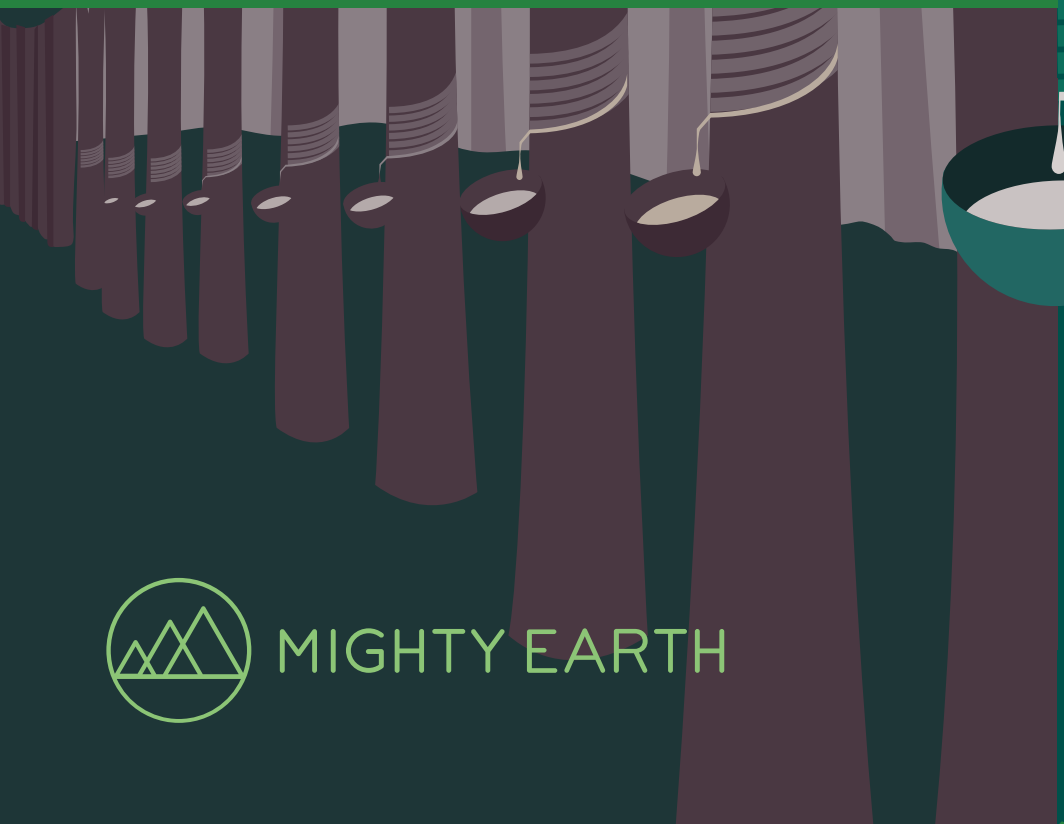
RUBBER AGROFORESTRY

FEASIBILITY AT SCALE

Report Summary



MIGHTY EARTH

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Rubber Agroforestry: Feasibility at Scale

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Overview

Agroforestry is a system of mixed farming involving the production of tree crops alongside other horticultural or agricultural crops, sometimes with livestock. In tropical landscapes, common tree crops found in agroforestry systems include coffee, cocoa, fruit trees, and *Hevea brasiliensis* – the tree from which natural rubber is derived.

This pamphlet summarizes the findings from a comprehensive, peer-reviewed report which analyzed rubber agroforestry systems compared with rubber monoculture plantations (farms where rubber trees are grown as the sole crop). The report, authored by a team of expert academics, and published by Mighty Earth in May 2021, considers the comparative benefits and disadvantages of both agroforestry and monoculture rubber systems with regards to rural livelihoods and food security, on-farm biodiversity, climate resilience, and the position of women and underrepresented groups in the rural economy.

All of these factors are especially important to consider given the current and future challenges facing rubber producers, processors and buyers. Climate change, rubber tree disease outbreaks, and a temporary slump in

A worker on a rubber plantation, Indonesia.

“Can agroforestry rubber provide a solution to the multiple economic, social and environmental challenges the rubber industry faces going forward?”

demand due to COVID-19 have placed even more pressure on an already unsustainable rubber industry.

The question is: can agroforestry provide a partial solution to the multiple economic, social and environmental challenges the rubber industry faces going forward – challenges that will become ever more pressing as demand for natural rubber grows in the future?

Natural Rubber Production: Monoculture versus agroforestry

MONOCULTURAL PRODUCTION

Natural rubber production continues to take up more and more land, mostly in Southeast Asia. Rubber is commonly cultivated as a monoculture, on farms that are planted solely with rubber trees, usually requiring the intensive use of agrochemicals. Some rubber is produced on large-scale plantations, but about 90% of natural rubber is produced

by smallholder farmers. These farmers are often strongly dependent on rubber tapping for their livelihoods, even though the income they receive from selling the latex tapped from rubber trees can be unstable. Although income from tapping rubber is key to many rural economies, there is mounting evidence of multiple social, economic and environmental risks and harms associated with monoculture rubber production, including:

- The widespread degradation of soils and freshwater resources
- Rampant deforestation, habitat loss, and ecosystem destruction
- Risks to rubber tree health from disease, drought, and frost which can leave farmers at a loss without other crops to eat or sell
- Vulnerability to increasing climate risks
- Threats to food and livelihood security of smallholder farmers due to fluctuations in the global rubber price

Rubber monoculture, Bangladesh

RUBBER AGROFORESTRY

Rubber agroforestry systems are dynamic and versatile, consisting of rubber trees as well as other plants and/or livestock. Mighty Earth's report on rubber agroforestry found that this practice of farming, as opposed to monoculture, is able to:

- Better support smallholder livelihoods
- Better support smallholder food security and nutrition
- Provide social advantages for smallholder farmers and rubber tappers
- Improve soil health and water quality, as well as creating other beneficial environmental, biodiversity and climate outcomes

There is currently no standard definition of the term "rubber agroforestry." Among stakeholders, definitions of "rubber agroforestry" contain two common themes: 1) a production system from which utility can be derived; and 2) the mixing of rubber trees with other plants/animals (i.e. not a monoculture). The following table provides a typology of the range of possible practices.

An agroforestry system intercropping rubber with cassava, Cambodia.

TABLE 1

RUBBER AGROFORESTRY PRACTICES AND SYSTEMS

TYPE	DESCRIPTION
Wild rubber (system)	Naturally occurring rubber trees in the Amazon. May not fit the definition of "agroforestry". At present, wild rubber extraction continues in some communities in the Amazon (including in Brazil, Peru and Bolivia) but is not a major source of latex production.
Traditional jungle rubber (system)	Rubber trees introduced into forests as part of swidden (i.e. slash and burn) agriculture, or via planting in thinned forest. Very extensive system with very limited management and chemical inputs. Typically uses unselected (low yielding) non-clonal rubber seedlings.
Modern jungle rubber (system)/Natural regrowth (practice)	Can be the result of an abandoned or unmanaged monoculture, or a choice by farmers to adopt low intensity of management. Harbors spontaneous/naturally regenerating wild species, which may be selected for their economic, medicinal, or cultural values.
Permanent intercropping (system)	Rubber trees inter-planted during or throughout the plantation cycle with one or more species with harvestable products, including food and non-food crops. A wide range of species can be used, including annuals (maize, pineapple), perennials (cocoa, coffee), fruit trees (mangosteen, orange), timber trees (teak, mahogany), palms, vegetables (*Gnetum* spp), spices (ginger, cardamom), and mushrooms.
Temporary/short-term intercropping and cover cropping (practice)	Light-demanding annuals/biannuals and leguminous cover crops (e.g. *Flemingia macrophylla*, *Mucuna* spp, *Senna* spp.) can be planted in the rubber plantation in the first few years of rubber establishment. Temporary intercropping with food crops is widely practiced in many countries. Cover cropping with nitrogen-fixing leguminous plants has long been promoted in plantation settings but scholars do not know the prevalence of adoption of this type of agroforestry, particularly regarding its use amongst smallholders.
Animal husbandry (practice)	Animal husbandry in a rubber plot, temporary or permanent, including larger livestock (e.g. cattle, sheep – less recommended), mini livestock (bees, rabbits), poultry and aquaculture.

INTEGRATING MULTIPLE CROPS

Rubber agroforestry can provide many benefits to farmers.

Rubber agroforesty is defined by the existence of multiple types of crops or livestock in one farm system, providing income and/or subsistence to farmers. These farms can be planned to best meet the needs of the climate, geography, and community.

A model agroforestry rubber forest garden, incorporating animal husbandry.

Kittitornkool, J *et al* (2019)

Key Findings: Agroforestry can improve social and environmental outcomes

BOLSTERING RURAL LIVELIHOODS

Research conducted for Mighty Earth has found strong evidence that rubber agroforestry systems can increase livelihood resilience for farmers, tappers, and rural communities. Temporary and permanent intercropping systems in rubber, as well as the integration of small-scale livestock farming, significantly contribute to smallholder income and income stability – especially in very poor households – based on studies conducted in Asia (Thailand, Sri Lanka, China, and the Philippines) and Africa (Cote d'Ivoire, Liberia, Nigeria and Gabon).

While yields can be complicated and context dependent, latex yields per rubber tree appear to be generally unaffected by intercropping practices. Intercropping can affect rubber tree growth (which affects commencement of tapping time), both positively and negatively depending on the intercrop and region. The shade from mature rubber, in turn, typically reduces intercrop yields but the introduction of banana in particular seems to benefit from being intercropped with rubber. Yield trade-offs may be balanced out by an overall gain when the yields from rubber and intercrops are combined, or by increasing the planting density of intercrops (e.g. by planting cinnamon or banana).

Agroforestry can also play a big part in improving household food and nutritional security, directly increasing the availability and diversity of foodstuffs by intercropping and/or integration of animal husbandry, or by increasing the cash income of farmers such that they can purchase the food they need. Other key livelihood outcomes of rubber agroforestry are increased farmer knowledge sharing, enhanced feelings of autonomy, and price premiums provided by buyers who see the benefits of agroforestry, all of which are cited by smallholder farmers as benefits to this type of farming.

"Rubber agroforestry systems can increase livelihood resilience for farmers, tappers, and rural communities."

Children play under sheets of rubber on their parents' plantation.
Credit: CC BY-NC-ND 2.0 IFPRI

IMPROVING SOCIAL OUTCOMES

Rubber agroforestry has been shown to improve some social outcomes including gender dynamics in relation to farm incomes and labor, as well as land tenure for smallholders.

Rubber agroforestry strategies can be tailored to local gender roles and cultural preferences to increase female interest and participation in agroforestry. Gender issues in agroforestry systems are important to consider, because in many societies women and men have distinct roles in local agricultural systems, for instance in land-use decision making, divisions in domestic, farm and off-farm labor, tree planting, and participation in rural value chains. In some countries, agroforestry involving permanent or long-lived crops, like rubber trees, can also improve land tenure security for smallholder farmers compared to annual crops alone, because tree planting facilitates claims of ownership and longer tenure durations by farmers.

SUPPORTING BIODIVERSITY AND HEALTHY ECOSYSTEMS

A substantial body of evidence clearly shows the benefits of permanent intercropping and jungle rubber agroforestry for enhanced on-farm biodiversity and soil health. Agroforestry systems consistently show higher soil carbon and soil nutrients, reduced water runoff and soil erosion, improved soil structure, increased water infiltration into soils, complementary water use between rubber and intercrops, reduced soil acidity, and enhanced soil microbial biodiversity. There is no evidence for nutrient competition between

Orangutans benefit from agroforestry.
Credit: CC BY-NC-ND 2.0 Mark Dumon

rubber trees and intercrops, meaning intercrops do not reduce nutrients important to producing latex growing rubber trees. Additionally, with agroforestry systems, there is the potential for reduced or zero chemical pesticides and herbicides, which means less negative impact on humans, environment and biodiversity.

Agroforestry supports and can maintain biodiversity by connecting natural habitat patches. There are examples of species from butterflies to orangutans benefitting from rubber agroforestry in various contexts globally, as well as cases where fewer invasive insects were present than in monocultures. Taken together, these improvements to health and the environment are significant draws for rubber agroforestry.

"Agroforestry can support biodiversity and protect habitats of critical species around the world."

STRENGTHENING CLIMATE RESILIENCY

The clearance of natural forests for rubber monocultures contributes to climate change. Climate change itself exposes the rubber supply chain, and broader society, to a multitude of risks and harms. When using agroforestry, it is possible that farmers can meet their needs with existing farmed land, rather than needing to clear more areas for new crops. Clearance of natural forest will always have a net negative impact on carbon emissions and climate change.

Aside from the implications of deforestation for climate change, global heating is already exacerbating existing risks facing rubber production, particularly in margin-

al areas. Smallholder rubber farmers from Thailand and the Philippines report concerns around climate change and consider agroforestry as an adaptation strategy, and there is some evidence that rubber agroforestry can buffer the effects of normal fluctuations in microclimate. It is important to remember that the benefits of agroforestry and the increased resiliency it can provide are in comparison to current rubber industry norms: monoculture plantations. Agroforestry is a solution for these already degraded lands—not a reason to clear more forests.

CASE STUDY: AGROFORESTRY FLOURISHES IN SOUTHERN THAILAND

Smallholder farmers in Southern Thailand have networked agroforestry practices that include peer-to-peer knowledge sharing and have improved livelihoods for smallholder farmers. These farmers reported various benefits from rubber agroforestry practices, including knowledge transfer, feelings of autonomy, and social benefits, for example, from harvesting edible species, like fruits, to give as gifts. These networks have also increased farmer knowledge about rubber processing and assessment of quality, enabling them to cut out middlemen in the supply chain and receive a price premium, in addition to enabling farmers to share knowledge and participate in research by universities about intercropping practices.

In Southern Thailand, various rubber agroforestry systems gave the same or greater returns to labor compared to monoculture, but some agroforestry systems gave lower returns to land. Farmers integrated livestock like cows, poultry, goats, and sheep into their agroforestry systems, with stingless bee-keeping an especially successful addition to their rubber holdings. They planted pepper, vegetables, fruits, and other crops to be sold on the market, eaten, or given as gifts. Rubber intercropping with fruit and timber trees gave the greatest returns to both land and labor in this case.

These rubber agroforest smallholder farmers have formed groups around common interests, which have facilitated the spread of agroforestry among peers as well as collaboration with researchers and industry. This case study exemplifies that while regional or case by case adjustments need to be made, peer-to-peer knowledge sharing can produce robust networks of farmers who readily adopt practices that support them, their families, and their environments.

Latex, Riau, Indonesia

Recommendations for wider adoption of agroforestry

Recommendations for agroforestry models and best practices need to be tailored to the diverse contexts in the places where rubber is grown to produce the best outcomes for rural livelihoods, household food and nutrition security, gender equity, and the environment. There is also a need for better dissemination of information about the benefits of agroforestry to local audiences - in particular, that there are no yield declines compared to monoculture systems.

GOVERNMENT POLICIES

To support agroforestry, government agencies and political decision-makers should:

- Actively promote rubber agroforestry as an alternative to monoculture plantations; both for current rubber producers, and where rubber is being introduced as a new crop on existing farmland.
- Deliver consistent policy and support interventions (e.g. subsidies, technical recommendations, and gender sensitive rural extension services) which favor agroforestry practices, and that encourage phased reductions in chemical fertilizer applications and herbicide spraying on rubber farms.
- Initiate progressive land rights and tenure reform policies that incentivize smallholders' investments in their farms, especially with regards to on-farm diversification.

Natural rubber-based tires.
Credit: CC BY-NC-ND 2.0 Alex Charraudeau

RUBBER INDUSTRY

To support agroforestry, industrial and large-estate plantations should

- Embrace additional indicators of sustainability around livelihoods, soils, water, biodiversity and climate resilience, whilst recognizing that low external chemical input rubber agroforestry systems can be a financially viable strategy towards sustainable production.
- Actively support rubber intercropping as part of smallholder out-grower schemes; e.g. by providing appropriate contracts, seeds and technical expertise, in consultation with rural households (especially women).
- Invest in research and development to identify cost-effective agroforestry practices.
- Trial low external input rubber agroforestry methods on a portion of their estates (e.g. when replanting older plantation areas), then replicate successful approaches more widely.
- Provide access to parts of the plantation for rubber workers or their families to intercrop.
- Plant riparian (stream/riverside) areas with a diversity of native and/or productive species.
- Utilize temporary intercropping between rubber rows during first three years of rubber establishment.

Rubber buyers, such as tire companies, should:

- Facilitate the adoption of agroforestry rubber by creating a demand for agroforestry rubber through procurement policies that include agroforestry-based rubber
- Provide a price premium for smallholders and industrial growers who implement agroforestry and other sustainable practices.

A farmer describes his agroforestry system in Hat Yai, Thailand.
Credit: Mighty Earth

NON-INDUSTRY ACTORS

Local and international researchers and civil society can support small-holder farmers by:

- Producing well-evidenced agroforestry knowledge
- Co-developing best practices with smallholder farmers and help to identify farmers' challenges
- Co-developing participatory research where possible, and sharing their research findings with rubber research institutes, civil society organizations (CSOs), community-based organizations (CBOs) and the farmer networks, associations and co-operatives they work with
- Uplifting smallholder farmer-produced and Indigenous knowledge by highlighting those in their work, as well as supporting farmer-to-farmer networks, co-ops and local grower associations.

Conclusions

To ensure a sustainable future all stake-holders in the rubber industry must make a cultural shift to agroforestry; from small-holders and rubber plantation companies, to the major tire brands (which buy the ma-jority of the world's natural rubber), to gov-ernment agencies, researchers, and CSOs. Input from industry actors is vital in terms of agroforestry value chain development, while input from male and female small-holder farmers on the ground is necessary to ensure an effective and equitable transi-tion from monocultures to diversified rub-ber cropping systems. The rewards of this transition will be a far more sustainable and resilient rubber sector for all. MAY, 2021