ANALOG FORESTRY APPLICATION IN VIETNAM

A Step-by-step Guide

COUNTERPART

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By Marianne Meijboom

Counterpart International

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Analog Forestry Application in Vietnam: A Step-by-step guide

First edition, March 2007

Design and layout: Heart and Mind Printing Company
Phan Huong Giang, Counterpart International Vietnam

Cover illustration courtesy of Furare, Ecuador

This Guide was made possible through the support provided by the United States Department of Agriculture (USDA) under the terms of Counterpart International's Food for Progress Grant FCC-440-2002/1025-00. The opinions expressed herein are those of Counterpart and do not necessarily reflect the views of USDA.

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Foreword

Biodiversity conservation and economic growth are often seen as opposing interests. Vietnam has not been saved from this conflict, especially in the last two decades when Vietnam posted impressive economic growth in its drive to eradicate extreme poverty and achieve developed nation status. While traditional communities lived for centuries under small-scale and sustainable farming systems, the drive for developed nation status has called for farming systems that emphasize specialization (mono-cropping) and high dependence on external inputs (hybrids, chemical pesticides and fertilizers).

Biodiversity conservation however cannot be considered a secondary objective; developed nations have already learned this lesson. As more lands are converted to "modern" farming systems, the survival of precious indigenous plant and animal species are relegated to the confines of protected natural areas. Even this situation is compromised, as demand for wildlife and precious hardwoods drive rural households to extract these illegally from protected forests.

Analog Forestry is a methodology that seeks to balance these competing interests. It is possible--at least in theory for the moment because the term is new in Vietnam--that biodiversity and ecological resiliency are enhanced in farmers' plots, while at the same time providing for farm households adequate and sustainable economic returns over the long term.

The concept is not entirely new. Home gardens and Forest gardens are traditional forms of crop cultivation in Vietnam, patches of cultivated land dominated by trees and perennials having the appearance of a forest, providing economic products as well as a pleasant living environment in traditional communities. What is different in Analog Forests is the deliberate design that mimics that natural forest, both in structure and ecological functions. It is analogous to the original climax forest, ancient landscapes now but patches of land fast disappearing in this rapidly changing Vietnam.

This accessible Guide, written for Counterpart by Marianne Meijboom based on previous work by Analog Forestry visionary and Counterpart Senior Scientist Dr. Ranil Senanayake, is an attempt by Counterpart International to disseminate the concept of Analog Forestry to a broad audience. Here we illustrate how its principles may be applied in a systematic way through an example of its early application in Quang Binh province, in farmers' lands adjacent to the World Natural Heritage Site Phong Nha - Ke Bang National Park.

Every piece of work is a work in progress. We welcome comments on how concepts and methodologies presented in this Guide may be refined. We would especially be keen to hear on how this Guide may or may not have been helpful.

Last but not least, we acknowledge the contributions, whether directly or indirectly, of people and institutions unmentioned elsewhere in this Guide who have contributed to our understanding of Analog

Forestry - Falls Brooke Centre in Canada, for their seminal Analog Forestry Manual; Lorena Gamboa of the Analog Forestry Network and Furare in Ecuador; and Rene Sita of Counterpart Philippines. Together with Ranil, Lorena and Rene came to Vietnam in the autumn of 2004 and kicked-off the learning process in Vietnam among farmers and development workers, under the shadow of Phong Nha - Ke Bang's mystical limestone cliffs.

Victor E B Pinga
Counterpart International Vietnam

Acknowledgments

This guide on Analog Forestry is based on the basic principles of Analog Forestry as described by Ranil Senanayake and John Jack in 1998 (Analog Forestry: An introduction. Monash University Press, Monash University, Clayton, Victoria, Australia) and on the implementation of the Forest Garden Project in Quang Binh Province, Vietnam by Fauna and Flora International (FFI) on behalf of Counterpart International. For the development of this document I am very grateful to Trinh Thang Long, Team Leader of the Forest Garden Project for his kind support and contributions. His dedication to transform and implement Analog Forestry in the Vietnamese context is very impressive. I also would like to thank Ranil Senanayake, senior scientist of Counterpart International, for his contributions to this guide. It was a real pleasure to meet him in person during the development of this document. Furthermore I would like to thank LeRoy Duvall, Sustainable Agricultural Senior Technical Advisor, Victor Pinga, Chief of Party - Food Security and Sustainable Agriculture and Nguyen Duy Luong, Agroforestry Officer of the Forest Garden Project for their comments on earlier drafts of this document.

Marianne Meijboom

Introduction

Forest resources in Vietnam are severely depleted because of high demand for agricultural land and forest products. Vietnam has a relative high population pressure and the demand for agricultural land is high. Most arable land in the lowlands has been converted to agriculture, while unsustainable land use systems are used in many upland areas to make a living. At present it is estimated that about 35% of the country is covered with forests, however most of the forests reported consist of monoculture plantations of pine, eucalyptus and acacia. Only 10% of the forest cover can be considered as natural forest. The unsustainable agriculture and forestry practices will lead to further exhaustion of soils, falling ground water tables, pollution of soil and water and increased dependency on external inputs such as seeds, fertilizer and pesticides. Furthermore the market dependency on one or two products makes farmers more susceptible to harvest loss due to droughts, floods and/or pest outbreaks or to price fluctuations in cases where yields are stable.

Analog forestry defined

Analog forestry can help local people build sustainable livelihoods. Analog forestry is about increasing the resilience and biodiversity of a landscape, by making use of the natural ecological succession processes (natural succession from barren land/grassland to climax forest) as a model for agricultural and forestry production and through mimicking of natural forest structures and related ecological functions with socio-economically valuable species.

The concept of analog forestry was first developed in Sri Lanka and is based on the traditional home garden model.[1] Starting from this model the NeoSynthesis Research Center in Sri Lanka experimented over a period of 25 years with different species to develop economically productive ecological systems that are similar in structure and function to a natural forest ecosystem.

Analog forestry is a new concept in Vietnam. However, most farmers already have some experience in establishing an analog forest garden, without calling it as such. The traditional Vietnamese home garden consisting of multiple species including a tree layer, shrub layer, annual plants, epiphytes and climbers, can also be considered as a form of analog forestry. Counterpart International's Forest Garden Project implemented by Flora and Fauna International is one of the first projects in Vietnam to test and apply analog forestry in the field.[2] This guide is based on the methodology applied by the Forest Garden Project with the aim to increase the interest in analog forestry and to help other interested parties apply its principles in the field.

This guide is written for local stakeholders, including extension workers and local organizations that are willing to support farmers in improving their agricultural and forestry systems and applying analog forestry techniques in the field. The guide describes the implementation of analog forestry in 10 steps. A seperate facilitator's manual has ben designed to complement this guide and offers practical sessions and exercises for each of the steps as described here, and will guide you through the process of using analog forestry as a tool to increase sustainable livelihoods and to improve, conserve and make sustainable use of biodiversity.[3]

[1] Sananayake, R. and J. Jack, 1998. Analog forestry: An introduction. Monash University Publications, Melbourne, Australia

[2] The term forest garden is traditionally used to describe a garden that mimics the forest structure. The concept of Analog Forestry is wider and can be considered as a methodology and tool to strengthen livelihoods and to increase the biodiversity and resilience of a landscape. A forest garden can be one of the outcomes of Analog Forestry. Counterpart International uses the term "Forest Gardens" to describe Analog Forestry application and uses the two terms interchangeably, although in this guide the latter is used to avoid consfusion with traditional forest gardens in Vietnam.

[3] See Analog Forestry Application in Vietnam: A Facilitators Manual. Counterpart Internaternational Vietnam, 2007

Basic principles of analog forestry

Analog forestry can be used as a tool and methodology to strengthen livelihoods and to increase the biodiversity and ecological resilience of a landscape by making use of natural ecological succession and natural forest functions.

Analog forestry makes use of three major principles:

1. Ecological succession - Analog forestry uses the natural succession from barren land/grassland to climax forest as a model for agricultural and forestry production. One goal of analog forestry is to speed up the progression of these seral stages.
2. Mimicking natural forests - By imitating the natural forest structure and related ecological functions with socio-economic valuable species, analog forestry aims to increase production while strengthening forest functions such as watershed protection, soil conservation, habitat provision, biological control, and conservation of genetic resources.[4]
3. Landscape ecology - The ultimate goal of using analog forestry in a landscape is to develop a network of natural and analogous forest patches to build up the biodiversity and resilience of the landscape, based on the existing vegetation patches in the landscape.

Ecological succession

Analog forestry uses natural succession processes, either starting with earlier stages such as barren land/grassland and progressing to climax forest or by enhancing and accelerating maturity in established home gardens for agricultural and forestry production. Under natural conditions, bare land will become grassland which will slowly evolve to shrub land with pioneer trees, then to pioneer forest, sub-climax forest and finally climax forest if people do not interfere. Soil conditions will similarly progress from underdeveloped soils with no humus layers to well-developed soils with thick humus layers. This is called ecological succession. The sequence of different stages in ecological succession is called seral progression.

Seral Stages

1st seral stage: Grasses dominate
In this first stage grasses dominate, the topsoil is not developed and only plants with a shallow rooting system can survive.

2nd seral stage: Shrub land and pioneer trees
In this stage shrubs gradually dominate with pioneer tree species while grasses disappear. The soil structure is improved and a new topsoil layer and a deeper rooting system is under development.

[4] Increase in production of socio-economically desirable products as well as biomass

3rd seral stage: Pioneer forest

In this stage the pioneer trees will grow and form the main canopy. This canopy will create the conditions necessary for seedlings and saplings of sub-climax species that need shade when young. The soil structure and the new topsoil layer and rooting systems are further improved.

4th seral stage: Sub-climax forest

In this stage the site is inhabited by more diverse plant and animal species. The forest structure is becoming more complex and several forest layers are formed (i.e. herb layer, shrub layer, lower canopy and upper canopy). The topsoil continues to develop with the beginnings of humus formation.

5th seral stage: Climax forest

At this stage all the different forest layers are formed and the highest possible level of biodiversity is reached. The soil is well developed with a thick humus layer.

In general, natural seral progression to climax forest can take anywhere from 50 to 1,000 years. In analog forestry it is also necessary to follow a seral progression. One goal of analog forestry is to speed up the development of the seral stages.

Sometimes the land may have already been planted with trees and resembles a pioneer or sub-climax stage. Here the addition of missing elements and/or growth forms (for example, climbers and epiphytes such as orchids) is used to help develop the agricultural/forest land towards higher maturity.

Seral Stage Succession

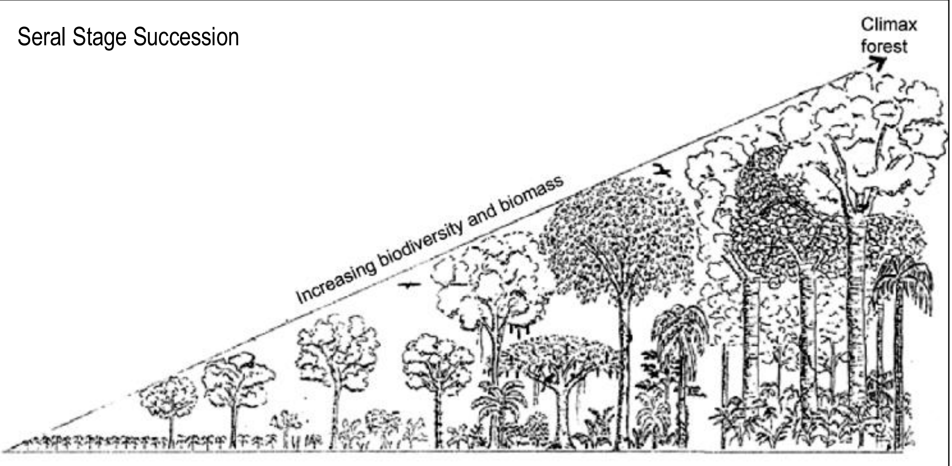

Illustration: Courtesy of Falls Brooke Centre Canada

Figure 1. Over time, successive seral stages provide increasing soil development, biodiversity and canopy cover

Mimicking natural forests

Often natural forests contain relatively few socio-economically desirable species. By planting andpromoting socio-economically valuable species to imitate natural forest structures and ecological functions, analog forestry seeks to increase production while strengthening forest functions such as watershed protection, reduced soil erosion, biological control, climate regulation, detoxification and conservation of genetic resources.[5]

Analog forestry tries to enhance and use natural forest functions to reduce the need for additional fertilizers and pesticides, and to conserve and build up the soil.

Plants in an analog forestry system have access to nutrients through the natural nutrient cycle and are less susceptible to large pest outbreaks. Forest gardens are also the home of natural predators and the increased diversity of the system provides for a better growing environment as well as for better adapted species.

Contrary to common beliefs, tropical forests grow mainly on soils of extremely low fertility. Forests are possible mainly because of extensive natural nutrient cycling, whereby nutrients stored in the forest biomass (e.g. plants, wood, leaves,

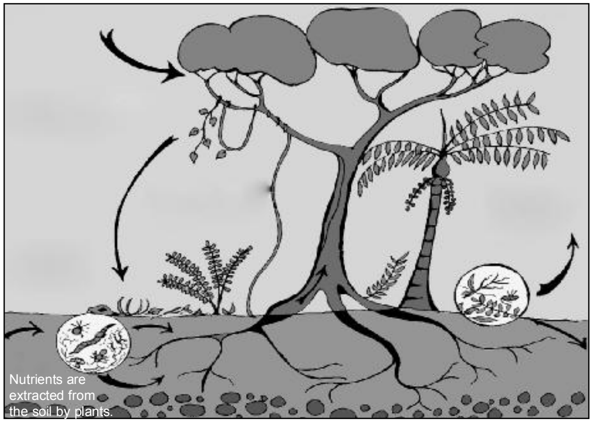

Illustration: Greg Blake

Figure 2. Natural nutrient cycle in a system mimicking natural forests

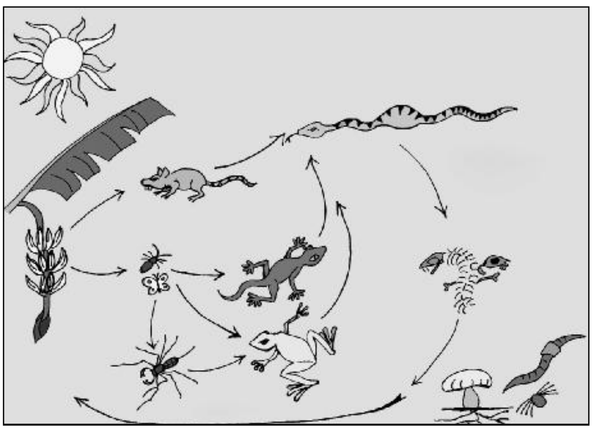

Illustration: Greg Blake

Figure 3. Natural predators and the food chain

[5] The forest functions as described here are mainly based on Groot, R.S. de, 1992. Functions of nature, evaluation of nature in environmental planning, management and decision-making. Wolters-Noordhoff. The Netherlands and Jacobs, M., 1987. The Tropical Rain Forest, a first encounter. Springer-Verlag, Berlin.

fruits and animals) become available when organisms die and decay, thereby releasing the nutrients to be reabsorbed by the forest - as long as a mature soil ecosystem is maintained.

Photo courtesy of Counterpart Philippines

Photo 1. Erosion where the natural vegetation has been cleared for mono-cropping

Functions of forests

Forests provide habitat for natural predators, pollinators and seed dispersers. For example, predators of rats (such as cats and snakes) need bushes and woodlands for shelter and reproduction. Without such habitat, natural predators of pests cannot survive and pests can thrive, leading to problems such as rat infestations which can destroy large amounts of crops.

Illustration: Greg Blake

Figure 4. Evapo-transpiration and forests as cloud generators

Forests also reduce soil loss from erosion or landslides. The different canopy layers, surface litter and humus layer minimize the impact of raindrops on the soil, and the litter layer and extended root network limits the extent to which soil is carried away in runoff. The roots will also facilitate the infiltration of water into the soil. In contrast, raindrops falling on bare ground loosen the soil, and runoff is increased. Heavy rain in bare, hilly areas may result in landslides. The eroded soil will be transported downstream and may cause damage through the silting up of watercourses or dams and other problems.

Forests return moisture to the air through transpiration and evaporation. Transpiration is the release of water vapor to the atmosphere through the pores of trees and other plants, while evaporation is the transformation of water to vapor from the surface of plants especially leaf surfaces, soil, rivers and other water sources into the air because of heating. Forests return 50 to 90% of the intercepted precipitation in the form of rain back to the air through evapo-transpiration, while only 30% of the precipitation falling on bare soil returns to the air, the remaining 70% is lost as erosion-enhancing runoff. Forests are thus cloud generators and provide a positive influence on the total rainfall and its effectiveness, especially in areas that are located further inland. Moist air, which is carried inland by winds from the sea, falls on the land in the form of rain. If this rain is intercepted by the forest, the forest will return most of the water back to the air, where winds will take it further inland, where it can fall again as rain. If forests are cleared, more water is lost as runoff and less moisture will be returned to the air, thereby reducing the likelihood of rain with the risk of consequent droughts which will affect agricultural yields.

An example of detoxification by plant communities in Sri Lanka

The use of plants to detoxify polluted environments is seen in the application of plant physiology and ecology in the design of "live filters" to control the pollution of drinking water wells from agriculturally introduced nitrates and nitrites. The inclusion of a community of plants (including the species Terminalia catappa, Terminalia arjuna, Hibiscus tilliaceus, Pandanus leram and Areca catecu) that have rooting characteristics encouraging the formation of an absorbent screen through which the polluted water flows to reach the well, have provided good controls.

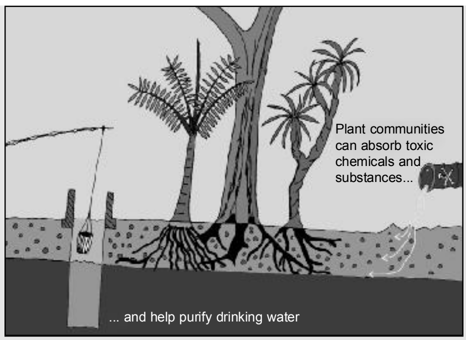

Illustration: Greg Blake

Figure 5. Detoxification by "live filters"

Kalpitiya is a sandy peninsula on the western coast of Sri Lanka. Being located between a shallow sea and a shallow lagoon, it enjoys a relatively high water table. The easy availability of good water and the well-draining sandy soils makes for easy production of high value crops such as tobacco and chilies. The agricultural techniques consisted of massive amounts of urea and other high nitrogen fertilizer salts being applied to the low fertility sandy soils. Over time the salts naturally leached into the shallow aquifer and began to build up in concentration until dangerously elevated levels of nitrates and nitrites were recorded in drinking water wells of the region by the Water Board of the Sri Lankan Government.

A management response to the problem was developed by the NeoSynthesis Research Center (NSRC) which established a ring planting of trees around each well, to act as a live filter for the well. Since the first planting four years ago a significant decrease has been recorded in the levels of nitrates and nitrites.

(By Ranil Senanayake)

Finally, forests can also act as natural purification systems that store and recycle or break down certain toxic materials (such as chemical pollutants or dust). The forests intercept the toxic components and store and/or recycle them through natural processes on the forest floor.

Landscape ecology

The configurations possible for analog forestry interventions depend on the existing vegetation patches in a landscape. A landscape is composed of a mosaic of different ecosystem patches such as rice fields, annual crop land, tree plantations, rivers, grassland, barren land, natural forests, among others.[6] Each patch offers its own unique ecological function and species composition, which differs from neighboring patches of vegetation. A small isolated patch of natural vegetation is likely to have relatively low biodiversity. If it is located far from other patches of natural forest, then ecological succession towards climax-forest becomes more difficult, or almost impossible, as there are limited opportunities for colonizing organisms from the forest to arrive in and enrich the isolated patch.

Photo: LeRoy Duvall

Photo 2. Landscape of different ecosystem patches

It is necessary to study the landscape to identify the different existing ecosystem patches and the possibilities for creating corridors or linkages between similar patches. The landscape study can identify marginalized areas where analog forestry can help to restore the ecological resilience of the various patches and the overall landscape. Analog forestry can be used to build up the natural resilience of the landscape by creating an analog forest patch that borders the natural forest in order to increase the total foest area, or to link two or more patches of natural forestland with a corridor. If an analog forest patch is created adjacent to a natural forest patch, the total size of the forest area will be extended thereby providing a greater range to existing plants and animals. The analog forest corridors facilitate the movement of species between patches and thus facilitate gene flow and the interaction of gene pools. The ultimate goal of analog forestry in a landscape is to develop a network of natural and analogous forest patches to build up the biodiversity and resilience of the landscape.

[6] Formann, R and M. Godron, 1986. Landscape ecology. John Wiley and Sons, New York.

Advantages and disadvantages of analog forestry

Analog forestry offers numerous ecological and socio-economic advantages compared to annual and mono-cropping systems. The ecological advantages include, among others, clean water and watershed protection, soil creation and soil conservation, biological control, and maintenance of biodiversity. Socio-economic advantages may include reduced risk of crop failure and less market dependency because of the diversity of crop products; reduced labor inputs, once the analog forest system is established and makes use of the ecological functions of a natural forest (no labor for plowing, seeding, transplanting and weeding); no or limited use of fertilizers because nutrients become available through the nutrient cycle (natural recycling of the nutrients stored in the biomass of the forest, for example plants, wood, leaves, fruits and animals); no or limited use of pesticides because the greater species diversity in analog forests reduces the risk of pest and disease outbreaks and the analog forest provides habitats for predators that are natural controls for pests. Furthermore, an analog forest system is self-maintaining, self-pollinating and self-reproducing as the system provides the habitat for pollinators and seed dispersers.

There are also a number of socio-economic disadvantages to analog forestry, the most significant being potential difficulty in the marketing of products. Quantities for any single product produced in analog forestry systems will be less than under monoculture systems, which increases transportation and other costs. Traders may only be interested in visiting remote communities to purchase products where they are sure quantities are large enough to be profitable.

Another major constraint is the range of valuable species that are suitable to a particular site (major factors include climate and elevation). Local species of economic interest that could be used in analog forestry may grow slowly or may not provide enough benefits. The limited availability of different indigenous species might be a constraint. In general plants will be purchased from nurseries or arboretums. However many indigenous species might not be available or only at high costs. They may be available from nurseries located far from the community, resulting in high transport costs after purchasing the seedlings. Another source of plants might be the wild, however the transplanting of wildlings is very labor-intensive. The establishment and maintenance of an analog forest in the first 1-3 years requires a lot of labor. Activities such as the identification of suitable species, their purchase and planting, soil conservation and soil fertility measures and weeding, all are costs that require the time and effort of the new analog forester. Furthermore, there are not many examples of well-functioning analog forestry systems available as demonstration sites because analog forestry, as defined in this guide, is still relatively unknown in Vietnam.

Table 1: Some advantages and disadvantages of analog forestry and mono-cropping systems

	Analog forestry system		Mono-cropping system	
	Advantages	Disadvantages	Advantages	Disadvantages
Ecological	• High biodiversity • Clean water and soil • Watershed protection • Soil conservation and soil creation • Ecologically sustainable	• None	• None	• Low biodiversity • Greater risk of soil and water pollution • Risk of falling ground water tables • Soil depletion and soil erosion • Ecologically unsustainable
Socio - economic	• Greater product diversity reduces risk • Low labor demand over the long-term • Biological control • Self fertilizing • Self-pollinating and reproducing • Socio-economically sustainable • Economic returns are over the long-term	• Low yields of a single product • Complex • Limited information on suitable species available • Limited availability of seeds/ seedlings of desired species • Labor intensive in the first years • Not well known	• High yields of single product(s) • Simpler to establish and manage • Well-known and widely practiced • More immediate economic returns	• Dependent on one or two crops • More vulnerable to market fluctuations • Higher and recurring labor demands over the long-term • Decreasing soil fertility over the long-term • High dependency on external inputs (pesticides, fertilizer, purchased seed, etc.)

Analog forestry in 10 steps

Step 10: Monitoring and evaluation at block, village and landscape level

Step 9: Implementation of initial analog forestry plans and follow up

Step 8: Nurseries, seed storage facilities and arboretum

Step 7: Development of an analog forestry plan (per block)

Step 6: Identification of potential species (per block) and database

Step 5: Development of a vision (per block or planning unit)

Step 4: Resource assessment (per analog forestry zone)

Step 3: Formation of analog forestry groups

Step 2: Village land use planning

Step 1: Landscape study and description of seral succession

Step 1: Landscape study and description of seral succession

As described earlier in the section on the basic principles of analog forestry, the study of the landscape is important to identify the most suitable locations for analog forestry interventions. By describing the landscape patches that surround the community, suitable locations for analog forestry within the community area can be identified in three ways. The first is by identifying locations that border a natural forest patch in order to extend the size of the natural forest and thus providing a greater range for both plant and animal species. The second is by identifying needs for the formation of an analog forest corridor to link two or more natural forest patches and to facilitate gene flow and the interaction of gene pools. The third is to identify patches of barren land where analog forestry interventions can be used to restore the ecological resilience of the patch and landscape.

Furthermore, the landscape study can help to prioritize areas for analog forestry interventions. This applies especially to areas that need further protection or special management, such as watersheds, wind breaks, landslides and other areas susceptible to erosion are all suitable landscape patches for analog forestry.

Photo 3. Using analog forestry to expand a natural forest patch

Photo 4. Creating a corridor to link natural forest patches

Photo 5. Using analog forestry to rehabilitate and improve the biodiversity of barren lands

The landscape is likely to represent natural forest in various seral stages. These natural forest stages should be described carefully as they will show how the vegetation would likely progress if nature were allowed to take its course. Forests can be described in many different ways. Counterpart's Forest Garden Project classified the forest vegetation according to growth form and structure, based on the method developed for the Tropical Forest Register.[7] This method was further adapted to increase its practical use for describing forest patches in the field. The variables described in this method are the basic leaf forms, the growth forms, height and coverage.[8]

[7] Jayal, N.D. (ed) 1989. The Tropical Forest Register. In: Deforestation, drought and desertification. INTACH, New Delhi, India. P.134-140.

[8] For the explanation and example of the terms used, see the separate Facilitators Manual published by Counterpart.

Table 2. Variables and symbols used for describing a forest patch

Growth Forms	Symbol	Height classes	Symbol
Trees		higher than 35 m	8
Broadleaf evergreen	B	> 20 to 35 m	7
Broadleaf deciduous	D	> 10 to 20 m	6
Needleleaf evergreen	E	> 5 to 10 m	5
Needleleaf deciduous	N	> 2 to 5 m	4
Semi-deciduous (B+D)	S	> 0.5 to 2 m	3
Mixed (D+E)	M	< 0.1 to 0.5 m	2
Herbaceous plants		< 0.1 m	1
Graminoids	G		
Forbs (ferns)	H		
Lichens, mosses	L		
Special Growth Forms	**Symbol**	**Coverage classes**	**Symbol**
Climbers and lianas	C	Continuous (over 75%)	c
Stem succulents	O	Interrupted (50-75%)	i
Rhizomatous	K	Patchy (25-50%)	p
Bamboos			
Epiphytes	V	Rare (6-25%)	r
Erect palms	X	Sporadic (1-6%)	b
Rattans	P	Almost absent (<1%)	a
Shrubs	R		
	U		

In this technique the highest canopy layer will be described first, followed by lower layers. For example an upper canopy layer consisting of broad leaf evergreen trees of 30 m in height that covers 60% will be described as B7i. A lower continuous canopy of broad leaf evergreen trees of 10 m is described as D5c and a layer of scattered rattan plants would be R4b. For climbers the maximum height that they reach is recorded as the height class, while for epiphytes it is the height at which they are found.

For example a patch of degraded natural forest in Xuan Son community, Son Trach commune in Bo Trach district, Quang Binh province is described as:

B5b, C5r; B4p, C4p, K3i, P3b, H3r, G1b, L1a

The formula describes a broad leaf evergreen forest with two canopy layers. The highest canopy layer is between 5 to 10 m, has a sporadic (1-6%) cover while climbers are rare (6 to 25%). The second layer has a height of 2 to 5 m with a patchy cover of climbers. There is also an interrupted cover of cardamoms and ginger plants of 0.5 to 2 m in height, sporadic palms of 0.5 to 2 m high, rare ferns of 0.5 to 2 m high, sporadic grasses less than 0.1 m high with lichens of less than 0.1 m almost absent.

Formulas are useful for concisely describing the structure and seral stage of the forest, compared to the long descriptions that would otherwise be needed. Furthermore the formula will facilitate the identification

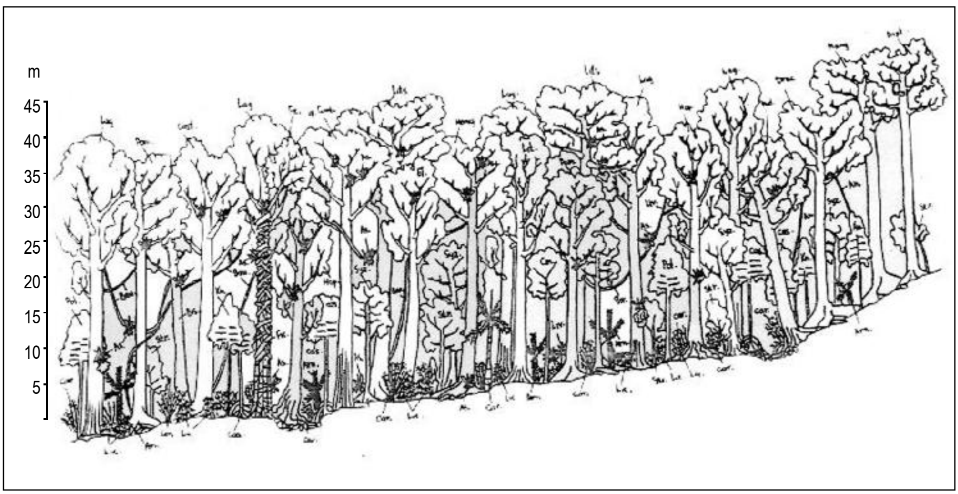

Illustration: A Kutznetsov

Figure 6. Vertical profile of a forest at an altitude of 100-150 m in a valley in Phong Nha-Ke Bang National Park in climax stage

of the next seral stage. Therefore, it is useful to describe all the distinctive natural succession stages occurring in the landscape. These formulas are useful for further reference and can further guide the development of visions and objectives for other vegetation patches within the landscape during the planning process, to increase the biodiversity of the landscape.

Forest patches can also be described through vertical and horizontal perspectives. A vertical profile can help to visualize the different canopy layers, the undergrowth and other life forms as shown in figure 6.

The horizontal profile shows the spacing of the vegetation as seen from above as for example in figure 7. While describing the forest it is also important to note the animal species (mammals, birds, reptiles, amphibians, and major insects) that are present in existing areas of the climax forest. The food and habitat requirements of these animals can then be incorporated in the analog forestry plan and/or the monitoring plan (see steps 7 and 10), while the presence of animals can be used as an indicator for success in imitating the natural forest (see step 10).

The landscape study is useful for collecting general data about the climate, soil and existing plant and animal species. These data are also useful in subsequent steps.

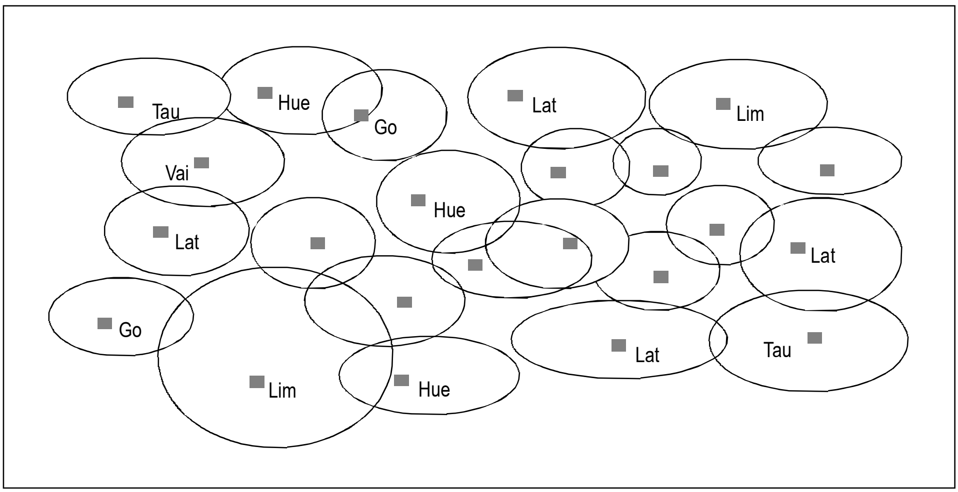

Figure 7. Horizontal Profile of a forest showing native species found in Phong Nha - Ke Bang area

Step 2: Community land use planning

Community land use planning is essential in Vietnam because residential areas are concentrated and agricultural and forest lands are scattered over the community area. Furthermore, land use options as identified in the land use plans are fixed and need to be implemented in the field once the plan is approved by the relevant authorities. Changing land use options is difficult and essentially only possible when a new plan is prepared (presently every 5 years). The current land use in a community should be assessed before starting to develop the community land use plan. A number of secondary documents may be available that contain relevant information about current land uses such as socio-economic statistics, areas under agricultural production and production yields and areas managed by various organizations and management boards. These documents can often be obtained from the community and/or commune authorities. After collecting existing secondary data, the data need to be updated. PRA techniques such as 3D modeling, transects and interviews can help visualize and facilitate discussion on the existing land use situation in the field. The final 3D model that can be used for future reference and discussions should show the major features of the community (such as roads, residential areas and rivers), different land uses, forest status, boundaries of different land tenures/occupants (boundaries of the community, boundaries and other sub-divisions within the community, administrative boundaries of State Forest Enterprises , Protection Forest Management Boards, Protected Areas, and lands allocated to households and organizations), and boundaries of "production forests", "protection forests" and "special-use forests" (as defined in the Vietnamese forestland classification system).

Photo: FFI

Photo 6. Using a 3D model for discussing the community land use plan in Xuan Son, Son Trach commune, Bo Trach district, Quang Binh Province

The 3D model and results of the transect can be used to facilitate further analysis of the current situation. The analysis should include the current social, economic and ecological situation and future needs. Each community should identify its own development goals and specific objectives to achieve sustainable land use, improved land management and improved economic and social conditions. They can then discuss how analog forestry can be used as a tool to reach these goals. In order to develop realistic planning options, and minimize future conflicts, a community should take into consideration: (1) the existing socio-economic development plans of the district and commune and existing plans of other organizations operating in the area, such as the State Forest Enterprise and the Protection Forest Management Board; (2) Vietnamese law and legislation; and (3) available funds.

During community land use planning, the locations suitable for analog forestry interventions should be identified and discussed. Areas highly suited for analog forestry interventions include forest lands that border other natural forest patches in bordering communities, the areas that can be used for developing a corridor to link different natural forest patches, watercourses, degraded/unused land, and/or areas that are considered to be unproductive at present. An agro-economic analysis for instance can reveal that the cultivation of peanuts on so-called dry land is hardly economically viable and may be better suited for analog forestry intervention. Locations selected for analog forestry interventions should reflect the linkages of the community with the wider landscape. The different land use options for each site should be identified and carefully assessed to select the best options reflecting the priorities of the community.

Step 3: Formation of analog forestry groups

The 3D model and the land use plan map indicate the areas that have similar conditions and have the same land use options. The areas for which land use options have been identified that reflect analog forestry activities are aggregated to analog forestry zones. These areas may be adjacent to each other but this is not a precondition for the formation of analog forestry zones.

Appropriate organizational structures should be established to implement the analog forestry activities in these zones. Management by individual households is more suitable for lands close to residential areas, while management by a group is more suitable for lands relatively far from residential areas where management is more extensive compared to the intensive management for sites closer to residences. The management of each unit or area should be discussed - will the zone be divided among individual households to implement the land use options, or should the entire zone be managed by a group of households or the community as a whole? The criteria and requirements for participation in the analog forestry interventions should be clearly defined for all sites and participation in analog forestry groups should be voluntary. It is essential that potential participants understand clearly what analog forestry is, including its advantages and disadvantages, and what would be expected from them as participants, so that they can make informed choices on whether to join an analog forestry group or not.

The analog forestry groups should decide among its members who will represent the group (the head and vice-head), the roles of the different members, the sharing mechanisms for both responsibilities and benefits, and how the group will operate.

In Counterpart's Forest Garden Project area there were three common situations to consider during the formation of analog forestry groups:

1. Areas of natural or degraded forest located at more than one hour walking distance from residential areas (unallocated lands)

Degraded forest lands relatively far from residential areas cannot be effectively managed by individual households. Therefore the project promoted establishment of analog forestry groups to manage these lands. Forestland would be allocated to the group with benefits and responsibilities to be shared among its members. If an area of natural forest was too large to be managed by one group, it was divided into smaller units and managed by several groups. It is recommended to use ecological features as much as possible to demarcate smaller areas within a zone since the establishment and management of areas with arbitrary boundaries based upon surveys or other methods is very complicated and time consuming. Participation in analog forestry groups is on voluntary basis, with the participants being those people that are interested in achieving the results outlined in the community land use plan. In general the land use option for these types of land includes forest protection and management with some enrichment planting. Expected outputs are mainly timber, fuel wood and other NTFPs.

2. Barren land or degraded forest located near residential areas (unallocated lands)

Here the forestland is at an earlier seral stage but physically located closer to residential areas. These lands would be allocated to individual households rather than to groups. The land use options here include forest development which is more input intensive than in the first case, but also capable of producing more products and/or products with higher value. Individuals come together and form groups to implement the community land use plan, but work on individual basis. The planning processes are all carried out by the group, but the actual implementation of the plan on the site is carried out individually. Participation in the groups is voluntary but a requirement is that they work as a group towards the same objective and implement the plans as developed by the group.

3. Dry land areas that are used for the cultivation of crops but which give low economic returns (allocated lands)

In areas where land has already been allocated to individual households, the formation of analog forestry groups is useful to increase management efficiency and to maximize the area under analog forestry in order to realize the ecological functions that are part of the analog forestry concept. Individual farmers often have several scattered parcels of land, rather than one large parcel. Bringing such individuals together as a group, for common management of adjacent lands can increase the effectiveness of analog forestry interventions. Analog forestry interventions are especially useful to build up the soil in locations where extensive monocropping has exhausted the soil and profits have become low or even negative.

Step 4: Resource assessment

The resource assessment for any management zone should be carried out by the analog forestry group that will be managing the zone. A first assessment should include preparing a description of the existing vegetation using the formula process described in step 1. The description should include the seral stage, a description of the soils (see box 1), slope, dominant plant species, desirable plant species (for timber, NTFPs and other uses), current management practices and major management problems. If needed, vertical and horizontal perspectives can be used to visualize the current status of the vegetation (see also step 1). This information is obtained through visiting and walking around the sites in the field. The members of the analog forestry group discuss if they all agree with the assessments and make any corrections justifiable.

When the vegetation is at a low seral stage there is no need to spend a lot of effort and resources in making sample plots and detailed resource assessments. Discussions with the group about the availability of existing socio-economically valuable species (for timber, fuel wood, medicinal plants, small timber for construction and or tools, rattan, etc.), will provide enough detail for making detailed analog forestry plans.

If the forest is more complex and at a higher seral stage, it is recommended to carry out resource assessments using sample plots and describe the existing vegetation and other features in more detail.[9] The analog forestry plan should make use of the existing vegetation and socio-economically valuable species for future plans for the plot.

Box 1: Soil profile descriptions

Examining the soil profile will help to describe the soil. A soil profile is a description or overview of the different horizons of the soil. These may include an A horizon which is the top soil that contains the most humus and nutrients and is the most important component for soil fertility. The B horizon is the zone often below the A horizon wherein clay, aluminum or organic compounds accumulate through leaching, which has some nutrients but not as much as the top soil. The C horizon is a layer of unconsolidated soil parent material, weathered rock and stone, which is the mineral soil and has little ability to hold nutrients and has very little potential for providing tree nutrients.

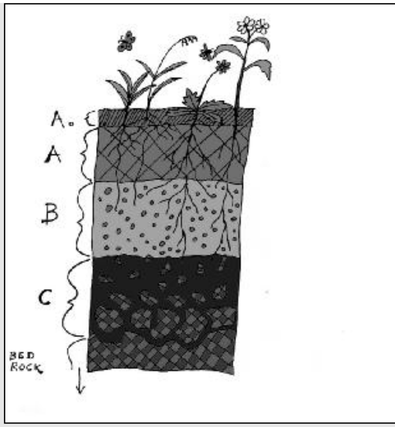

Illustration: Greg Blake

The description of the soil focuses on the A and B horizon as in the following example:

Depth: Depth of the A1 (the humus accumulation layer), A and B horizon in centimeters

Color: The color of a soil varies with its moisture content and physical state

Moisture: A soil can be dry, moist, wet or very wet

Texture: Soil texture is defined by the size distribution of primary mineral particles (2 mm diameter or less). The textural classes are determined by estimating the percentage of clay (less than 0.002 mm diameter) and sand (0.05 to < 2.0 mm diameter).

Percent of coarse fragments: Including percentages of gravel (diameter 2.0 - 7.5 cm), cobbles (diameter 7.5 to 25 cm) and stones and boulders (diameter> 25 cm)

[9] For the establishment of sample plots and forest resource assessments see also the Training Package in Community Forestry developed by GTZ/GFA, Hanoi, Vietnam in 2004.

Step 5: Visioning

An overall management goal or "vision" should be developed for each area or zone, based on the land use options defined in the community land use plan and the outcomes of the resource assessment. If the land use objective is to create a habitat of high biodiversity, for personal or ecotourism reasons, the vision should, for example, include increased diversity of supportive species around dwellings or target areas. If the objective is increased agricultural production in fields close to residential areas, agroforestry is a suitable vision. If the objective is increased income generation and forest management for a site that is located relatively far from residential areas, the vision might be a natural forest with enrichment plantings using economically valuable species. Analog forestry aims to increase the biodiversity and resilience of a landscape by making use of ecological processes but this does not mean that the whole landscape should be converted to forest.

The visioning in this step should be more detailed than is done during the community land use planning. The vision for the zone can be developed in part by answering questions such as how the zone should look like in 20 years' time. What should the formula be in 20 years? What products (species and quantity) are expected to be extracted from this zone in 20 years' time?

Information on the climax structure and different seral stages in similar ecological conditions (as collected in step 1) can help formulate the vision. It is also useful to use drawings to develop the vision for a certain zone.

For the example in Xuan Son community, the Forest Garden Project assisted residents to do a resource assessment and develop a vision. The resource assessment described the forest patch as shrub land with some valueless young pole-size trees, including a tree layer between 5 to 20 m in height, consisting of a light (6 to 25 %) cover of mainly evergreen species with some deciduous trees (no climbers or epiphytes occurring in this layer), and an undergrowth layer mainly of shrubs (50 to 75%) and some (6 to 25 %) wild ginger, bananas, and grasses as well as some ferns (1 to 6%). This forest patch was described with the following formula:

B6r,S5b; K3r,U3i, G2r,H2b

The vision developed for this forest patch seeks an eventual climax forest structure with four canopy layers, similar to what existed in the past. The vision includes a layer of broad leaf evergreen trees with a height of more than 35 m and a patchy (25 to 50%) cover. This layer will include some (6 to 25%) orchids, and other epiphytes. A second layer between 10 to 20 m high will cover about 50 % the forest patch and will consist of (6 to 25%) palms and (6-25 %) broad leaf evergreen trees, and climbers (6 to 25 %). The third layer, between 5 to 10 m in height, will cover about 30% and include bamboos, broad leaf evergreen trees and bananas. The lowest layer, between 0.1 to 2 m, which will cover the ground for about 50 %, and will include broad leaf evergreen seedlings, climbers, bananas, gingers and ferns. In short this vision is represented by the formula:

B8p,X7r; B6r,P6r,V6r; C5r; B5r,K5r; B3r,C3r,K3p,H2r,K2r

Based on the vision of the desired vegetation structure in 20 years' time, the goals and objectives can be formulated to further guide the selection of suitable analog forestry interventions.

Step 6: Database and selection of potential species

Mimicking a natural forest structure through the use of socio-economically valuable species requires a thorough knowledge of the various desirable species available, in order to select plants that will complement rather than compete with each other. A plant species database with relevant information about plants as well as animals can assist in the identification and selection of suitable plants for use in the forest garden. In addition to being a tool for designing analog forestry interventions the database also brings together information, from community itself, about plants and animals that are not formalized or found in publications. The database will also give the community a sense of ownership in the project design and demonstrate to them how local knowledge and current scientific knowledge can be brought together for better planning.

The database used by Counterpart's Forest Garden project contains the following fields for each species entered - name (scientific and local names), life form, height, canopy crown (heavy, medium, light), root system (fibrous, taproot, buttresses), root action (influence of the roots on the soil), nitrogen fixation, use purpose, trophic relations (animals that use the plant for food including primary consumers that eat the plant, and secondary consumers that eat insects and animals attracted to the plant, microhabitat (name of plant/ animals that use the plant as shelter or support), required living environment (soil depth, soil fertility, soil humidity, humus content, light/shade), growth rate, propagation, flowering season and fruiting season.

The above database was developed using Microsoft Access, and is available upon request from Counterpart. A database however can be simple or complex depending on actual need. A database is developed with the aim to provide a tool for identifying or selecting appropriate species that can be used for analog forestry planning. Naturally a database will never be completed as new species will need to be added, while information about species already entered may be modified and updated as new insights and information become available.

Meetings should be held at the communities to assess and analyze the existing database to determine species of interest that can be planted in the area. The information in the database should be verified with the community. After potential species are selected and incorporated in the database, the addition of species to the database should be discussed. Things to be considered include other species that would be suitable for analog forestry and what we know about these species. Species identified for possible use in the analog forestry system in the community are not necessarily the species that will be planted in the zones. The actual species to be planted depends on the decision of the user groups and the details developed in the analog forestry plan for the site (see next step).

Step 7: Development of an initial analog forestry plan

The analog forestry plan for each zone is developed based on the outcomes of the resource assessment, the vision developed and information available from the database. The development of the plan consists of three sub-steps related to the selection of species, soil improvement and management activities.

Selection of species

The selection of suitable plant species for analog forestry depends on the vision developed and the actual situation. If a vision is developed that in the future ultimately results in a complicated forest structure, while the current situation is still in the first seral stages, the easiest way to start designing the plan is by listing the potential species to be used by life form and seral stage, drawing on the information in the database.

After candidate species have been listed by life form and seral stage, their individual characteristics need to be analyzed in order to determine if they can be grown together and will complement each other, or if there are serious incompatibility issues. Information useful for analyzing species characteristics can be found in the database. After reviewing the species characteristics, some species may have to be rejected because of incompatibility or other issues.

Many farmers live in poverty and must seek short-term benefits. They often can not afford the luxury of waiting for long-term returns from products such as timber especially from slower growing indigenous tree species such as "ironwood" (Erythrophloeum fordii, "lim" in Vietnamese), or "chittagong wood" (Chukrasia tabularis, "lat hoa" in Vietnamese).

However, timber of indigenous tree species are usually very valuable and planting such species is a good way to build up capital over the long-term and to ensure the availability of good quality timber for house construction or other purposes for future generations.

The soil is the foundation for plant growth. When the soil is degraded the ability of plants to grow is diminished. If the resource assessment reveals that the soil is poor, measures should be taken that can speed up soil improvement. As described in the section on basic principles of analog forestry, the soil will naturally develop with the progression of the ecological succession stages, but several measures can be taken to speed up the process. Management techniques that use organic matter to contribute to soil improvement include mulching, use of green manure and the planting of hedgerows on contour lines (see the descriptions in box 2).[10]

[10] There are many publications about mulching, green manuring and hedgerows. See for example the Sustainable Agriculture Extension Manual for Eastern and Southern Africa (1998) on www.iirr.org/saem/page 147-152.htm and the website of the online information service for non chemical pest management: www.oisat.org. Another interesting reference in this respect is T. Dierolf, T.H. Fairhust and E.W. Mutert, 2000. Soil fertility kit: a tool kit for acid upland soil fertility management in Southern Asia.

Box 2: Mulching, green manure and hedgerows

Mulching

Mulch is vegetative material, for example straw, hay, rice husks, leaves and saw dust, that is used to cover and protect the soil. Mulch helps to: (1) reduce evaporation and retain moisture; (2) provide plant nutrients as the material decomposes; (3) controlerosion by reducing the impacts of raindrops and by slowing runoff; (4) control weeds through shading; (5) prevent pest outbreaks by acting as a barrier and by providing home to earthworms and other natural enemies; and (6) maintain a more even temperature in the soil. However mulching is very labor intensive, can introduce new pests (slugs, snails and mice) into the field, and materials suitable for mulching might not be readily available.

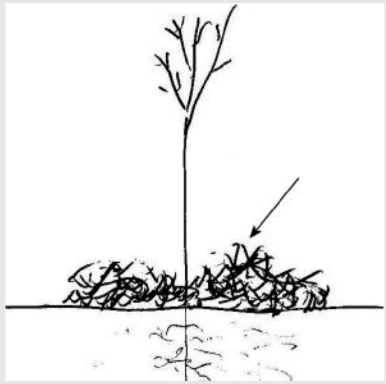

Illustration: LeRoy Duvall

Green manures are fast growing plants that are planted to improve the soil fertility and protect the soil from erosion. The plants are slashed and incorporated into the soil when they are green or soon after they flower. Examples of suitable green manure crops are mustard, sweet potato, peanut, and clover, among others. Green manure helps to: (1) improve the soil fertility; (2) improve the soil structure; (3) control erosion by reducing the impact of raindrops and by slowing run-off; (4) control weeds through shading; (5) control insects, mites, nematodes and diseases and promotes a habitat for natural enemies of other pests. Compared to mulching, green manure require less labor and are cheaper to plant and easy to manage. However, there are risks with greenmanures. Some green manures might compete with the existing crops, while may become weeds if allowed to grow long enough to set and release seed and thus becoming competition for the crops in the following seasons. Still, some green manures might attract new pests and diseases. Green manures therefore should be carefully reviewed and selected.

Hedgerows are bands or rows of shrubs or other perennial plants that are planted along the contour on sloping land to reduce soil loss by erosion. Hedgerows help to: (1) control erosion; (2) increase the organic matter content of the soil through its leaf litter; (3) reduce the risk of wind damage; (4) reduce the risk of pest outbreaks by providing an environment for natural enemies of many common pests. However, hedgerows do take up space that could otherwise be used for agriculture and might harbor pests. Hedgerow species that might compete with other crops should be avoided.

Photo: LeRoy Duvall

One consideration that should be taken into account when trying to build up the organic matter of the soil through the incorporation of organic matter is the Carbon - Nitrogen Ratio (see box 3).[11] The use of organic matter to increase soil fertility is preferable to the use of chemical fertilizers. Mulching, green manuring and hedgerows build on the ecological capacity of the natural environment, have a positive effect on soil structure and fertility, and enhance natural relations as they can provide for suitable habitats for natural enemies of pests.

[11] Text about the C:N ratio is mainly derived from D. Cowan. Measure and manage, building soil organic matter. http://www.agtest.com/articles/building.htm

Carbon and nitrogen are essential nutrients for plant growth. Organic matter in the soil serves as a resource base for these and other nutrients, which are slowly released back into the soil and made available to plants. Organic matter also protects the soil and regulates soil temperature and humidity. However it is difficult to build up the organic content of the soil because added carbon is consumed by soil microbes and lost through respiration. When using mulch, crop residues or green manures to build up the organic matter content of the soil, one very important factor is the Carbon Nitrogen (C:N) ratio. The ratio of carbon to nitrogen in the organic matter determines the availability of nitrogen to plants, another key plant nutrient. Low C:N ratios have nitrogen available for plants; high C:N ratios result in the nitrogen being immobilized (made unavailable) through biological processes. Thus when organic materials with high C:N ratios such as sawdust (C:N - 200:1) or fresh tree leaves (C:N - 90:1) are applied to the soil the planted crop may experience a nitrogen shortage. The soil organisms break down and consume the carbon, but in the process they need the nitrogen to multiply. By using organic materials with lower C:N ratios in the range of 20:1, nitrogen is more readily available and a more favorable nutrient balance is maintained for subsequent crop production. C:N ratios of greater than 40:1 may limit nitrogen availability to crops. To be safe, ratios of 20:1 are relatively stable and cause few problems with nitrogen availability. On a dry weight basis, the ideal ratio is 30:1 (anywhere from 25 - 35:1). Organic materials that have a C:N ratio of less than 20:1 include poultry manure (10:1), early cut alfalfa (13:1) and cow manure with low straw content (17:1). Dry, coarse materials such as straw, wood chips, etc. are high in C and low in N and “green” materials such as grass clippings, fresh plant material, kitchen scraps and manures, are high in N and lower in C. Visually, when making a compost pile, it is recommened that the volume of brown to green materials is eyeballed at about 50/50.

Establishing analog forestry and forest gardens is especially time consuming in the first years. Detailed work plans should be made to schedule activities for soil improvement, planting (new species and enrichment planting), and other management activities such as clearance of undesirable species, weeding, pruning, thinning, and protection. After the initial two or three years, the forest garden will become less labor intensive as it becomes more and more self-maintaining.

Step 8: Nurseries, seed storage and arboretum

One of the potential drawbacks of analog forestry could be limited availability of seeds and seedlings for the species desired for planting. Some species are readily available in existing private nurseries or state forest enterprises, while others may not. Seedlings of some species might be transplanted from the wild to the selected site, if only small quantities are needed of that particular species. Other species that are in greater demand should be grown in nurseries. Seeds for these species can be collected from the natural forest during the seeding season, if available.

Before establishing nurseries, the seedling demands for the community should be assessed to ensure that the correct quantities and species are produced. Nurseries also provide a site for experiments, such as propagation techniques for new species (cuttings, seeds, grafting, etc.) and trials with new trees and other NTFP species such as rattan, bamboo and medicinal plants. A simple nursery can be made with locally available materials and black plastic netting to provide cover to protect the seedlings from direct sunlight and wind. The actual shading requirements depend on the individual species, some are very light tolerant (pioneer species) while other species need heavy shade and protection (climax species).[12]

A seed storage facility could also be constructed to ensure the availability of seeds for the nursery. It is important to know the seed viability of different species as well as how to properly prepare, store and propagate the seed. Seeds of some species, such as agarwood, loose their viability within two weeks of being collected, while other seeds can be stored for a long time. Seeds of some species such as durian, mangosteen and rambutan should be planted fresh after the pulp is removed. Proper preparation of other seeds may include thorough cleaning and removing all fleshy material, drying and placing them in sealed containers in a dry and cool place.[13]

An arboretum or demonstration site can be established, both for demonstration purposes as well as to provide a source for seeds and seedlings. The best location for an arboretum would be near the nursery and close to the residential area in the community. The arboretum should contain different life forms, including trees as well as other plants such as climbers, orchids, rattans and bamboo. Once established, an arboretum can be used to show the structure and function of different species to the community and other interested people in analog forestry.

As part of the planning process, community and participants should discuss and agree on nurseries, seed storage facilities, the desirability of establishing a demonstration site or arboretum. Issues to be covered should include agreeing on where such facilities will be located, whether they will be group or individual household activities, who will be responsible for their establishment and maintenance, what benefits will go to the people, who will do these tasks, as well as what the long-term land use rights and

[12] For the establishment of nurseries in Vietnam see for example: Kuchelmeister, G. and Le Quoc Huy (eds), 2005. Vietnamese-German Financial Cooperation Smallholder Forestry Project. Training Manual, volume 1.

[13] For the establishment of seed storage facilities, see for example the Seed storage manual for small facilities developed by the Hawaii Conservation Alliance in 2001. This manual focuses on seed storage practices for native Hawaiian plants but can easily be adapted to the conditions in Vietnam. See http://www.hawaii.edu/scb/docs/science/seed/seedmanual.html

responsibilities will be, and of course what species and quantities of seedlings will be produced and how they will be distributed. Agreement on these items will reduce future conflicts. An advantage of group ownership for nurseries, arboretums and demonstration sites is the chance to provide the community with a greater sense of ownership.

Step 9: Implementation of initial analog forestry plans and follow-up

After all the preceding steps have been completed, the analog forestry plan can be implemented in the field as developed step 7. If new ideas come up that were not in the initial plan, any adjustments should be recorded, especially for the arboretum and demonstration sites in order to see whether the plan is successful (see also step 10).

Once the plants for the initial plan become established, the forest garden becomes less labor intensive as the garden matures and becomes self-maintaining. The forest garden and can fertilize, pollinate, suppress weeds and resists pests and diseases mostly by itself. Maintenance activities will then consist mainly of pruning and controlling any encroachment by plants on each other.

Step 10: Monitoring and evaluation

Monitoring and evaluation seeks to identify difficulties, solutions and best practices. Monitoring is the systematic and ongoing collection of information over time which can be used to assess the progress made. Monitoring is important to assess whether the analog forestry plan is implemented as planned and to assess whether the analog forestry interventions will lead to the desired results.

Monitoring can help identify difficulties at an early stage, so the strategies and activities can be adjusted to reduce problems and avoid later failures. Monitoring can also help to identify solutions and best practices, this is important if the intervention is to be replicated elsewhere.

There are different levels of monitoring. Compliance monitoring is needed to assess whether all the planned activities are being carried out properly. Impact monitoring is needed to assess if the implemented activities will or have led to foreseen as well as unforeseen impacts, such as soil improvement, increased incomes and increased biodiversity. Relevant impact indicators for analog forestry systems can for example include:

- The reappearance of keystone flora or fauna species recorded in step 1 describing the climax stage of a forest
- The presence and development of a humus layer
- The growth rate and crop productivity of several species
- Increased economic returns
- Development of the seral stages

For each zone, relevant impact indicators should be identified based on the analog forestry plan and the developed vision.

An evaluation is an assessment of progress and achievements made. In the context of analog forestry, an evaluation looks at the background, objectives for the analog forestry zone, results achieved in the zone, and activities implemented in the zone with the goal to draw lessons that may guide future interventions to become more effective and efficient.

Markets and marketing

By growing new species or varieties, the analog forestry farmer may be able to access or create new market opportunities. As the initial volume of the new products will be small, the risks to the farmer in marketing such products will also be small.

The new and emerging markets for organic, ecological friendly and fair trade products may create opportunities for adding value through certification or labeling of products from analog forest farms. The possibility of higher premiums paid for products in these markets may provide an incentive for wholesalers and exporters to seek out the products from analog forestry farmers. In Sri Lanka products from analog forests are certified and labeled as "Forest Garden Products." The price obtained by farmers growing these products through analog forestry is much higher than the price obtained by farmers growing the same agricultural products conventionally with chemical fertilizers and chemical pesticides. For example the price for conventionally produced Kitul Palm Syrup is US $ 1.00 in Sri Lanka while forest garden certified products sell for US $ 2.00 locally and US $ 3.50 in Europe. Similarly the price for conventionally grown Guarana in Brazil is now US $ 18.00 a kilo while the certified product is exported at US $ 35.00 a kilo.[14]

[14] All figures quoted were prevailing in June 2005

The goal of certification is to improve the environmental, social and economic aspects of natural resource management by ensuring market access for responsibly produced products. There are several certification schemes that are relevant to analog forestry, including:[15]

- Forest management certification
- Social certification
- Organic certification and
- Product quality certification

Forest management certification mainly assesses the ecological aspects of resource management, including both the forest as a whole and the species or product being produced. Some programs and organizations, such as the Forest Stewardship Council (FSC), have developed specific guidelines for the certification of wood and NTFPs.[16]

Social certification, such as Fair Trade products, assures that labor conditions are acceptable and benefits are shared equitably among those involved in the production and trade.

Organic certification verifies that the products are grown without the use of chemical fertilizers and pesticides. The "International Foundation of Organic Agricultural Movements" (IFOAM) unites more than 750 member organizations from 108 countries and provides a market guarantee, "the Organic Guarantee System" (OGS) which includes a common system of standards, verification and market identity.[17]

Product quality certification aims at ensuring that certain defined production standards are followed. These standards can focus on the product itself as well as on the manufacturing process.

There are also a number of certification guidelines that combine the different schemes mentioned above. An example is the World Health Organization (WHO) guidelines on Good Agricultural and Collection Practices (GACP) for medicinal plants.[18] Another is the certification of Analog Forestry Products in Sri Lanka where products from forest gardens are certified and labeled. This guarantees the buyer that the product is derived from a forest garden, that it is an organic product and increases incomes for local farmers, increases forest cover and biodiversity.

In Vietnam, certification is still in its initial stages. There are some pilot projects dealing with forest management certification under the FSC guidelines in Gia Lai Province. Hanoi Organics sells organically produced agricultural products grown in the vicinity of Hanoi that were formerly certified by ACT (a Thai certification organization for organic agricultural products accredited by IFOAM two years ago). Hanoi

[15] S. Walter, 2002. Certification and benefit-sharing mechanisms in the field of non-wood forest products-an overview. Medicinal Plant Conservation, Volume 8, Newsletter of the IUCN Species Survival Commission, Medicinal Plant Specialist Group, Bonn

[16] The Forest Stewardship Council - www.fsc.org

[17] See also their homepage http://www.ifoam.org

[18] WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants, World Health Organization, 2003.

CERTIFIED FOREST GARDEN PRODUCTS.

for health and bio-diversity

The logo depicts a Hummingbird (Spingid) moth feeding on a Musa flower. Hummingbird moths (Spingidae) are found in all rain-forest environments. They disappear with forest destruction, but return when habitat has been re-established. Musa sp. (Musaceae) belongs to a genus of plants that is found in all rain-forests and re-establishes the rain-forest environment rapidly.

Figure 8. Logo of certified forest garden products

Organics subsequently decided to stop certifying its products because of the relatively high cost of certification and because certification was felt to be unnecessary as their customers now know the origin of the product and trust the organization.[19] The Swiss Import Promotion Programme and the UNCTAD BioTrade Initiative are also starting a program in Vietnam to support the sustainable use of biodiversity and the trade of products derived from medicinal plants to markets in Europe, produced and marketed in accordance with the WHO's GACP guidelines.

Product certification is expensive and requires an organizational structure and trained staff to set up a successful certification program. It remains to be seen if certification is feasible for poor farmers living in remote areas, unless they receive extensive support in establishing marketing linkages for certified products. For local farmers the strongest and possibly only reason to produce certified products is to get a better price for their organic agricultural and forestry products. This requires consumers who are concerned about the environment and the potentially high levels of pesticide and fertilizer residues in conventionally produced agricultural and forest products. Certification may not be necessary for local marketing as local consumers know the origin of the products and possibly know the analog forestry farmers as well.

[19] Koen den Braber, Personal Communication June 2005.

The role of extension workers, project staff and the community

Analog forestry is a methodology and tool to conserve and sustainably use biodiversity and improve the resilience of the landscape and improve sustainable livelihoods. The application of analog forestry is complex and requires a high level of understanding of plant and animal species, the ecological functions and succession of forests and the landscape. Therefore the extension worker and project staff should play the role of facilitators, meaning that they should promote communication between farmers and extension workers, and between farmers to exchange information, resolve problems and encourage people to participate.

The facilitator should moderate group discussions and ensure that disadvantaged, groups such as the poor and the women in the community, can express their ideas, and that their opinions are considered and taken seriously by others. The facilitator furthermore mediates conflicts, contributes technical knowledge and never imposes his or her knowledge on the group. He or she offers technical solutions for consideration, as a contribution to the learning process, and moderates discussions on how the technical know-how can be applied. The personal attitude of a facilitator should always be positive and respectful towards local farmers. Facilitators should be interested in the local experiences of farmers, give positive and helpful feedback, and should create an atmosphere of trust and openness in which people are willing to share information and cooperate with each other.

The implementation of the 10 analog forestry steps as described in this handbook includes several community meetings and analog forestry group meetings. The project staff and extension workers should initially help to organize these meetings and ensure that all the needed documents and materials are available during the meetings. The project staff and extension worker can also help organize the initial group meetings. Once the analog forestry plan has been developed and agreed upon by the participants, the analog forestry groups should be able to organize their own meetings for further cooperation and implementation of the plan.

The ultimate goal of analog forestry in a landscape, namely to build up its resilience and increase its biodiversity, can only be achieved if analog forestry is applied at a larger scale. Therefore the extension workers and project staff should aim to integrate analog forestry in commune and district planning in order to enhance the positive effects of analog forestry.

The roles of the community members are to actively contribute and participate during the process to develop analog forestry. This includes active participation in meetings and to apply analog forestry activities in their fields according to the analog forestry management plans as developed (including the establishment of nurseries, seed storage facilities, ect.). Project staff and extension workers should not take it upon themselves to establish ananalog forestry model for the community nor participate in the actual field implementation, other than to offer technical guidance. For example, project staff should not be planting the trees for the farmers in their fields. The ownership and responsibilities should be left to the community while the project staff and extension workers have a facilitating and supporting role.

Monitoring and evaluation should be done by the community, extension workers and project staff. Monitoring by the community includes assessing whether analog forestry is a suitable tool for them to increase their livelihoods in a sustainable manner, and if the proposed activities were carried out as planned. Monitoring by project staff and extension workers should be more focused on impact monitoring, to assess whether the intended impacts, such as increased biodiversity, ecosystem resilience and increased productivity, were realized within the expected time frame.

Counterpart International
Website: www.counterpart.org
Email: info@counterpart.org