

# COSTS AND BENEFITS OF FOREST RESTORATION

## Costs

Costs can include both time and money.

### Time costs

Villagers must sacrifice time that could be spent on agriculture for meetings to set up restoration and administer it, including – regulation, dispute resolution, reporting, accounting and benefit-sharing.

### Financial costs

Financial costs can include legal/admin fees, survey costs (e.g. for baseline carbon, timber and NTFP's) and forest maintenance/ management costs, particularly fire prevention. Financial costs should also include the income forgone from *not* converting forest to agricultural land. Where forest is absent or severely degraded the cost of restoration must also be included.

## Benefits

Restoration forestry provides five categories of benefit: forest products, watershed services, carbon sinks, biodiversity conservation and opportunities for ecotourism.

### Products

At least 150 different forest products, including rattan, bamboo, nuts, essential oils and pharmaceuticals, traded internationally, contribute about US\$ 4.7 billion/year to the global economy. Products from restored forests can include foods (e.g. game, wild vegetables, mushrooms etc.), fuel-wood, medicines and household products (e.g. glues, resins, rubber, oils, fibres etc.). Many of these products are gathered by rural people and are often not bought or sold. Their value, therefore, is not included in economic indices such as GDP. However, it can be estimated in terms of the money that would have to be spent to replace these products, if they were not gathered from the wild. For example, indigenous people living in Sabah would have to spend \$40 million/year on meat, to replace the wild pig meat they obtain from hunting. Some products (e.g. fish and timber) are traded internationally and are therefore accounted for in the world's economy. Other products include new species of plants and animals domesticated and used for agriculture. Often nature provides ideas for new products, without providing the products directly. For example, many drugs, originally discovered in wild herbs, are now synthesised chemically. About 25% of the world's drugs originate from wild plants and animals

Harvesting of NTFP's should be carried out sustainably. This involves measure the standing crop and growth rate of the product, then ensuring that the annual harvest does not exceed the annual production. This is usually achieved by setting quotas and issuing permits. The total

harvest must be recorded, as well as the harvest effort (number of permits issued or time spent by the collectors). How the yield changes over time (quantity collected/effort) indicates if the resource is being under- or over-exploited - so that appropriate changes can be made in the number of permits issued. Often, the costs of administering such systems are higher than the value of the products collected.

Therefore, the trend is to bring NTFP's into cultivation. This can actually encourage forest clearance, to provide land to cultivate valuable former-forest products. The exception is mushrooms of mycorrhizal fungi that are totally dependent on forest trees as their hosts.

### **Watershed Services**

Deforestation increases water yield (as transpiration through tree crowns is reduced) but outflow becomes more seasonal. Tropical forests add enormous quantities of organic matter to soils, which increases their field capacity (gm water stored per gm dry soil). Such soils soak up water during the rainy season (reducing floods) and release it gradually during the dry season (reducing droughts). Deforestation exposes the soil to erosion and compaction. Absorptive top soil is rapidly lost. Infiltration is reduced and runoff increases, resulting in flash floods & landslides. Sedimentation of watercourses lowers their volume, resulting in higher floods. Blockage of irrigation systems lowers agricultural productivity.

### **Carbon Sinks**

Tropical forests (in general) absorb more CO<sub>2</sub> than they emit about 1.3 gigatonnes of carbon (GtC) per year (Lewis et al., 2009) – equivalent to 16.6% of carbon emissions from burning fossil fuels and the cement industry, and 60% of the sink provided by all of the terrestrial vegetation on Earth. The carbon sink size depends on the type of forest. Natural forests are 6 times better than agroforestry and 40 times better than plantations at storing carbon (Lewis et al., 2019).

Tropical forests store about 240 tC/ha in trees/soil - crop lands, about 80 tC/ha, mostly in soil. So, clearing 1 ha of tropical forest emits about 160 tC and also reduces subsequent sequestration rate. Agriculture also releases methane, which is 20 times more efficient at trapping heat than CO<sub>2</sub> is.

### **Carbon Credits**

Trading in carbon credits could turn the carbon storage potential of forest restoration projects into cash. Carbon dioxide is the most important greenhouse gas. Power stations that burn coal or oil release CO<sub>2</sub> into the atmosphere, while tropical forests absorb it. So, if a power company pays for forest restoration, they could continue to emit CO<sub>2</sub> without actually increasing the atmospheric CO<sub>2</sub> concentration. A company that buys carbon credits buys the right to emit a certain amount of CO<sub>2</sub>.

The money paid for those carbon credits could then be used to finance forest restoration thereby increasing the capacity of the global carbon sink. Carbon credits are traded, like stocks and shares. So, their prices can go up or down according to demand. There are two kinds:

- i) Compliance credits are bought by corporations and governments in order to meet their obligations under national; laws or international agreements, thereby offsetting some of the carbon they emit. The protocol's Clean Development Mechanism (CDM) channels the credited money into projects that absorb CO<sub>2</sub> or reduce emissions.
- ii) Voluntary credits are bought by individuals or organisations seeking to reduce their 'carbon footprints'.

The 'voluntary market' is much smaller than the compliance market and the credits are cheaper because the projects supported by it do not have to meet the stringent requirements of the CDM. At present, few forest restoration projects have been approved for support under the CDM, because it is difficult to measure the amount of carbon stored in forests, which have very variable growth rates and which could easily burn or become degraded. So, several obstacles must be overcome before compliance credits could generate income for forest restoration projects. The voluntary principle, however, is proving to be much more successful. All over the world, corporations are sponsoring tree planting, partly to off-set their carbon footprints, but also to promote a cleaner, greener image.

REDD+, stands for 'reducing emissions from deforestation and forest degradation'. This is a set of policies and incentives being developed under the UN Framework Convention on Climate Change (UNFCCC) to reduce CO<sub>2</sub> emissions derived from clearing and burning tropical forests. The concept was recently expanded to include the 'enhancement of carbon stocks', i.e. forest restoration to actually increase CO<sub>2</sub> absorption. This international framework provides approved funding and monitoring mechanisms for both forest conservation and forest restoration projects that enhance the net global forest 'sink' for CO<sub>2</sub>, while also conserving biodiversity and benefiting local people. Funding comes from both established carbon credit markets and specially created international funds. The success of REDD+ will depend on considerable improvements in forest governance, as well as capacity-building at all levels, from villagers to policy makers. Despite these challenges, several pilot REDD+ projects are already underway, which will provide valuable lessons for the future development of the program.

### **Biodiversity – values**

"Diversity" itself is difficult to monetarize. It can be viewed as the sum of the values of products/services from all species combined – with the added value of economic security. The latter arises from the fact that when harvesting a diversity range NTFP's (for example) villagers can switch from one product to another in response to fluctuating market prices. This is difficult or costly with conventional mono-culture plantations (e.g. converting from rubber to oil palm). Mono-culture plantations are therefore high-risk/low-security systems, whereas diverse forests offer lower risks and higher security.

Pollination is one of the few environmental services that results directly from diversity. Crops, grown near to forest, often have high yields and are of high quality, due to the presence of a diverse community of pollinating animal species that depend on forest habitats to complete their life cycles (Ricketts et al., 2004).

## Ecotourism

Ecotourism is another source of income that depends on the maintenance of biodiversity, provided that wildlife and scenery are the main attractions. Interactions between tourism and forests will be covered in detail in the next lecture.

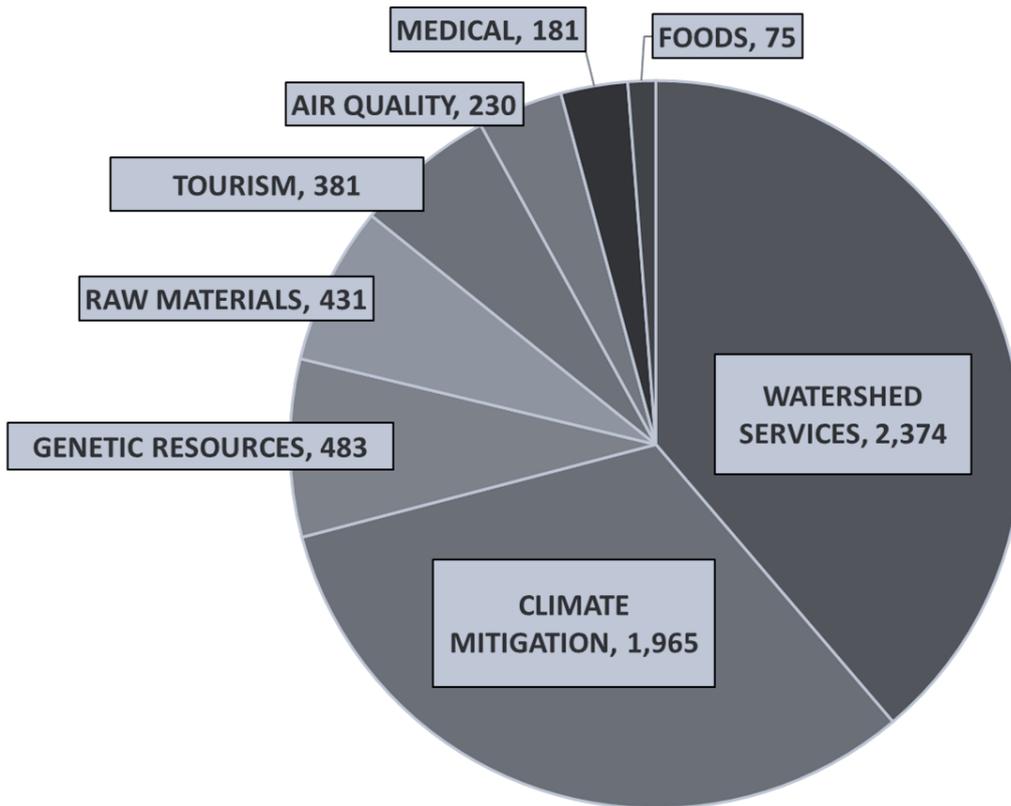
## Realizing total value

The value of all products and services combined, in 1 ha of intact tropical, exceeds 6,000 US\$/ha/y – about 10 times the income from 1 ha of oil palm in southern Thailand. But “value” is not the same as “income”. Converting value into income requires good governance (e.g. laws, tenure, institutes) that allows local people to access diverse income streams that could potentially flow from intact forest ecosystem, whilst simultaneously regulating for sustainable management. Access to venture capital is needed to start new businesses. Investment in human resources would also be needed – training and skills development to enable local people to produce novel products and services. Skilful marketing and advertising would also be needed, to persuade potential customers to buy new products and services and to pay for resources (e.g. flood prevention, water, carbon storage), which were formerly regarded as free or very low cost.

The economic elegance of restoration forestry is that it generates diverse income streams shared amongst diverse stake-holders. So, if the market price of one service/product falls, others can be developed to maintain profitability. Restoration forestry could well become a highly lucrative global industry. One day ... money really will grow on trees!

## Reading

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*Potential value of ecosystem products/services from 1 ha of tropical forest (US\$/y) exceeds 6,000US\$ (according to TEEB)*

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