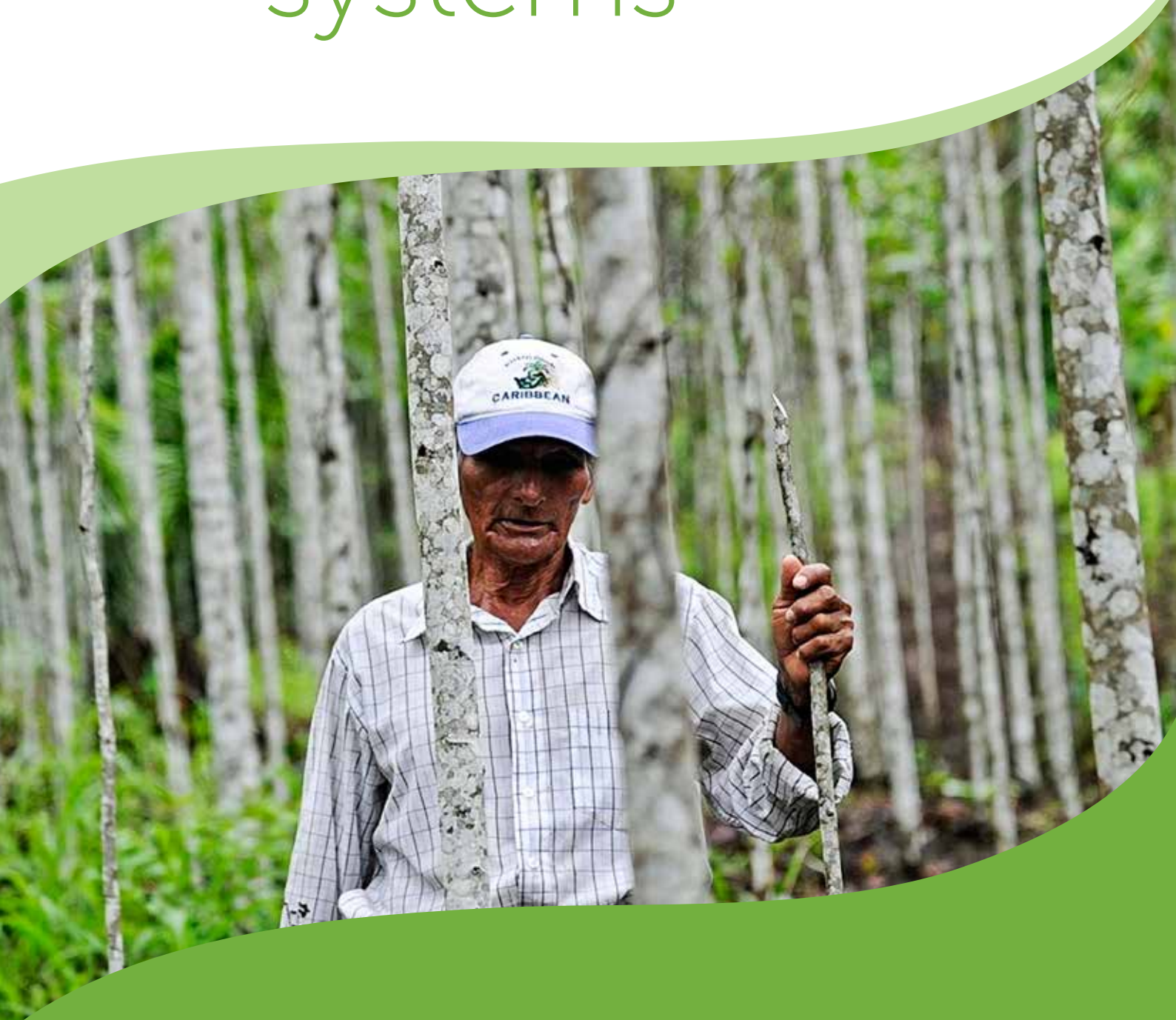




Livelihood systems



The extent and management of tree and forest cover on farms and across landscapes impacts the resilience, productivity and income of smallholders. This research theme harnesses the transformative power of trees, through developing and promoting innovations in management, markets and policies to reduce poverty, and increases the food and nutrition security of smallholders. Better tree management contributes to these livelihood goals while protecting the environment, enhancing natural capital and strengthening people's capacity to adapt to climate change.



RESEARCH
PROGRAM ON
Forests, Trees and
Agroforestry



How can trees enhance smallholder livelihoods?

The area of livelihoods is the starting point for this research theme because smallholders make decisions about how to manage farms, considering all their constraints and opportunities, including those unrelated to trees and forests. In addition to direct contributions to diet and income from timber, coffee, cocoa, rubber, oil palm, fruits, nuts and other products, much of the contribution that trees make is through system intensification, involving interactions with other livelihood components (Figure 1).

For example, on-farm tree fodder increases livestock productivity while reducing labor required for collection, freeing time for people to invest in other paths to intensification. Such knock-on effects of better tree management are important. They include trees restoring and maintaining soil health through fostering higher abundance and activity of beneficial soil organisms, as well as contributing to soil fertility through tightening nutrient and water cycles, improving nutrient and water use efficiency and thereby closing yield gaps of food crops.



FTA research on livelihood systems

This theme is organized in five clusters of research activity that address key questions, as follows.

Systems analysis, synthesis and scaling

How can key tipping points in adoption of forest and agroforestry innovations leading to transformation of livelihoods be determined for food security and poverty reduction outcomes? What tools and methods will most efficiently, effectively and equitably support the generation and selection of diverse and inclusive options that improve the use of trees and forests by smallholders and codevelopment

of principles for matching options to the fine-scale variation in context? How do contextual factors (biophysical and socioeconomic) affect the suitability of different types of innovations? How can new scientific evidence be most effectively curated to support policy development and negotiation among stakeholders to manage the impacts of land-use change on ecosystem service provision?

Production and marketing of food, fuel, timber and non-timber forest products (NTFPs)

How can barriers be removed to smallholders accessing markets for tree and forest products, allowing them to capture more of their value, especially for people who are socially or economically marginalized (including women and young people)? What types of products and markets

are most suitable and what interventions are most cost effective to realize these outcomes? How can smallholders profitably produce and market quality timber on a small scale? How do different approaches to forest management impact smallholder livelihoods at the forest margin?

Tree-crop commodities (cocoa, coffee, tea, oil palm and rubber)

FTA posits that the incorporation and management of companion trees in cocoa and coffee production systems, alongside appropriate fertilizer and pest control, can increase and sustain productivity of existing stands and buffer against climate change; that rubber and oil palm production systems can be made more sustainable through intercropping; and that smallholders can derive higher income from product sales through improved certification schemes and by exploiting specialist market niches, which lead to the following key research questions.

How can smallholder tree-crop commodity production systems be sustainably managed in the face of climate change, price volatility, declining yield and soil fertility following forest conversion, coupled with constraints on opening new forest areas, and those imposed by the dynamics of migration? What is required in terms of an enabling environment to switch from unsustainable monocultures to more diverse and resilient production practices?



Photo by Y. Nofriani/ICRAF/FTA

Trees on agricultural land supporting land restoration and sustainable intensification

What are the optimum levels of tree density and diversity in different contexts required to increase total factor productivity of smallholder livelihood systems while conferring resilience at farm and landscape scales? How can the desired tree density and diversity be most effectively promoted, given a widespread history of removing trees from agricultural land, conflicts between grazing animals and tree regeneration and promoting of a few, largely exotic tree species on farms and

in woodlots, rather than more diverse options? What is the relationship between tree cover (density and diversity) and soil health and where are there tradeoffs and synergies between production goals and the provision of other ecosystem services? How can key tipping points for land degradation be recognized, and used to avoid further degradation and prioritize restoration?

Silvopastoral systems

This research theme's overarching hypothesis is that the establishment and better management of tree cover on pastures can contribute simultaneously to higher livestock productivity, animal welfare and biodiversity conservation, as well as restoring degraded rangelands and avoiding future degradation. This leads to the following key research questions. What is the relationship between tree cover and pasture and animal productivity and welfare in silvopastoral systems? Where are there tradeoffs and synergies between production goals and the provision of other ecosystem services?



△ Rwandan woman Clemence shows bank account and family insurance certificates that were paid for with proceeds of tree tomato sales. Photo by A. Mamo/ICRAF

How will FTA's research create change?

This research theme's theory of change rests on three interrelated assumptions that: the current management of tree cover on farms, in pastures and at forest margins can be improved, contributing to sustainable intensification of livelihoods through higher total factor productivity, leading to higher food and nutrition security; smallholders and particularly women can achieve higher returns from tree and forest products by better marketing and processing, thereby increasing their income; and people (especially women, young people and other marginalized groups) can participate more

in, and benefit more from, using tree and forest resources if policies, legislation and institutions affecting their use are reformed to enable this, including financing investment to establish trees.

Through embedding some of its research within the scaling-up process, this research theme simultaneously accelerates impact for development partners while enabling research to be conducted at the scale at which FTA aspires to make impact (Figure 2).

Case study 1: Trees for all reasons

FTA's research in development paradigm, supported by the Australian Centre for International Agricultural Research (ACIAR), the International Fund for Agricultural Development (IFAD)/EU and the UK's Department for International Development (DfID), works with thousands of farmers to evaluate the performance of agroforestry options across contexts in Africa.

In Rwanda, wooden stakes from farm trees have doubled the yield of climbing beans, green manure from nitrogen-fixing *Alnus acuminata* raised potato yield more than 50 percent, while income from tree tomato has helped people transition out of poverty, for instance, enabling women to open bank accounts and purchase health insurance for their families for the first time. Farmers adopting novel soil and water conservation methods in Kenya obtained maize yields over the last two seasons when most maize failed due to drought, while innovation platforms in Zambia are connecting farmers

with buyers, and overcoming diseases and low prices through collective rearing and marketing of local chickens together with soya and solwezi beans. Farmers in Tanzania and Ethiopia are trying out a raft of sustainable intensification and land-restoration options.

Demonstration of the practical value of agroforestry from this research is leading to policy change. In Ethiopia, a national agroforestry scaling platform has been set up and the government has committed to turning over 33,000 state nurseries to entrepreneurial youth and women's groups along the rural resource center model pioneered by FTA. The Food and Agriculture Organization of the UN (FAO) has used FTA research to inform the development of national agroforestry policy in Rwanda and FTA is engaged with Vi-Agroforestry and farmers' groups in informing policy development through parliamentary processes in Uganda.

Case study 2: The paternoster principle: Scaling up by coupling bottom-up and top-down approaches

Much of northwest Vietnam comprises steep slopes with maize monocultures that are prone to high rates of soil erosion and land degradation, leading to decline and collapse of farm income.

ACIAR-funded FTA research on market-based agroforestry, which can increase farm income and conserve soil through contour planting of high-value trees, has identified the need to couple 'bottom up' participatory development of feasible options with 'top down' incentives and government sanction to promote wide-scale adoption of agroforestry practices. This is known as the "paternoster principle" after the paternoster elevator, a continuously moving open-sided conveyer with no doors or buttons, where compartments going up are linked in a cycle to those coming down. Strategic co-investment from FTA brought practices like ox-back contour planting from the Philippines to Vietnam and enabled the ACIAR project to respond to farmers' interest in trying out more diverse,

multistrata contour planting options than research and development organizations in Vietnam had considered. These were brought together in a series of exemplar landscapes where more than one-third of farmers in a contiguous area were encouraged to increase tree cover on their farms, creating visible landscape-scale impact.

There are now six such landscapes involving co-investment from provincial governments that have led to profound changes in advice and incentives available to farmers. In Dien Bien, for example, policy changes at provincial level now provide monetary incentives for farmers to adopt contour planting and to establish stands of *son tra* (an indigenous fruit tree) in some districts. Domestication of *son tra* has gone hand in hand with growing the market through developing novel, non-perishable products from the fruit (tea and extracts), now taken up by a food exporting company.

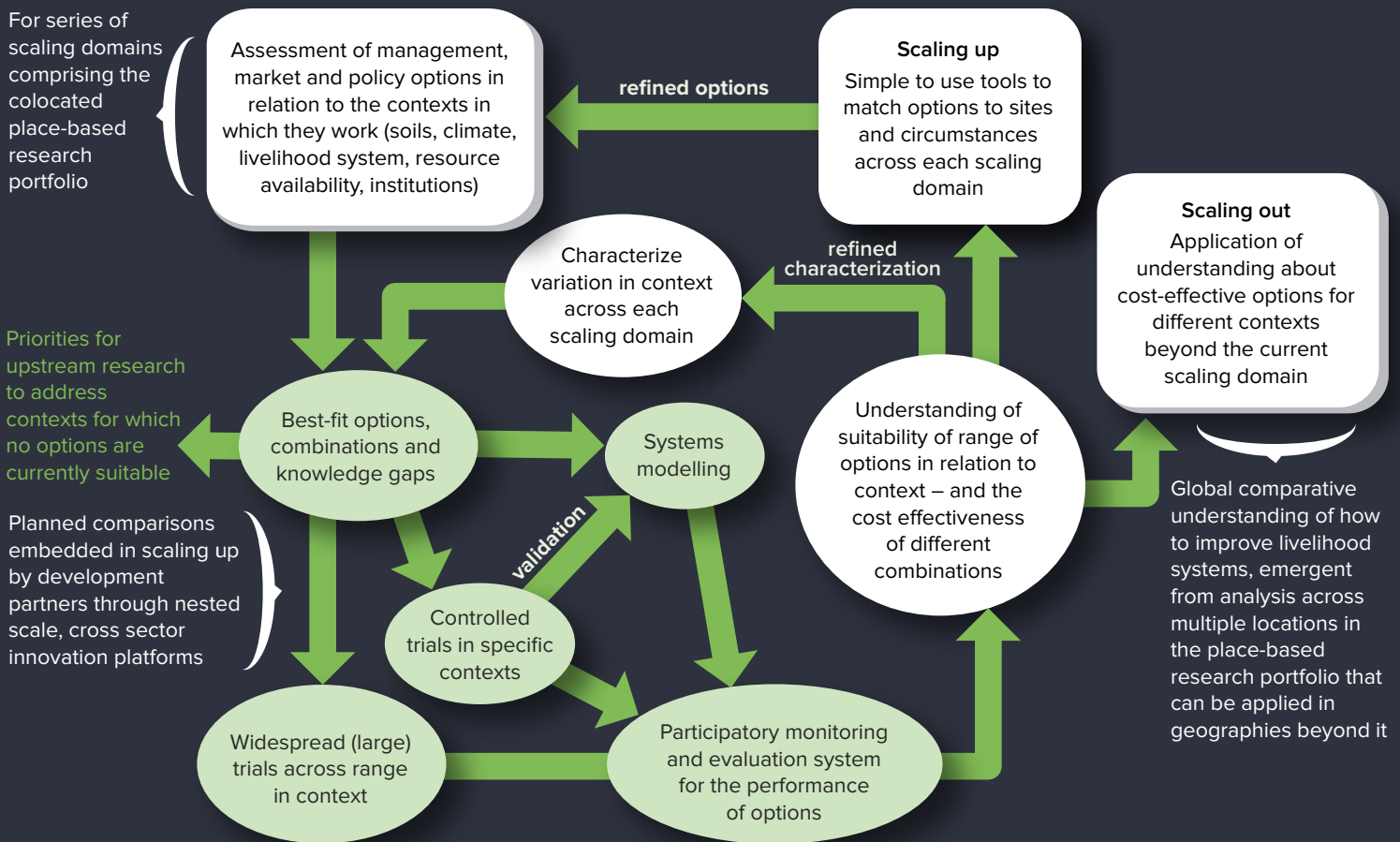


Figure 2. The research in development paradigm to generate best-fit options and suitability domains at scale

Who does FTA work with?

The research theme's partnership strategy involves three main types: donors, upstream research providers and the users of FTA's research outputs. Partnerships with the private sector cut across these as they may involve funding, collaboration in cutting-edge science and the use of research outputs. By engaging with development partners, the private sector and policy makers from the outset, FTA ensures that its outputs address important issues in a form suitable for uptake and maximize the likelihood of generating outcomes and impact.

Upstream partners include: Simulistics on livelihood trajectory modelling; Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) on incorporating trees within its Agricultural Production Systems Simulator (APSIM) suite of globally calibrated crop models; Bangor University in the UK on genomics to understand the functional profiles of

soil biota; as well as many other universities — the Swedish University of Agricultural Sciences (SLU); Cornell, Columbia, Colorado and Montana in the US; Adelaide and Southern Cross in Australia; Jomo Kenyatta University of Agriculture and Technology (JKUAT) in Kenya; Makerere in Uganda; and Mekele, Hawassa and Wondo Genet in Ethiopia.

Private sector partners include Mars on cocoa in Côte d'Ivoire; Natura on oil palm diversification in Brazil; and small and medium enterprises that codevelop novel products (e.g. nonperishable forms of *Docynia indica* in Vietnam).

IFAD, the World Wildlife Fund (WWF), WorldVision, Vi-Agroforestry, One Acre Fund, CARE and SahelEco are examples of partners for delivery at scale, together with national and local governments (e.g. in Ethiopia, Peru and Vietnam).



▼ Farmers in North west Vietnam prepare for planting at one of three 50-hectare agroforestry demonstration landscapes in the region. Photo by R. Finlayson/CRAF

Cover: Farmer Belisario Villacrez stands in a private bolaina tree plantation in Peru. Photo by R. Sears

The CGIAR Research Program on Forests, Trees and Agroforestry (FTA) is the world's largest research for development program to enhance the role of forests, trees and agroforestry in sustainable development and food security and to address climate change. CIFOR leads FTA in partnership with Bioversity International, CATIE, CIRAD, ICRAF, INBAR and TBI.

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