
- *Afzelia xylocarpa*
- *Aquilaria crassna*

Seed production in 2004:

- Department of Forest and Wildlife (DFW), Provincial Forest Office (PFO), and Forestry Administration (FA) produced 18.3 million
- Hun Sen nurseries: 4.2 million
- British American Tobacco Cambodia Ltd; 5.8 million

Problems:

- Lack of budget for operations
 - Monitoring, protecting plantings, enforcement of logging ban etc
- Low quality of seeds
- Lack of market for forest goods produced
- Poor maintenance
- Poor choice of tree species
- Encroachment

Comment: Steve:

You should find native species to plant. There will always be non-market value for native species. If there is no market for acacia or eucalypt, then why are you planting them? The World Bank should not be encouraging the use of Australian species, it is not in the best interest for Cambodia.

3. Forest Rehabilitation in Kbal Chhay Watershed by Mr. Sauth Onn

Background of Watershed: Southern Cambodia

- Si Hanouk Ville total area 6,200 Ha
- 1979-85 under control of Khmer Rouge
- Logging and land speculation started in 1985
- 1997 Government decreed that forests are special and will not be destroyed

Objectives of Rehabilitation:

- Secure water supply: currently not reliable
- Environmental protection: biodiversity conservation, soil erosion control etc.
- Ecotourism development

Rehabilitation Activities:

- Tree improvement
- Tree planting both native and exotic species in degraded forests
- Protect natural forests for regeneration
- Prevent agricultural uses on rehabilitation areas.

Local Community Participation:

It is absolutely necessary. The activities are as follows;

- For plantations: produce seedlings, plant trees
- Family nurseries sell seedlings to the project
- School nursery collaboration

Benefits for Local Community:

- Acacia mushroom collection \$1 per kilo
- Medicinal plants, wild tubers, vegetables not sold in markets
- Some tourism based economy

Problems:

- Land encroachment: agriculture and business development
- Forest encroachment: house building, illegal logging, illegal pole/firewood collection, illegal charcoal production
- Forest fire: in year 2005: 80 ha of *Acacia* plantation destroyed.
- UXO (Bomb): The Khmer Rouge left UXO and landmines in the land

Experiences gained:

- Most natives cannot compete in the grasslands
- Some exotics are better in grasslands such as *Acacia* spp.

Conclusion:

- Hard work and expansive effort and time will lead to forest restoration.
- Local participation and the enforcement of law are simultaneously necessary.

Question: How often do you weed?

Answer: The plantation rows (between trees) are ploughed twice a year.

4. Reforestation in Kompong Chhang (SE Cambodia) by Mr. Chea Buntha

Conservation Activities:

- Tree planting: economically driven both in private and government sponsored projects
- 100 ha planted in year 2005: 2,222 trees/ha planted 1.5 m apart
- Plantation design. Blocks: 100 ha with 4 lots of 25 ha
- Tree planting by roads to reduce erosion and provide shade
- Tree planting for demarcation
- Fence around yards to protect against wind; usually bamboo
- Trees for fodder, near the house often *Sesbania grandiflora*
 - Trees in public areas: schools hospitals Pagodas, public gardens.

Question: How do you protect from termites and insects?

Answer: Insecticide.

5. Community Based Small Scale Plantation in Koh Kong by Mr. Chhay Saran

- The southwest mountains create an unusually wet climate up to 40cm annual precipitation
- Groups participating: Cardamom Mountain Conservation International, Elephant Conservation Project with Wild Aid, some NGOs
- Native wood species are higher quality and value and are therefore better to plant than fast growing exotics
- *Acacia* and *Eucalyptus* spp. are currently used in rehabilitation
- Koh Kong is the best climate for *Aquilaria crassna* planted locally by villagers and can plant co-cropped with pepper
- Stems, branches and roots are all usable and processed to make the valuable oil.
- Up to \$1,000 dollars per liter on export

Framework species plots Session on Thursday 3rd November 2005

The participants visited the Framework Species Demonstration Plots and the rare and endangered species plot planted in June 2005. They learned about the Framework techniques through direct observation. Dr. Steve Elliott also explained about the planting process:

- Survey site and locate natural seedlings and seed sources etc
- For restoration: identify and assist the growth of natural species present, protect seedlings and stumps then plant additional species
- Mark site
- 6 weeks before planting carefully slash weeds around the natural seedlings,
- 3 weeks before planting spray the weeds with glyphosate- vegetation dies within 3 weeks.

Discussion about Site Preparation:

Question: Is the spacing so close because of expected loss?

Answer: The 1.8 spacing was chosen because of projected losses, but also you save money because the canopy closes in 3+ years which eliminates the need/cost of weeding beyond 2-3 years. But, spacing may be too much because not enough volunteers are coming in. The goal for quick canopy is bad for complete biodiversity recovery

Question: Why is it bad to be so close?

Answer: Too much competition for the new saplings...seeds may germinate but cannot grow successfully

Question: What do you use for fertilizers?

Answer: In this plot we used organic fertilizer directly after planting.

Framework Species Demonstration Plot

Twenty nine native framework trees species are planted for forest restoration. Within 2-3 years, some species already producing fruits and flowers which attract birds and animal seed dispersers; new wildlife colonises over subsequent years

Discussion for Framework Species Method

Question: If some species grow faster will they dominate the slower growing species?

Answer: Yes, some slow growers will die. The shading out of species is a natural event in the ecosystem. Not all of a species will die.

Question: Who will take care of the park and who will support this technique in the future?

Answer: The Royal Forestry Department (RFD) gets a budget yearly. This technique is expensive for 1-2 years, which is hard for the RFD to budget for, even though there are no costs after 2 years. We need to spread the idea by education, workshops, talking to people from other communities and countries. Eden sponsors communities to their own projects.

Question: What species naturally regrow?

Answer: Pioneers. Unless you plant seedlings you do not get natural regrowth areas. You can get canopy closer but a slower recovery of biodiversity.

Direct Seeding by Panitnart:

Can you restore the forest without planting trees?

Yes, by direct seeding. Seeding can be an important part of restoration, which is proven by this 1 Rai test plot with 6 species collected from the forest. These have been sown in 2 groups, split between the nursery and the field. We monitored growth and survival from germination for one year. Direct seeded trees grew taller than nursery raised seedlings for 4 species tested.

Benefits:

- Seeding saves the cost of planting and nursery production
- Some species are difficult to germinate in the nursery
- Reduces negative effect of root bound container stock

Discussion

Question: How many seeds per hole, how many grow?

Answer: 4seeds/hole, sometimes all the seeds germinate.

Question: What about seed pretreatments? Did the seeds germinate at the same time in field and nursery in this experiment?

Answer: No treatment was given to the seeds. We sowed the seeds at the same time in both nursery and field. The germination of seeds depends on their dormancy. The recalcitrant seeds mostly germinate immediately. Some orthodox species have a hard seed coat which may prolong their germination time, but gives some protection against insects and rodents.

Question: Why does weed cover result in higher survival rate?

Answer: We don't know. We suspect that weeds can protect against sun, dry and predation.

Community Motivation Session on Thursday 3rd November 2005

Summary of Mae Sa Mai Village

The Ban Mae Sa Mai organized in the past 50 years; population of 1800; lychee (Chinese variety) is the main cash crop. Vegetables are considered as cash crops and are now the second income.

Ban Mae Sa Mai Natural Resource Conservation Club was founded 1990 to work with the village committee. In the early work, most jobs involved planting with forest officers and fire break construction. The village established their local rules of no hunting/gathering, or walking in the forest and instigated a cash penalty for violation.

The conservation club members took care the forest in the past, now the whole village participates in the conservation and protect the forest. Furthermore, now 4 villages coordinate working the firebreaks: 1,800 people in 360 families.

Currently the government is respecting the citizenship rights of people living in the park. The villagers realized that educational work and public awareness should be promoted that their lifestyles in the village must change for sustainable life in nature and conservation.

Discussion from Floor

Question: What % of income is derived from lychees?

Answer: Up to 50%. When the price was higher for lychee, the crop represented 70% of total income.

Question: Does illegal logging cause the majority of deforestation?

Answer: The village has rules against logging even stricter than the National Parks. The government/village relationship used to be volatile and violent with gunfights killings and arrests. It really appears that both sides want cooperation now.

Question: How do local people benefit from FORRU?

Answer: Expertise and resources from FORRU are most important to BMSM, which benefits from having the forests restored. Two types of rewards: tangible and intangible. Intangible: stable relationships, policy making experience, water supply/quality, soil stability, and ecotourism opportunities. Tangible: non-timber forest products.

Question: Are there any villagers who do not understand or support the restoration project?

Answer: Very few villagers do not participate in the forest activities.

Question: Does the village grow enough food to support itself?

Answer: No, Hmong have traditional rice staple diet, but now no rice is grown in BMSM. We have to go to the lowland and rent the land to grow our tradition rice for consumption.

Question: Can other people move to the village?

Answer: No, it is very hard because of the National Park Regulation. We cannot sell the land or pass the rights to outsiders. In addition, Hmong people usually marry Hmong.

Question: Is it hard to get volunteer labour?

Answer: Yes, because the people are so poor. It is hard to demand laborers when they are losing opportunity to work for their families.

Question: What would happen if FORRU could no longer give support?

Answer: The forest will not be cut because Thailand has a ban for logging outside of plantations. The villagers now have alternative business such as merchants and labor in town. Moreover, the possibility to run ecotourism in the village will help us to reduce the forest-based agriculture and life style.

Question: Will fire teams be blamed if fires destroy trees/crops?

Answer: No, they would never be blamed. The fire watchers are responsible for raising the alarm when fire occurs. If there is a fire, everyone in the village has to help to beat the fire. So the responsible does not belong to one group or the fire team only.



FORRU Field Days on Friday 4th November 2005

The research work of FORRU and forest types of Doi Suthep, which varies in biodiversity, were explained. The term ‘framework species’ includes both pioneer and climax, and pioneers: create 1st level of growth. They usually attract seed-dispersing animals with quick flowering and fruiting. The climax trees are the 2nd level. Through seed dispersing animals the 3rd level of tree growth is created. There are 600+ tree species in mixed-forest ecotone: the 30 FW species planted only represents about 5%. The recruitments represent the “natural forest”. Original animal activity should return with the growth of the 3rd story.

Identifying the seed tree is very important to make sure you identify the donor tree correctly. The voucher specimens of all seed trees are important in case identification is queried in the future.

Herbarium and Their Database on Friday 4th November 2005

Chiang Mai University Herbarium Visit

The Chiang Mai University Herbarium stores 25,000 specimens and about 4,000 species. More than 2,200 specimens are from Doi Suthep-Pui National Park. Mr. Maxwell, the curator showed participants the voucher specimens, both dry and preserved in alcohol. They received FORRU’s Production Schedule Poster which displayed photos of fruits and seeds of selected framework species. The participants were made aware of the utmost importance of accurate tree species identification in forest restoration projects. In an area which has no herbarium or institution that helps to identify trees, they appreciated the value of setting up an herbarium.

Seed Collection and Genetic Considerations

Dr. Gruek Pakkad presented his research about genetic considerations of seed collection, plant database and data collection.

Seed Collection for Forest Restoration:

The following issues were explored:

1. How to achieve good planting
 - Good seedlings: free from disease and insect damage
 - Good seed
 - Good parents

2. Why the selection of seed trees is important
 - Efficient nursery production is important
 - High survival rate in degraded areas
 - Efficient site recapture eliminates replanting need
 - High relative growth rate: effective recapture
 - Genetic diversity
 - Avoid narrowing the genetic base

3. Collection techniques:

- Choice of 15-25 parent trees at least 100m apart
- Selection of from trees displaying vigorous health
- Mature trees
- Collection from different parts of the crown
- Avoiding collection from plantations

4. Broad genetic diversity:

- Increased survival chances in field
- Maintenance of environmental integrity
- High/varied growth rates
- Natural resistance to insects and disease
- Evolutionary continuance

FORRU Nursery Days on Saturday 5th November 2005

Establishment of Research Nursery

Mr. Kunakorn initiated a discussion on how to establish a research nursery with participants, by exchanging experiences. The following topics were discussed:

Nursery Establishment

1. Land/location/size/access/distance to site/forest type
2. Water source/system
3. Fences
4. Facilities: seed storage, warehouse, materials
5. Labor
6. Seed sources
7. Administration legalization/education

Seed Source:

- Buy from locals/government
- Collect yourself
- Influence of size of planting site
- Collection of phenology information before collecting seeds
- Consideration of the use of wildings or cuttings

FORRU Nursery Site:

- Poor access: can't drive down to nursery
- Permanent construction: expensive but will last
- Benches: attached to floor: bad idea
- Concrete table tops: poor drainage, mesh better
- Special room with small mesh fencing
 - Seed predation from squirrel mice, birds
 - Research room needs protection from external factors

Temporary nursery: local cheap and recycled building materials for quick nursery.

Germination Trials

Mr. Cherdasak described the nursery process from seed treatments through to pricking out. One experiment aimed to simulate the forest canopy by growing seeds under the table with netting. The main part of the experimental program involves germination trials, which are very important for each species. Seed pretreatments do not need to rely solely on technology for effectiveness, as there is much to learn from nature. For example:

- Check for health, wait a week for insects to leave pods
- Soak in the water
- Easy to determine seed quality
- If species germinates in rainy season → soak seeds in water
- If germinate well after natural fires → heat water or burn
- Germ well after being eaten → acid treatment
 - 1/1 ratio add acid before the water
 - Soak 30 seconds wait a day to plant

Without treatment seeds can take 2 years to germinate.

- Crack seeds open
- Use scarification method
- Research all treatment methods to determine the most effective method

Sowing:

- Use forest soil
- Local media: 2/1/1 ratio
 - Forest soil
 - Peanut husk
 - Coconut husk
- Easy for roots to grow

Potting Seedlings

Experiences we shared amongst the participants

Monitoring Seedling Growth

The monitoring of seedling growth is the major task for research nursery. The seedling growth rate is very important for production schedule. This was discussed in some depth.

Nurturing Wilding in Nursery

Use of wildings provoked a lot of interest amongst the participants, and was discussed in depth.

Caring for Seedling in Nursery

The participants were interested in all aspects of nursery production, particularly the use of root-trainers and how to control pests. They recommended the use of organic pesticides to the FORRU staff.

Production Schedule and Analyses on Monday 7th November 2005

Dormancy and Seed Collection Times

The dormancy and seed collection time is very important for a nursery producing a wide variety of species: consequently this was considered in some depth.

Analysing Seed Germination Experiments

Germination experiments aim to maximize germination % and accelerate germination rate. MLD: time it took for half the germinated seeds to germinate. An exercise was carried out which allowed the participants to analyse seed germination data. This exercise was very new for most of participants and they clearly wanted to learn more in the next workshop in their country.

Production Schedule

The production schedule is the combination of phenology, germination, and growth experiment data. It is critical for the successful production of a wide range of species which all have to be ready for dispatch at the start of the rainy season. Hence a lot of time was spent on this topic.

Monitoring Tree Performances on Tuesday 8th November 2005

Seedling Performance

The standard tree monitoring methods employed by FORRU were demonstrated. The participants also monitored seedlings for themselves. They measured growth, health, canopy width, and weed score.

Discussion from Participants

Question: Why wait 18 months between monitoring?

Answer: The work depends on budget and objective. This is just the minimum. FORRU checks once a season, FORRU assumes that the growth rate changes for each season.

Biodiversity monitoring:

- Bird activity in the early morning
- We want choose species that attract the birds and other animals

Discussion from Participants

Question: How do you monitor birds?

Answer: Visually, binoculars and a bird book.

Question: What if birds come at night?

Answer: Mostly fruit-eating birds come in daytime.

Vegetation Monitoring

Vegetation monitoring is part of our biodiversity survey. Mr. Maxwell demonstrated the circular method for vegetation survey. All ground flora species which is under 1 metre tall in the circle are recorded and scored by the Braun Blanquet method. Our objective is to recreate the forest. How do we choose the framework species? There are about 700 tree species on Doi Suthep, but not all of them are suitable for reforestation. The first action on a FORRU planting site is to survey the existing flora. We want to observe what happens to the weeds as the trees grow, also, we want to observe natural seedling emergence.

Why would we want to do a forest survey?

- economic information
- wildlife → forest is more than trees
- food/medicinal plants

The participants already learn the process and methodology. They found out that the survey is not difficult to do. However, the most difficult part is plant identification. They realized that plant taxonomy is another subject that they need to study more and try to create more experts in plant taxonomy.

Discussion from Participants

Question: How much do you have to survey over the mountain to be effective?

Answer: 10-12% is the minimum sample for statistical reliability

- Determining this is the job of the ecologist, not the taxonomist
- That's why you need a team of scientists

Question: Because there are not many scientists in Cambodia can we use local knowledge?

Answer: Locals can help but the survey needs to be done scientifically.

Process:

- Write down every name of the plants
- Scientific or common name (villager good help for this)
- Then determine percentage in the circle

Planning Analysis and Scenario on Wednesday 9th November 2005

Planning & Labor Analysis

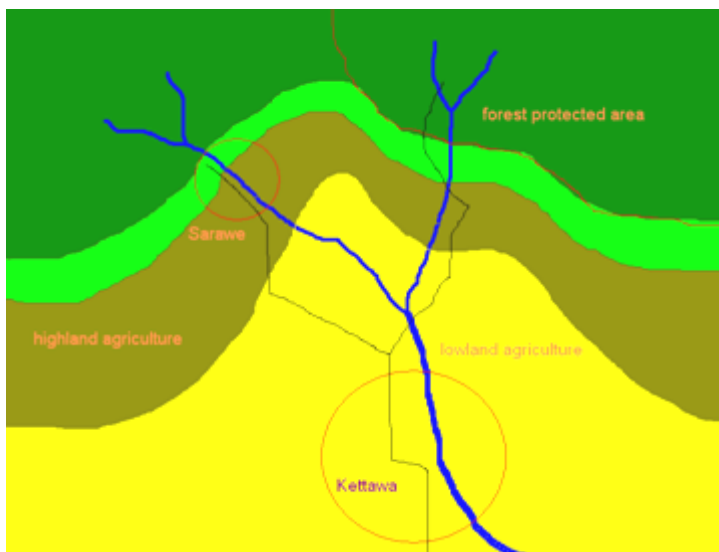
Sudarat presented the planning for a forest restoration program. Planning and devising an action plan for forest restoration must be undertaken with the villagers. The number of workers determines how big of an area should be planted each year. Labor is the biggest cost in the budget. With all free labor the total cost can be cut by 33%. The participants were concerned about labor and costs of planting more than the actual activities. Many questions were raised after the session. They asked for the presentation files for trying their own data to calculate for their own forest restoration programs in their country.

Role Play Scenario

Mr. Kunakorn started the role play scenario by allowing each participant to draw the role for the characters. The situation was presented and discussed.

Role Play Activity

Scenario



There is a river named Moheka running down the Matro Nui Mountain Ranges, from the highest elevation of about 1,800 m asl. At the upstream almost to the head water, is a village named Sarawe; at the downstream in the lowland area situating a larger village named Kettawa. The population of Sarawe village and Kettawa village are about 400 and 1,000, respectively.

Being near the gate to the Matro Nui forest protected areas, covering the whole catchment of one tributary of Moheka River, most people in Sarawe

village are farmers practicing their traditional way of agriculture. The village's infrastructure is limited and poverty is still a big problem. However, due to the outstanding scenery around the village area, a trend of eco-tourism and other related occupations has been rising.

At the downstream site of Kettawa village, with its higher population, the quality of life is better, with more resources, such as a small hospital, school, post office, stores, market, and local government offices. People here have more variety of occupations including farmers, merchants, teachers, shop owners, governmental officers. The growing trend of tourism has also benefited this village, where the tourists usually stop for supplies and services.

Process

- | | |
|--|----------------|
| 1. The facilitator explains the activity steps. | 15 min |
| 2. All participants randomly pick out a role-card from the lottery pot. | 10 min |
| 3. Participants divided into groups according to the role-cards they chose. | 5 min |
| 4. Each role-group discuss their task and plan their approach | 30 min |
| 5. All role-groups react by approaching one another for their tasks | 20 min |
| 6. All participants are invited to the Forest Restoration meeting at
The University of Tekaha to discuss the development of FORRU | 30 min |
| 7. The Facilitator summarizes the activity | 10 min |
| Total | 120 min |

Roles, tasks & interests

Role-group	Tasks & interests	Members
Villagers from Sarawe	Want to develop better infrastructure and life quality, interested in local eco-tourism development	3
Villagers from Kettawa	Want new technology for better agriculture, need help for soil quality and garbage & wastewater problems	3
Foresters from Matro Nui forest protected area	Take care of the forest protected area and building up local ecosystem understanding, interested in local eco-tourism development	3
Researchers from The University of Tekaha	Have practical technology for forest restoration, want to set up a forest research unit and planting sites	3
Environmentalists & Socialists from outside NGO	Have access to resources and financial support from outside, want to help solving local problems and improving life quality	3
Agencies from outside Private Logging Company	Want to generate some plantations for wood production, would like to work with local people	3

Comment & Summary for Role Play Activity by Kunakorn Boonsai

The following are the ideas given out by different role-groups after the discussion within each group.

- Researchers from the university presented their awareness of deforestation and biodiversity loss problems, as well as concerns about limited life quality in both villages. They offered to generate the forest survey study work, reforestation method development and life quality improvement by co-working with the local forestry department office and coordinating with outside NGO agencies for financial supports.
- Villagers from Sarawe, the upper water-village, showed their interest in looking for help and financial support from other organizations for the development of local infrastructure, school and eco-tourist center. They have already started to write a proposal for this.
- Villagers from Kettawa, the lower water village, presented their concerns that the wastewater problem they have was caused by the activities of Sarawe village upstream. They proposed that Sarawe should take more care of the watercourse running down the mountain, and also mentioned that Sarawe people should take care of the forest around the head water. The group looked for help from NGOs for the development of agricultural technology, as well as generating eco-tourist related business.
- Showing that they were aware of the problems in both villages and understood the research's points, the NGO group pointed out that these issues need to be prioritized before planning activities and implementations. They proposed that Sarawe village should start with the improvement of local infrastructure followed by reforestation work in the disturbed forested areas around and above the village. In Kettawa, the improvement of agricultural technology should be the first task to tackle, i.e., quality seed sources seeking and seed storing, irrigation, proper crops management.
- The forestry department officers agreed with the points of NGO group and also did not oppose the ideas from both villages. However, as the government officers taking care of protected forest areas, they will project their interest in biodiversity conservation including wildlife conservation along with the development of local ecotourism facilities.
- The agencies from the logging and plantation companies presented their objectives of working locally, which focused on local economic indigenous tree species. They were also willing to work closely with local people and offered their help in developing some parts of local infrastructure such as road access, school, hospital and resources for ecotourism. They also added that their approach will generate job opportunities for local residents.

The facilitator then intervened to stimulate the thinking process, by asking the question "What should be the first thing to do for the initiating the implementation of the forest research unit?" the entire group put together some ideas, as follows.

- The research team from the university starts the forest survey study in Sarawe area by working with NGOs and the Forestry Department.
- The NGO partners will also combine their socio-economic survey in both villages with the work plan.
- The forestry department will co-share their already existing information and ready to provide their input to the project.

- In addition, the research team will also carry out the work for local tree species identifying and recruiting for forest restoration purpose.

The role play activity was ended by the facilitator with a summary that highlighted to the participants some of the factors and conditions they will need to face and address in the actual work in their own country.

Analyzing Field Data

Dr. Steve Elliott explained more about why data analysis is so important. The analysis can prove the hypotheses or objectives of your studies.

Trail plot objectives:

- compare possible Framework Species for survival growth canopy etc
- compare possible treatments: mulching, weeding fertilizing
- monitor recovery of biodiversity in relation to time

Discussion from Floor:

Questions:

- What effect does distance from planting site from natural forest have on biodiversity recovery?
- Are FORRUs small plots are too small to effectively judge the recovery of animal species?
- What are the effects of plot size and connectivity?
- What are the side effects of planting density?

Answers:

Experimental design requires control plots, standardization of the slope, elevation and soil type, distance, and etc. Comments:

- Essential for comparing natural regeneration with framework plantings
- Maybe 1.8 m is too dense for optimal biodiversity recovery
- If control regenerates rapidly ANR may be more appropriate than planting
- Do not site control plot adjacent to experimental plots
- Replication: at least 3 sites for each landscape
 - Harder and more expensive but achieves much better results and captures variation
- Monitor 25 trees per plot per treatment
 - Even if you suffer mortality you still have a good sample
 - Plant roughly the same number of species in each plot to standardize competition
- Include planted and natural trees to determine the % contribution of recruited trees.

Non-Timber Forest Products (NTFP)

Kunakorn introduced NTFPs in Thailand and discussed their use in Thailand and Cambodia. Both countries share common issues about NTFPs uses and regulations.

There is a lot of potential for NTFP in Thailand especially in the north:

- They contribute to the livelihood of rural and poor people
- might contribute to economic growth: local, regional and national
- might help natural resource management
 - to avoid under utilization and create a balance of use vs. conservation of products

- In Thailand, which is rich in biodiversity
 - international assistance NGOs
 - government interest
 - local community hot issue
 - new constitution → improves the cooperative approach
 - community forestry bill (almost law)

Discussion from Floor:

Questions: What percentage of forests are under the government control in Thailand

Answer: All under the control of the RFD.

Questions: How much is controlled by community forests?

Answer: The community Bill is yet not approved. Estimated 1,000 community forests in Thailand.

Overview of NTFPs:

- Fiber products → bamboos, rattan
- Plant food products → fruits, nuts, mushrooms, honey, insects
- Medicinal and aromatic products → spices
- Extractive products → gums, resins, oils
- Non-food products → pets feathers...can be illegal

Questions: What % of Thais use medicinal products?

Answer: Many varieties of plants were used, could be up to 1 million Baht.

Questions: How do they harvest NTFPs?

Answer: In the NPs it is illegal to remove forest products without a permit, but in other forest designations you are allowed to harvest

- If the village is inside the forest (BMSM) then you can harvest products because you are not crossing the park boundary.

Final Discussion - How to apply FORRU in Cambodia?

Questions for group discussion.

1. Where would you locate a FORRU?
2. How would you organise/administer it and what sort of research should be carried out?
3. Who should be involved?
4. Which of the concepts that you have learnt about during this workshop would you consider adapting to running a FORRU in Cambodia?
5. Are there any forest restorations concepts that you want to explore that have not been covered in this workshop?
6. Which research methods demonstrated in this workshop would you use when running a FORRU?
7. What other research techniques would you like to have seen included in the workshop?
8. Can you name any Cambodian forest tree species that you think are worth testing as framework species?
9. How might you use the lessons learned during this workshop over the next 6 months?
10. What other comments would you like to make about the contents or running of this workshop?

Discussion of Group 1

1. Where would you locate a FORRU
 - HQ FORRU Cambodia Sihanoukville Forest Cantonment Kbal Chhay
 - (Or Koh Lang Forestry Thmar Bang District Cardomum Mountains)
2. How would you organise/administer it and what sort of research should be carried out?
 - Forest Research Institute Cantonment Forestry Sihanouke Koh Kang
 - Phenology Survey
3. Who should be involved?
 - FRI Canton Admin Forestry Koh Kong
 - Local Agencies
 - DANIDA
 - Local Communities
 - NGO's Care etc. Wild Aid
4. Which of the concepts that you have learnt about during this workshop would you consider adapting to running a FORRU in Cambodia?
 - ANR and FW spp
5. Are there any forest restoration concepts that you want to explore that have not been covered in this workshop?
 - None
6. Which research methods demonstrated in this workshop would you use when running a FORRU?
 - Phenology
 - Nursery techniques, such as seed testing
 - Tree planting tests
 - Direct sowing
 - Ground flora survey and monitoring
 - Data analysis
7. What other research techniques would you like to have seen included in the workshop?
 - Economic consideration of the species planted
8. Can you name any Cambodian forest tree species that you think are worth testing as framework species?
 - *Irvingia malayana*
 - *Pentacme sauvis*
 - *Parinari sp.*
 - *Afzelia xylocarpa*
 - *Tetrameles nudiflora*
 - *Anthocephalus chinensis*
 - *Sandoricum koetjape*

9. How might you use the lessons learned during this workshop over the next 6 months?
 - Determination of site location
 - Extend concept of forest restoration to others
 - Discuss location of future FORRU Cambodia

10. What other comments would you like to make about the contents or running of this workshop?
 - Extend data analysis
 - Satisfied with content

Discussion

Question: Steve: Is *Azadirachta* sp. native?

Answer: Yes, we have two native variations.

Steve Comment: Glad to hear that you are happy with the content. We can include more data analysis during the workshop in Cambodia. You should stay in contact with us and each other to determine a FORRU Cambodia Headquarters before the workshop. You know have the resources to extend this knowledge for education in Cambodia. Consider translating the resources into Khmer.

Discussion of Group 2

1. Where would you locate a FORRU?
 - Bantay Srey Dist Seam Reap N. Tonlesap Lake Admin
 - Bottom of the mountain near National Park – National Park is under Ministry of Environment and Forestry is under Ministry of Agriculture – sometimes difficult to work together. Near National Park – for FORRU.
2. How would you organize/administer it and what sort of research should be carried out?
 - Leader of the For and Wildlife Inst under For Admin
 - Officer of Forestry Admin Inspectorate of N. Tonlesap Lake
 - Lowland degraded forest area
3. Who should be involved?
 - Local authorities
 - Local communities
 - School Universities
 - NGO's
4. Which of the concepts that you have learnt about during this workshop would you consider adapting to running a FORRU in Cambodia?
 - ANR - very suitable for Cambodia
 - Framework Species Method
5. Are there any forest restoration concepts that you want to explore that have not been covered in this workshop?
 - None
6. Which research methods demonstrated in this workshop would you use when running a FORRU?
 - Vegetation Monitoring
 - Nursery establishment techniques
 - Phenology
 - Tree planting
 - Germination, Seedling growth, Planting experiments
 - Data analyses
7. What other research techniques would you like to have seen included in the workshop?
 - Soil survey techniques
8. Can you name any local Cambodian forest tree species that you think are worth testing as framework species?
 - *Dipterocarpus* spp.
 - *Syzygium* sp.
 - *Azelia xylocarpa*
 - *Mitrella mesyi*

- *Dialium cochinchinensis*
 - *Peltophorum dasyrrhachis*
 - *Pterocarpus macrocarpus*
 - *Tateria javanica*
 - *Dalbergia bariensis*
9. How might you use the lessons learned during this workshop over the next 6 months?
- Translation of documents into Khmer
 - Site observation and communication
 - Draft project proposal
10. What other comments would you like to make about the contents or running of this workshop?
- In nursery and field site should be use natural fertilizer for seedling health
 - Time for data analysis is too short.
 - Human resources for forest restoration should be built up. Training courses in Administration.

Steve Comment: For a soil survey we collect samples and send them to Soil Laboratory in Faculty of Agriculture for analysis. Outside assistance should be sought for this aspect. Try not to make this about the Forestry Administration but spread it to a more multilateral organization scheme and you will achieve a better result. It is important to involve schools, university, research institutions and local/international organizations.

Conclusion

After the final discussion, the participants wrote up the plan for hosting workshop in Cambodia and taking the work forward on the other outputs.

PROPOSED AGENDA FOR THE WORKSHOP IN CAMBODIA

Title: “Forest Restoration in Cambodia”

Objectives:

- To formulate a comprehensive integrated FORRU plan for Cambodia.
- To write up a proposal to establish the Forest Restoration and Research Project (FORRP) in Cambodia.

Major Content:

The issues to be addressed by workshop

1. Presentation/Discussion
 - a. FORRU concepts
 - b. Need for FORRU Cambodia
 - c. “How to plant a tree”(Draft in Khmer)
2. Discuss the establishment and implementation of FORRU → draft document

Venue: for workshop and field trip

- Phnom Pen
- One day field trip to Kbal Chhay watershed to see forest restoration.

Organised by:

- Head of FA will be the Chairman,
- FORRU Thailand,
- FWSRI (Forest Wildlife and Science Research Institute)
- JICA (provide venue and training facilities)
- Forestry Administration (Organize field trip)

Participants:

14 Forestry Administration people, 4 from University, 2 from Ministry of the Environment, 5 from outside NGOs

Duration: In October 2006, 4 days (tentative)

- Open for general agenda and Closed session for proposal write-up

Expecting Outputs:





- The Draft of implementation plan of FORRU Cambodia
- Publications;
 - Fieldguide – “**How to Plant a Forest.**”
 - Manual – “**How to establish Forest Restoration and Research Project**”Both of them will be translated and adapted to Cambodian version by skilled/experience foresters.

Expected Funding Agencies:

- FAO
- AUSAID
- ITTO
- APAFRI
- EMA

EVALUATION REPORT

Please fill in the form how you satisfy about each section of the workshop.

Workshop Program	Satisfaction score			
				
2/11/05 – Objectives of the workshop. Introduction to FORRU and the framework species method, Why are FORRUs needed?	15	1		
3/11/05 – Framework species plots - what can be achieved	13	3		
3/11//05 – Community motivation for forest restoration - BMSM	10	6		
4/11//05 - Phenology and seed collection in natural forest	14	2		
5/11/05 – Herbarium Visit, Phenology data analysis and genetic considerations of seed collection	9	6	1	
6/11//05 – Nursery techniques	13	2		
7/11/05 – Analysing seed experiments, Dormancy, Production Schedule	11	3	1	
8/11/05 – Montioring tree performance, Weeding/fertilizer performance	10	5		
9/11/05 – Vegetation monitoring - field work	10	5		
10/11/05 – Planning - time, labour and costs, Role Play Scenario	13	2		
10/11/05 – Analysing field data, NTFPs, Selecting Framework Species	8	7		
11/11/05 – Final discussion - planning exercise	11	4		

Any subject do you think FORRU should provide more information? Why?

- Framework Species, phenology studies and analyzing field data are the main interests in Cambodia

Which subject do you think FORRU should cut from the program? Why?

- None

Comments and Suggestion?

- Keep up with the good work

- More information about sponsors to establish FORRU in Cambodia

- Need to have a workshop in Cambodia

- Need more time for training.

- Satisfy and Happy