

Mitigating the negative impacts of the maize boom on landscapes and livelihoods in Laos

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Introduction: boom crops in the agrarian transition

Boom crops are a global environmental challenge increasingly addressed through a telecoupling lens that emphasizes interactions between remote producers' and consumers' places at both ends of complex agri-chains. Assessments of environmental footprint of boom crops must include distant locations but also multiple temporal and socio-political scales. Indeed, changing market demands for global commodities such as rubber, oil palm, maize or cassava are having tremendous impacts on local landscapes and livelihoods. Crop boom syndrome is described here as the rapid spatial expansion of a crop and increasing economic impact through least effort and most profitable land use pathways for stakeholders along the agri-chain. Understanding underlying mechanisms of these land use changes, especially how decisions are made by smallholder producers involved in crop booms, is expected to help designing sustainable agri-food systems that would avoid boom effects.

In this presentation, we take the example of the maize boom in Southeast Asia as it largely involves smallholders and not only large-scale land acquisition by foreign corporations. As an annual crop, maize development trends are also different from plantations such as banana, oil palm, rubber or coffee which have longer production cycles. Short production cycles provide more flexibility as compared to perennial crops in term of expansion or relocation depending on the fluctuations in the socio-ecological context of the production. Southeast Asia, and especially Laos, provides good examples of very fast land use changes driven by opportunistic behaviours.

The objectives of this presentation are to: (i) describe crop booms as trajectories of land use change, (ii) identify what can be learned from studying past boom trajectories, (iii) identify at what points in the trajectory interventions can be made to avoid negative consequences and (iv) show how to empower local communities and policy makers to better deal with boom crops.

A conceptual framework for intervention on boom crop trajectories

Typical boom-crop pathways repeat in time and space, *i.e.* land degradation, poverty traps, deceived high expectations, *e.g.* jatropha hype (Amsalu and Zoomers, 2014), banana boom (Friis and Nielsen, 2016), rubber juggernaut (Ziegler *et al.*, 2009). Concrete solutions can be found to avoid the same cause to produce the same effects again and again all around the region. We believe that quick and relevant interventions can avoid many adverse effects of the crop booms. Therefore, we need better methods to assess land use changes on the one hand early and fast enough and on the other hand at multiple scales from local to regional levels. In short, we need to understand boom trajectory mechanisms in order to steer the socio-ecological systems towards more sustainable trajectories.

Early recognition of a boom crop syndrome. Land science has a tradition of post-hoc observations at the regional level (*e.g.* gradual process of transition from one land use pattern to another) that may not be adapted to rapid changes, or arrives too late to support intervention and thus achieves limited impacts. In addition, top-down approaches are poorly adapted to local drivers of land use changes (LUC). When observed at the local level, transitions can be extremely rapid, sometimes with unexpected drivers that do not always fit well with observations at the regional level. Local level land use changes are difficult

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to anticipate and sometimes also difficult to relate to broader, regional level trajectories that are usually more easily captured and predicted. In a context of regime shift, *i.e.* fast transitions in socio-ecological systems that limit predictability of LUC (Müller *et al.*, 2014; Ramankutti and Coomes, 2016) we need to recognize the early warning signs in order to respond timely. Early recognition is necessary to identify ‘*windows of opportunity*’, *i.e.* locations or time periods that are favourable to intervention and innovation (Lestrelin and Castella, 2011) and to adjust intervention modes to local contexts so as to avoid negative consequences of boom trajectories and show alternatives.

Opening the black box of the boom. Disentangling underlying mechanisms of the boom is necessary for meaningful intervention; since crop booms appear as an abstract, emergent entity that is difficult to grasp. Below the regional maize trajectory many singular village LUC trajectories are unfolding, responding differently to the same stimuli depending on their local contexts and history. These path-dependent trajectories need to be understood if we want to effectively address the booms. Understanding the trajectories requires studying the underlying, contextualized decisions that shape the trajectories (Ornetsmüller *et al.*, 2016). This can help identifying leverage points for mitigating negative consequences of crop booms and promoting alternative practices. Transformative approaches to land use include alternative crops and practices, landscape management modes, and involvement of agri-chain stakeholders in coordination processes.

Methods: representing and simulating the maize boom to understand its underlying mechanisms

Data collection. Field surveys have been conducted in seven villages in the northern uplands of Laos located at different stages of the maize boom. Semi-structured questionnaires addressed the constraints to adoption of technical innovations in a boom context. In addition, we investigated the impacts of maize on land use changes in Sayabouri, Xieng Khouang and Houaphan through analysis of remote sensing data combined with household surveys and focus group discussions. A literature review complemented our analysis of the impacts of the maize boom on local landscapes and livelihoods (*e.g.* expansion of maize roads in the villages, impacts on deforestation and land degradation, process of capital accumulation and reinvestment in paddy land terracing and other diversification options).

Participatory simulations and knowledge integration into a model of the maize boom. Gaming experiments were conducted to capture context-sensitive decisions of farming households (Ornetsmüller *et al.*, 2016). First, LUC were investigated at the interface between macro and micro drivers of change: regional market demand versus individual decision making. A series of individual games were developed with local land users to address specific questions *e.g.* how short-term decisions and long-term investments are related (MIALU game), how farmers perceive and react to land degradation (MALAD game), how smallholders manage indebtedness and risk (MARISK game). Village and individual trajectories were elicited through field surveys that led to the game design, then specific decisions and scenarios were explored with the game and finally validated during the collective and individual debriefing sessions. Second, the individual games were organized into an integrative meta-game named Mahasaly (‘*higher level perspective on maize*’ in Lao language). The insights of the game may be further used to (i) identify opportunity windows for intervention and to (ii) virtually test transformative landscape approaches towards sustainable land uses.

Results: the maize boom from the bottom-up

Characterizing the maize boom trajectory in Laos. The successive stages of the maize boom, *i.e.* adoption, expansion, intensification, diversification, abandonment; are described as well as their positive impacts on farmers’ cash income and livelihoods and negative impacts on deforestation, land degradation, loss of biodiversity, pollution with herbicides and household indebtedness. Changes in landscapes are mainly driven by replacement of swidden fallows by maize, opening of maize feeder roads for maize expansion until the land frontier is reached, *i.e.* free access to common land is not possible anymore, leading to the emergence of a local land market and changes in land tenure systems.

Analysing smallholder decision pathways. Disentangling the boom mechanisms means understanding the context of the successive, path-dependent decisions that feed the maize boom trajectory (Ornetsmüller *et al.*, 2016). Crucial strategic decisions are usually followed by routine decisions (business as usual – same practice used for a few years) until new signals show a need for next strategic decision. Here we present elements of context that shape strategic decisions as elicited through the role games. In all cases, villagers manage a transition period from a dominant system to another (regime shift). Overall, we found that on the individual level the available set of competitive opportunities, profitability and feasibility play a strong role in the decision-making process and that the system dynamics in the maize boom are intricately linked to income for household and family oriented goals.

Discussion: drawing lessons for timely and relevant intervention

Reconciling local and regional scales, short term and long term strategies. Farmers engaged in the boom may be looked upon as short-sighted as they are well aware of the downside effects of mono-cropping practices, deforestation and intensive use of chemical inputs. However, they usually combine short term with long term strategic decisions. Farmers use the profits from maize to invest in their children's education and in terracing paddy fields. They tend to dig into the natural resource base through intensive maize systems to secure the conditions of a transition towards more sustainable systems. Some farmers displayed unsustainable strategies during the games that aimed at stretching the maize system a few more years before the children have finished their school years and then turning to other, more sustainable cropping systems afterwards that may involve investment of capital or seem risky at first to them.

Recognizing intervention windows. A better understanding of farmer's perspective allowed identifying early signals of transition between the successive phases of the boom. Interventions are almost impossible during the expansion-intensification phase as long as there is no alternative that can compete with mainstream maize production modes. Two main intervention windows were identified: adoption (pre-boom) phase and diversification-abandonment (post-boom) phase, *i.e.* at the initial stage of the boom before villagers turn to non-sustainable mono-cropping practices and then during the crisis phase when farmers are more receptive to alternative practices as their maize systems do not perform well anymore.

Transformative approaches to sustainable landscapes and livelihoods. We captured the contextualized patterns of decision-making within a limited amount of time (4 months) so that scenarios of alternative behaviours can be tested with multiple stakeholder groups. As an explorative tool the Mahasaly model could be used to assess with local populations the feasibility of compensation mechanisms such as projects that would promote paddy rice terracing in exchange of not opening maize feeder roads, a main driver of maize expansion and deforestation. The feasibility of such an intervention is highly dependent on the local context and the willingness of multiple stakeholder groups to coordinate their actions.

Conclusions

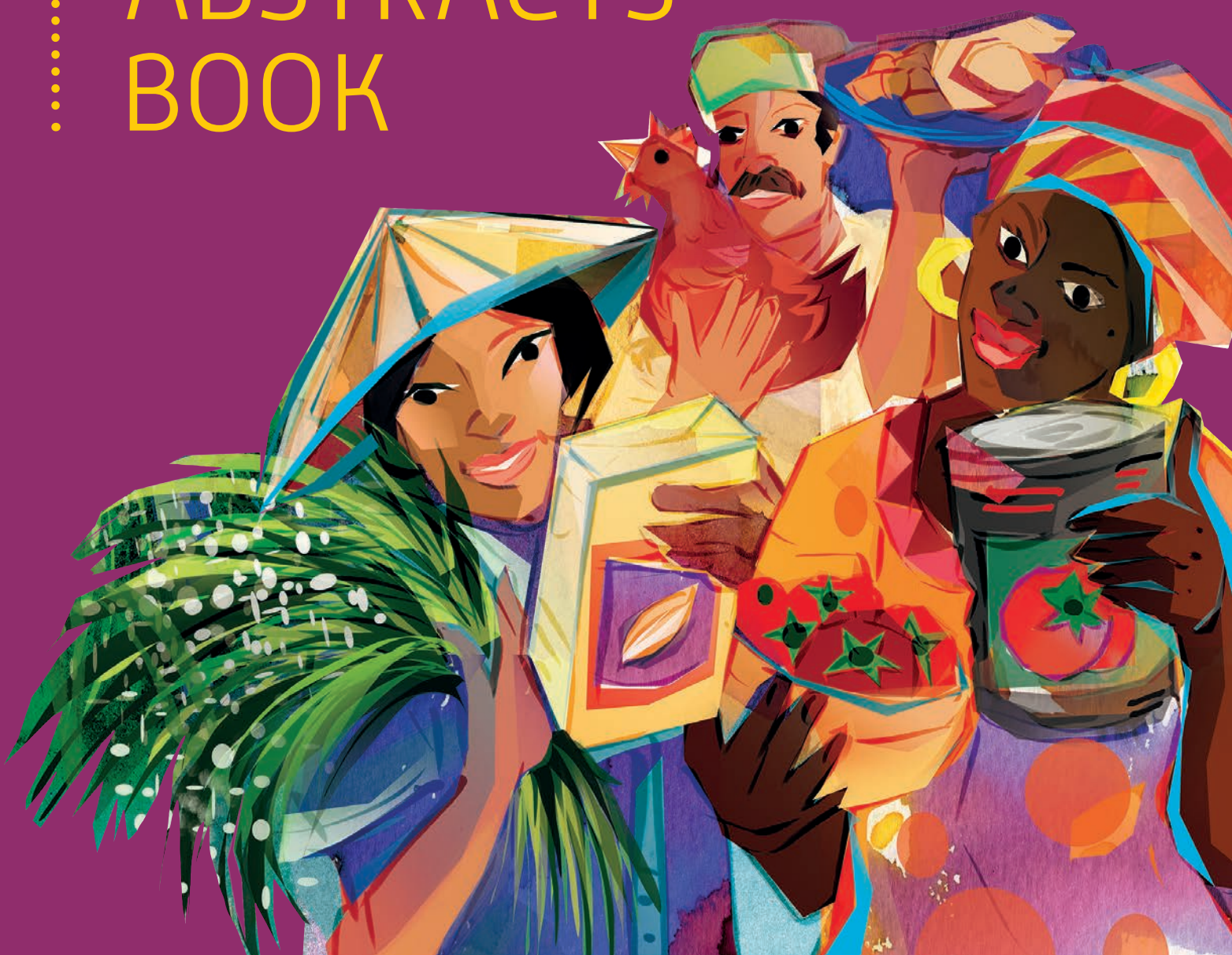
Repeated strong calls from policy makers to address global development issues (*e.g.* climate change mitigation and adaptation, poverty reduction, biodiversity conservation) by tackling unsustainable land use practices (*e.g.* deforestation or forest degradation, overuse of pesticides) may look analytically very effective, as land use can be both cause and solution to these global issues, but they are difficult to implement on the ground as early attempts for transformative changes towards sustainable land use have repeatedly shown. Crop booms are symptomatic of these major conceptual problems with transformative approaches that would be managed from the top down. Misinterpretation of the underlying decisional mechanisms of land use change leads to scale mismatch and time-lag of large-scale assessments. We believe our proposed bottom-up approach can be harnessed for the design of more effective interventions.

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Agri-Chains & Sustainable Development
> *Linking local and global dynamics*

ABSTRACTS BOOK



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Welcome to AC&SD 2016

On behalf of the Scientific and Organizing Committees, it is a great pleasure to welcome you to the International Conference on Agri-chains and Sustainable Development (AC&SD 2016). This conference aspires to widen the debate about the role of agricultural value chains towards sustainable development. Year 2015 was a critical political and diplomatic milestone: the member states of the United Nations signed a new agenda for development, with the 17 Sustainable Development Goals (SDGs) placing sustainability at the core of international efforts. Development and academic actors are since then exploring new avenues for translating the SDGs into reality and implementing global and local frameworks and partnerships. Our conference aims at joining these efforts, with the consideration that agricultural value chains form spaces where local and global challenges to sustainability connect and within which local and global actors experiment and negotiate innovative solutions.

The scientific committee has assembled a very attractive program for AC&SD 2016 that seeks to cover and confront the diversity of realities behind agri-chains, from localized chains, embedded in specific places, to global value chains. In the parallel sessions, transformations of these agri-chains and their connections to sustainable development will be discussed by speakers from the academia, the civil society, the private sector and decision makers. This multi-stakeholder perspective will also be brought about in the plenary sessions. Here, world renowned keynotes and panelists to three high level round tables will discuss about the role and importance of evaluation, public and private institutions and innovations at different scales for transforming agri-chains towards sustainability transitions.

This edition gathers about 250 participants from 39 countries. AC&SD 2016 owes a lot to the scientific and organizing committees for preparing the program, and particularly to Brigitte Cabantous, Chantal Carrasco and Nathalie Curiallet for all the logistics, as well as to our support team of Alpha Visa that we warmly thank for their help.

We wish us all a fascinating, successful, inspiring and enjoyable AC&SD 2016 and we very much look forward to its result and to the strengthening of both a scientific community and a community of practice to implement the outcome!!

Estelle Biénabe, Patrick Caron and Flavia Fabiano,
Cirad Co-chairs AC&SD 2016

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