**Introduction**

In the myriad national and subnational Latin American contexts, oil palm expansion has led to varied and often controversial outcomes (Castiblanco, Etter and Ramirez 2015; Richard and Aide 2017). Evidence is emerging that oil palm adoption can have positive impacts on smallholder livelihoods (e.g., Feintrenie, Chong and Levang 2010), but impacts depend on the relationships between farmers and processors. Key aspects include types of supply arrangement, such as nucleus estates with smallholder outgrowers versus independent farmers, and technical aspects, e.g., prescribed technological packages, minimum area required, minimum supply volumes and technical assistance. Supply arrangements and technical content must be considered in relation to the requirements for mainstreaming inclusive production is key to meeting environmental, livelihood and wider economic goals.”
livelihoods and assets of farmers, and to their productive and marketing capacity. From an environmental perspective, recent studies highlight the positive roles of smallholder farming practices (poly-culture, alley cropping) and landscape heterogeneity on provision of ecosystem services (e.g., Azhar et al. 2015; 2017).

More inclusive and sustainable palm oil production requires both technological and business-model innovations. Without the former, production on degraded land cannot be both profitable and restorative of biodiversity and ecosystem functioning. Without the latter, farmers will struggle to engage in ways that allow them to participate in the value chain and improve their livelihoods. But approaches to engage smallholders, including certification, are not yet characterized by such dual innovation. Agroindustrial production models that recommend how farmers can be supported to meet specifications and increase technical performance still dominate; lacking the dual approach, they will not overcome barriers to successful smallholder participation. Developing suitable schemes for smallholders requires their direct participation in the design phase.

This article reports on the initial activities of the USAID-supported project “Oil palm diversification: reconciling conservation with livelihoods,” led by the innovation department of Natura, the Brazilian cosmetics and personal care manufacturer (part of the Natura & Co. cosmetics group, together with Aesop and the Body Shop), with Cooperativa Agrícola Mista de Tomé-Açu (CAMTA), the Brazilian Agricultural Research Corporation (Embrapa) and World Agroforestry Centre (ICRAF), an international research centre. The project aims to develop smallholder–inclusive approaches through a shift toward diversified, agroforestry-based production that is supported by inclusive business models. The partnership builds on a groundbreaking 18-ha field experiment initiated by Natura and CAMTA in 2007 in Tomé-Açu municipality, Pará state, in the Brazilian Amazon. The practices yielded highly encouraging results in productivity and environmental co-benefits, including increases in carbon storage capacity (Ramos et al. 2018), soil fertility, nutrient cycling and biodiversity. Another objective was to define a strategy to scale up these pioneering systems to fit smallholders’ socioeconomic realities.

Challenges to smallholder-inclusive production in Pará State

By 2014 the area under oil palm more than tripled to some 255,000 ha, following policy incentives including the National Biodiesel Programme (2004) and National Sustainable Palm Oil Production Programme (2010). The National Biodiesel Programme established social safeguards for family farmers. Contracts required approval from farmer organizations, technical assistance from companies, inclusion of food crops in plantations, and “cultural suitability” for production systems, ensured through farmer participation in decision-making (LegisWeb 2009). But expansion of oil palm ceased when political instability and macroeconomic and market conditions created a loss of confidence. Today, outgrowers account for only 20% of the total area in northeast Pará, including some 1,500 family farmers (Brandão, Schoneveld and Pacheco 2018).

Equitable smallholder participation in the value chain remained a challenge, especially for marginalized groups. Constraints included a minimum area requirement (6–10 ha of degraded land), and contractual clauses obliging farmers to implement technological packages prohibiting intercropping and requiring the use of synthetic fertilizers and pesticides. Additionally, credit was sufficient only to plant oil palm, excluding the possibility of introducing other crops. This model was also criticized for absorbing much family labour and land, leading to reduced food security, in addition to farmers’ perspectives of serious environmental impacts (Ferreira et al. 2016).
However, a comprehensive study of smallholder outgrowers in northeast Pará (Brandão, de Castro and Futemma 2018) showed that capacity for hiring labour is a more important determinant of labour allocation in plantation management than the availability of household labour. This questioned the assumption that adopting oil palm would lead to crop specialization and reduced food security, since strategies for including labour and land-constrained smallholders allow for smaller plot sizes and enable diversification through intercropping.

**Oil palm agroforestry — a groundbreaking innovation**

In 2007, Natura Brasil’s innovation department established a partnership with CAMTA and Embrapa to explore oil palm agroforestry (Castellani et al. 2011); this was triggered by Natura’s strong corporate interest in socially and environmentally responsible supply chains. CAMTA is an internationally recognized farmer cooperative that promotes agroforestry practices (Piekielek 2010). Founded by Japanese immigrants in 1949, it soon became Brazil’s leading exporter of black pepper, but by the 1970s plant disease caused it to move away from monocropping. CAMTA is now a vertically-integrated enterprise selling a range of processed products. Their experience is a good example of commercial, diversified agroforestry production and agroecological services, with an important role as a disseminator and advocate of agroforestry-based production.

Field experiments established by Natura and CAMTA tested two agroforestry combinations: simple and complex. The latter prioritized fertilizer companion species; both combinations were subjected to manual or mechanized site preparation (Castellani et al. 2009). Up to 17 associated species per treatment were chosen according to several criteria, including farmer needs, ecological functions (i.e., biomass production and nutrient cycling), and other considerations such as agrobiodiversity conservation, market demand, and soil conditions.
Findings to date are very encouraging. Oil palm yields and environmental services are superior to those from local monocrop systems, and the areas also produce other crops. Carbon storage potential is greater than that of monocrop and conventional agroforestry systems in the region (without oil palm) and comparable to that of secondary forests. Moreover, an evaluation of the ecological services indicated values approximately three times those of oil palm monoculture.

**Scaling innovation by an option-by-context approach**

In 2016, ICRAF joined the Natura-CAMTA-Embrapa alliance through its participation in the “Oil Palm Diversification: reconciling conservation with livelihoods” project to consolidate research on the existing experiments and identify scaling strategies for marginalized farmers. ICRAF is implementing a research-and-development approach based on a co-learning platform that involves multiple stakeholders and employs participatory research methods (Coe, Sinclair and Barrios 2014). This approach integrates two elements: tailoring oil palm agroforestry practices to specific social and biophysical contexts (option design, by engaging farmers in design and implementation); and analyzing the socio-ecological factors that support the successful adoption of the identified options (in terms of profitability for farmers and positive livelihood and environmental outcomes). These results will be used to identify the scaling domains and the variation of enabling factors over the territory (Figure 1).

In the context of this project, the term “scaling domain” refers to the main geographical areas where diversified oil palm might potentially be upscaled (Figure 2). The project should take these areas into account in its strategy with regard to variables that might inhibit or promote the adoption of innovations in systems and governance.

**Figure 1. Option-by-context approach used in a research-and-development process**

Based on Coe, Sinclair and Barrios 2014.
Eleven oil palm agroforestry demonstration sites were co-designed and established with representatives of three major types of farmer: independent family farmers; organized family farmers; and medium-sized CAMTA-member farmers. Selection was based on criteria such as representativeness, availability of legally eligible degraded land, a desire to diversify, and interest in facilitating wider dissemination of agroforestry practices. Sites are used to monitor system performance and characterize factors that might influence adoption, implementation and profitability with respect to different social groups.

A socio-environmental appraisal was first conducted on 15 pre-selected farms by applying the tool for planning and evaluation for decision-making in agroforestry systems (PLANTSAFS) under development by ICRAF (Miccolis et al. 2018). PLANTSAFS supports diagnosis and design of agroforestry interventions based on 40 indicators of household livelihood assets, constraints, aspirations, objectives and biophysical-agroecological conditions. Appraisal included consideration of socioeconomic and biophysical constraints to adapting the CAMTA experimental model to smallholder circumstances. Following a co-design workshop with farmers, researchers and technicians, demonstration sites (11 plots, 20 ha in total) were established. Extensionists visit the sites monthly, supplemented by farmer exchanges with the project team. Mean species richness is 14 (range 3-19), with 33 different species over all plots. In addition to oil palm, the plots included a combination of other fruits, hardwoods, green manures, and annual crops, with a wide variation in spatial arrangements.

The study identified and characterized potential farmer groups by assets, constraints and opportunities. The aim was to inform the co-design of options tailored to each group and delineate the main scaling domains for the options. This characterization and analysis of interplay among socioeconomic, market, institutional and biophysical agroclimatic aspects helps provide an understanding
of feasibility, and ultimately of the attractiveness of any given option. During the first year, the study design also included expert consultations and focus group work on livelihood strategies, farming systems, local governance and institutions, and value chains, and building a spatial database including information on settlements, infrastructure, land cover, land use, production systems and legal issues. The study was complemented by an inventory and structural and functional characterization of existing agroforestry practices in Tome-Açu, with an appraisal of farmers’ perceptions about those systems.

**Scaling inclusive oil palm agroforestry**

Preliminary findings shed light on farmers’ interest in diversification, identified important barriers and research questions, and helped to determine a way forward. All types of farmers had great interest in diversification. Key motivations included potentially greater resilience to market risks and fluctuations; greater ability to adapt to climate change; optimization of the use of scarce labour and land (particularly when oil palm is in the juvenile, unproductive phase); enhanced food security for all farmer groups through integration of food crops; and soil improvement by fertilizer species.

Potential barriers include high costs and the knowledge-intensive nature of agroforestry in comparison to standard monoculture. Barriers vary by farmer group; more marginalized farmers have less access to labour, knowledge and capital required to establish and manage complex systems, and less access to markets, processing equipment and policy incentives, particularly for credit and extension services. Upscaling will require higher investment in capacity building, extension services and credit to allow farmers to meet establishment costs, with opportunities further limited as only 19% of households belong to an association or cooperative (IBGE 2017).

Three other specific measures for building more inclusive palm oil production are identified.

1. **Inclusion of more food crops**: optimizes labour use, reduces time for return on high initial investment costs, improves food security.
2. **Equitable value chain development for other products**: processing and marketing of cacao, black pepper, açai, cassava and passionfruit, among others, implying investments in processing and strengthening smallholder organizations.
3. **Development of independent, collectively owned, small-scale processing**: to strengthen smallholder livelihoods through capturing a greater share of value addition and enabling autonomy from the prevailing business model, by which they depend on large industry to extract oil from fresh fruit bunches.

Addressing these barriers will certainly contribute to, but not necessarily lead to, massive adoption of biodiverse oil palm agroforestry across different farmer types and local contexts. Widespread adoption among smallholders, particularly in those areas outside Tomé-Açu where CAMTA has not been active in dissemination, will probably also depend on reducing structural barriers that apply to agroforestry systems in general. Successful scaling among smallholders also depends on how the still-dominant large companies might take on diversification as part of their contracts with smallholders. Key companies have already shown interest.

Although organized family farmers and medium-sized farmers have greater access to knowledge, credit, labour and machinery, the agroforestry systems they practise are becoming increasingly
simplified and dependent on external chemical inputs. This is because management decisions are most often based on farmer perceptions of economic and market variables. Nevertheless, increasing concerns about plant diseases and a changing climate, and the potential for a premium market for more sustainably grown products, provide sufficient motivation for farmers to diversify and adopt agroecological practices in oil palm agroforests. To increase adoption and make policymakers aware of what solutions need to be supported in each local context requires further evidence on the costs and benefits of various technological approaches and governance mechanisms, enabling farmers to choose options most suited to their circumstances.

Ways forward

Comparisons between conventional and agroforestry-based production are made difficult by information asymmetry. Conventional production is backed up by decades of agronomic research and experience, whereas research on oil palm agroforestry is in its infancy. Regarding ecosystem services, lessons from wider agroforestry experience are probably applicable, whereas factors determining the feasibility for smallholder farmers are still lacking. Continued monitoring and modelling of household livelihood impacts will make an important contribution to understanding these factors.

The demand for diversified, profitable palm oil production that reconciles narrow financial objectives with environmental goals comes from at least four groups of actors. These are various types of farmers, companies committed to a sustainability ethos (such as Natura), palm oil companies (whose motivation may reflect reputational factors rather than deeper-seated commitments), and consumers and the wider community (local, regional, national and global) that value conservation of biodiversity, maintenance of ecosystem services, and social justice. This research focused only on farmers, but can help to determine the requirements for mainstreaming inclusive production to meet environmental and livelihood goals and wider economic objectives. It could also help identify whether the demand for public goods (which in one way or another underlies the motivation of the other three groups) can be met by smallholders without incurring additional costs.

Approaches should seek to construct options that tailor technological and business model elements to smallholder circumstances. This requires investment by government agencies in producer and consumer countries as key to shifting smallholder contexts so that they can benefit from inclusive business arrangements while meeting wider demands. Given the global importance and impact of palm oil, substantial investment in developing and implementing inclusive approaches is crucial. This will allow oil palm to continue to be the world’s most cost-efficient source of vegetable oil while also enhancing the livelihoods of rural people, and preventing the environmental costs that have led to its virtual demonization.

References


