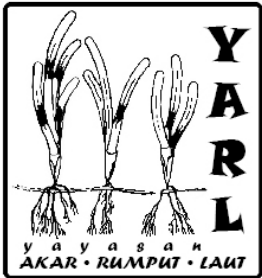
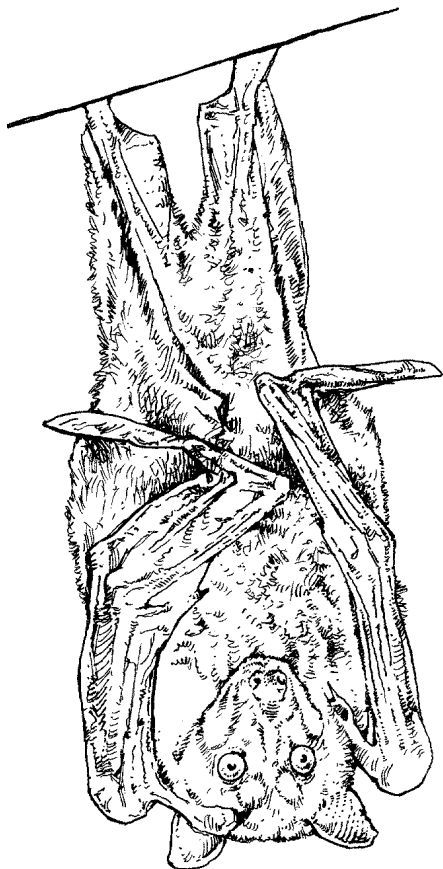


Five Steps To...



...Successful Ecological Restoration of Mangroves



this manual was put together mostly in the wee hours of night by
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and small whose lives are entwined with the
fate of the mangroves.



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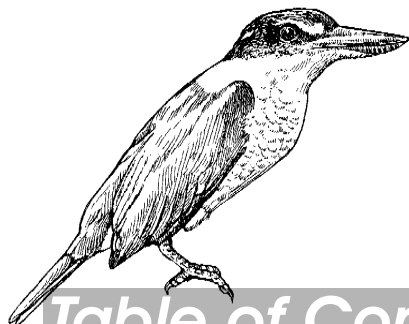


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Introduction

Restoration and rehabilitation* of existing or former mangrove forest areas is extremely important today. In fact, given the importance of mangrove forest ecosystems, and the current threat to these coastal forests, this is an imperative. But actual planting of mangroves is rarely needed as mangroves annually produce hundreds or thousands of seeds or seedlings per tree, which under the proper hydrologic conditions can recolonize former mangrove areas (returned to normal hydrology) very rapidly.

There are many different techniques and methods utilized in restoring mangroves. Because some of these have resulted in identifiable successes or failures, we wish to present herein a summary description of several preferred methods for planning and implementing mangrove rehabilitation.

In summary, five critical steps are necessary to achieve successful mangrove restoration:

1. Understand the autecology (individual species ecology) of the mangrove species at the site; in particular the patterns of reproduction, propagule distribution, and successful seedling establishment.
2. Understand the normal hydrologic patterns that control the distribution and successful establishment and growth of targeted mangrove species.
3. Assess modifications of the original mangrove environment that currently prevent natural secondary succession (recovery after damage).
4. Design the restoration program to restore appropriate hydrology and, if possible, utilize natural volunteer mangrove propagule recruitment for plant establishment.
5. Only utilize actual planting of propagules, collected seedlings, or cultivated seedlings after determining (through steps a-d) that natural recruitment will not provide the quantity of successfully established seedlings, rate of stabilization, or rate of growth of saplings established as objectives for the restoration project (Lewis and Marshall 1997).

This manual provides an illustration of these five important steps, in order to make the methodology accessible to a wider range of coastal resource managers and mangrove restoration practitioners. It should be noted that this is not a comprehensive guide to mangrove restoration. For a fuller understanding and a more certain approach to restoration, the reader should research more thoroughly this subject, and consult more directly with those who are experienced experts in hands-on restoration techniques (see resources section at the end of this booklet). The techniques outlined herein are only a basic guide, and should be tailored to each unique situation and coastal region where restoration is being attempted.

It should also be made clear that **restoring** mangroves is only a partial solution. **Protection** of those precious remaining mangrove ecosystems must become an imperative for all nations, before too much is lost, and our restoration efforts are in vain.

- Mangrove Action Project Restoration Team, 2005

**The terms restoration and rehabilitation are used throughout this manual in the following way; The term "restoration" has been adopted to specifically mean any activity that aims to return system to a preexisting condition (whether or not this was pristine) (sensu Lewis 1990b), whereas the term "rehabilitation" is applied more generally and is used to denote any activity (including restoration and habitat creation) that aims to convert a degraded system to a stable alternative.*



Introduction

Involvement of the local community where mangrove rehabilitation is taking place is essential to the long term survival of the restored forest. This manual can not go into detail on the community organizing process, but will provide a few insights into ways that the community should be involved.

It may be best to think in terms of PAST, PRESENT and FUTURE when contemplating community involvement.

PAST - Why and how were the mangroves destroyed in the first place? What did the original mangrove forest look like? How did the community use the mangroves?



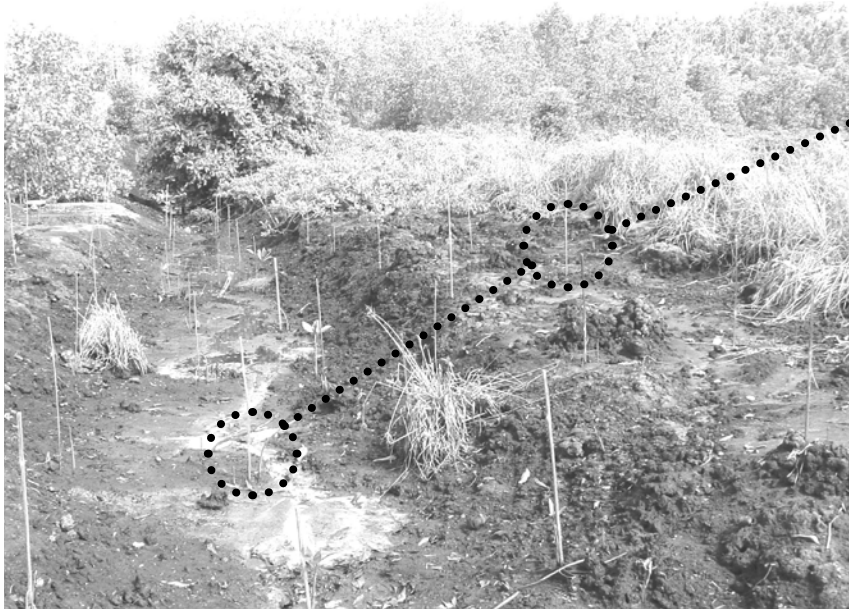
PRESENT - Who currently owns the land or has use rights to the land? Is the area currently productive? Who are the local actors interested in restoring the mangrove? What are the tidal levels of this region? Where does the water come from that feeds this mangrove area? How will we restore this mangrove area?

FUTURE - How will the community look after this mangrove once it is restored? What activities will be allowed/dis-allowed in the mangrove area? Who will enforce village regulations on mangrove protection and sustainable use? Is co-management with the government an option? How will you protect the mangroves from outside developers/investors?

technical failures

There have been many failed restoration projects over the years, invariably wasting both time and money. One case study from North Sulawesi, Indonesia shows that the government planted the same disused shrimp pond area 5 times over a period of 8 years. Seedlings were planted without regard to ecological requirements (substrate height, water flow, appropriate species selection) and resultantly died within a year after each planting (below). Nonetheless project money was continually made available for re-planting without addressing the cause of the failure.

Introduction



seedlings planted without regard to substrate height, both in ditches and on dike walls.

social failures

In Kwandang Bay, Gorontalo Province, Indonesia the Forestry Department paid the village leader and seven of his family members 5 cents a piece to raise 60,000 seedlings, and promised another 5 cents for planting when the seedlings matured. The second payment never came, and the seedlings remain to this day, rooted in the nursery. The community at large was never involved in the project.

Restoration Failures

Introduction

“Ecological restoration” has been defined by the Society for Ecological Restoration (SER, 2002) as the “process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed”.

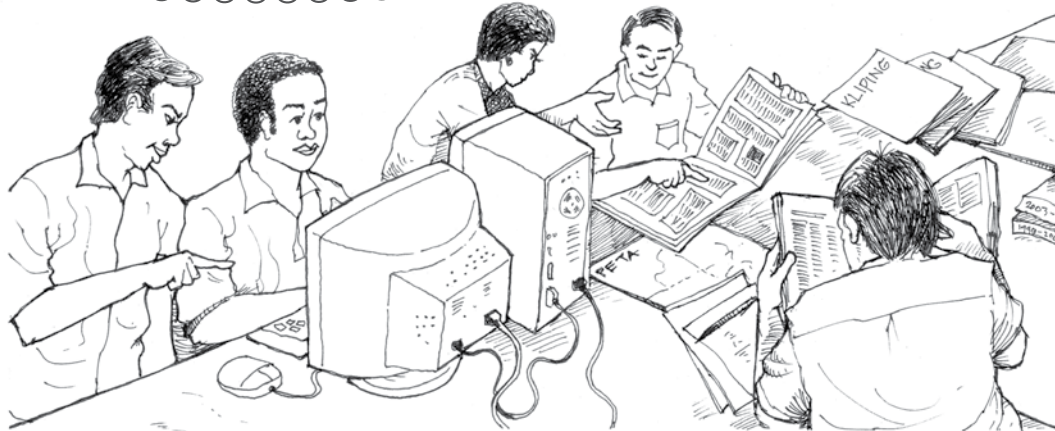
Restoration or rehabilitation may be recommended when an ecosystem has been altered to such an extent that it can no longer self-correct or self-renew. Under such conditions, ecosystem homeostasis has been permanently stopped and the normal processes of secondary succession (Clements, 1929) or natural recovery from damage are inhibited in some way.

This manual is going to highlight the importance of assessing the existing hydrology of natural extant mangrove ecosystems, and applying this knowledge to first protect existing mangroves, and second to achieve successful and cost-effective ecological restoration if needed.

Key Concepts

Some homework is needed in advance of starting to plan a mangrove restoration project.

Introduction



Examples of things to look into might include reading tide tables and measuring tidal levels. Look for literature about the mangroves of your area and if possible their distribution and tidal requirements. Can you find any recent or even historical aerial photos? Has anyone ever tried to restore mangroves in your area? If so, what were their successes and failures? Were there any lessons learned from these previous efforts?

Things You May Need:

- Map of location (scale 1:25,000)
- Forestry management map (scale 1:5000)
- Land use map
- Tide tables from nearest port
- Survey equipment such as compass, rope, stakes, notebook, measuring tape, GPS unit.

Do Your Homework