

CANSEA a R&D Network on Agroecology Transition in South East Asia

Platform of Agro-ecological systems of Research and Training for Development

Vira Leng^{1,2,3}, Sovannara Chheong³, Ouddom Chett³, Samnang Yen⁴, Sopheak Trang³, Sokphea Prum³, Lyda Hok⁴, Manny Reyes⁵, Saruth Chan^{1,6}, Pech Sovanno¹, Koy Ra^{1,2}, Rada Kong³, Florent Tivet^{3,7}, Stéphane Boulakia⁷

¹ General Directorate of Agriculture; ²Department of Agricultural Land Resources Management; ³Conservation Agriculture Service Centre; ⁴Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN), Royal University of Agriculture (RUA); ⁵Kansas State University, Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification; ⁶Department of Agricultural Engineering; ⁷Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD).



Key results and lessons learned from the Action

The Platform offers a diversity of activities with (i) the design and assessment of agroecological systems exploring patterns of crop diversification, (ii) the preservation and evaluation of a large genetic bank of staple, cash and cover/relay crops (50 species, ~ 335 cultivars), (iii) analytical experiments to test plant diversity under different management, to understand the effect of practices (i.e. trials of cover crops termination, different mix of plants and density), and to quantify the impacts on biological processes (i.e., soil organic C transformation, nutrient cycling and soil structure), (iv) demonstrations of appropriate-scale machinery, (v) training and field days for smallholder farmers, development operators and research partners.

Cropping systems, appropriate-scale machinery and plant diversity, designed and tested at the Platform, are also evaluated and adapted on-farm on different agro-ecosystems (rice farming under irrigated conditions, rainfed lowland, and in the uplands) in Cambodia. In 2018, these farmer networks cover 85 ha for rice cropping systems (57 households) and ~ 400 ha for the annual upland crops (144 households).

Major advances are emphasized with the technology of “planting green” where main crops are direct sown on standing cover/relay crops minimizing or eliminating the use of herbicide for the control of the cover crops, improving weeds control, increasing biomass inputs and productivity. Organic management under direct seeding mulch-based cropping (DMC) systems are one of our main target and different tools are aggregated to enhance biological processes. Cover crops are managed mechanically through the use of roller crimper. In addition, seed producers are established since 2017 as a direct result of the technical ability of the team to master the seed preservation and production, and to transfer these know-how and knowledge.

Several scientific peer-review articles (5) were published emphasizing that the Platform is an efficient support to produce science-based evidence to land managers, policy-makers and donors. Strengthening a scientific community is also one of the main achievement of the Platform with specific focus on soil organic C dynamics, predicting changes over time, soil biological activity and water retention capacity under contrasted soil and crop management. Several partners institutions benefit

today from the Platform for their own research contributing to a larger understanding of biological processes and enriching the learning loop to design agro-ecological systems.

Field days and training are regularly organized. As an example, twenty field days (135 attendants) were organized in 2017, fourteen so far in 2018 (323 attendants) with a two-days training in August bringing together 50 farmers from 6 provinces and 34 development operators, governmental staff and partners from higher education and research institutes.

The platform is at the crossroad of several countries and represents a unique location to strengthen a regional research and training center on agroecological systems. Facilities are in place with 14.5 ha land dedicated to experiments, demonstrations, germplasm preservation, seed production, appropriate-scale machinery demonstrations, seed store, training rooms, and dormitories for men and women.



Field visit of students from Prey Veng and Svay Rieng provinces coordinated by Chea Sim University of Kamchaymear (CSUK) and Svay Rieng University (SRU)

Context of the Action

The Platform Agro-ecological Systems comprises the oldest experiments under Conservation Agriculture (CA) in South-East Asia with activities established since 2004 (AFD funding). This unique heritage has been strengthened through ACTAE/CANSEA (Towards Agro-ecological Transition in South-East Asia, AFD), UNCCD and the Cambodia Climate Change Alliance (CCCA), and CE SAIN (Center of Excellence on Sustainable Agricultural Intensification and Nutrition, The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification, USAID) supports since 2015.

Objectives of the Action

- Design and assess the transition towards agro-ecological systems (technical requirements, performances and ecological balance shifts).
- Provide training and build capacities of smallholder farmers and development operators (youth, women and men) on innovative cropping systems management, appropriate-scale machinery, use of a large diversity of plant species and bio-products.
- Understand biological processes that sustain and enhance agroecological systems.
- Provide science-based evidence to land-managers and donors on medium to long-term benefits of agroecological systems.

Location and description of the Action

The Platform is located at Bos Khnor Commune, Chamkar Leu District, Kampong Cham province (12°12'30" N, 105°19'07"E).

Partnership

The Agroecological Systems Platform is dependent on the General Directorate of Agriculture (GDA). Activities are implemented by the Department of Agricultural Land Resources Management (GDA/DALRM), the Conservation Agriculture Service Center (CASC), the Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN) in partnership with the French Agricultural Research Centre for International Development (CIRAD). The Platform is also part of the network of Technology Parks (5) established by CE SAIN which are connected with education (high schools and universities) and extension services.



Cambodia Climate Change Alliance (CCA)



Design and diversity of the activities implemented at the Platform Agroecological Systems (credit CE SAIN)

Upland rice sown on standing cover crops of Sorghum bicolor + sunnhemp + Sesbania + Kenaf + cowpea; Bos Khnor Station, July 2018

Designing Agroecological systems

Cropping systems design emphasizes:

- The maintenance of permanent choice in crops and cover crops associations, and successions as response to climate and market variability,
- An optimization of the cover crop multi-functionality and ecosystemic services through biomass inputs and plant species diversification,
- An orientation toward pesticide-free management with a focus on herbicide suppression and test of organic inputs (i.e., bio-fertilizer and pest bio-control).

Promoting plant diversity and cropping system diversification

The Platform is also the foundation of one of the largest diversity of annual crops and cover/relay crops in the region. Our genetic bank comprises ~ 50 species and 335 cultivars of soybean, aerobic rice, mung-bean, cowpea, under-utilized species, leguminous cover crops, and grass fodder and cover crops.

Analytical experiments

Analytical studies represent one of the main pillar of the platform (Hok et al., 2015, 2018; Ngoc Le et al., 2018) aiming at assessing and modelling changes in soil organic C & N, soil biota, physical and chemical parameters under conventional plough-based tillage and agroecological systems. Significant improvement of soil ecosystems services are observed under agroecological systems with increase in soil organic C transformation, nutrient cycling and improvement of soil structure.

Sharing knowledge and know-how

The Platform is largely used for field days, technical training for smallholder farmers and development operators but also for academic training with the example of training on the use of the Biofunctool® to assess changes in soil ecosystem services (November 2017), involving Bsc students, lecturer and researcher from RUA, from the Institute of Technology of Cambodia (ITC), researchers from CIRAD and IRD (UMR Eco&Sols), team from CASC and CE SAIN.

Expected impacts and prospects

Advances in Agroecological systems

Agroecology stands for the food system but a large number of households are trapped into commodities (including rice) that bring low income with adverse environmental and social impacts. There is a need to buffer those impacts and priorities are given to the design of organic cropping systems for lowland rice, annual upland crops such as maize, soybean, among others crops.

Appropriate-scale machinery plays a key role for an integrated approach of soil and water management. Activities on machinery should be strengthened at different scale (hand, power-tiller and small size tractor) targeting an agroecological transition of the farming systems in the lowlands and in the uplands while safeguarding the environment and the human resources capital.



Seed swap, seed sharing and seed production of sunhemp

Sustaining seed bank

There is a need to integrate a larger diversity of plants at different time and space (field to landscape), to enhance market connections, to bring options for smallholder farmers maintaining the possibilities for vulnerable communities to earn a livelihood from agriculture and natural resources management. Thus, genetic bank is an essential tool that has to be sustained and promoted to empower rural communities into plant diversity preservation and sharing.

Analytical research

Research studies help to build scientific credibility, strengthen a national network and bring progressively others partners in such dynamic. This is a great achievement emphasizing the need of long-term experiments to conduct high-value scientific studies. The Platform is an useful tool to consolidate such network.

Sharing knowledge and know-how

Along with technical support to farmer groups (Kampong Thom, Preah Vihear and Battambang), the Platform is an efficient tool to share knowledge and know-how through field days, technical and academic training. Pedagogical materials are developed taking stock of experiments, cropping systems designed, plant diversity and machinery used.

Useful links and contacts

For further information, consult our Youtube Channel Soil is Life: <https://www.youtube.com/channel/UCTI6LtmstZEYoQF-Sa4wFIA>

Conservation Agriculture Service Center, Department of Agricultural Land Resources Management, General Directorate of Agriculture: lengvira@yahoo.com; koyra2010@yahoo.com; florent.tivet@cirad.fr

Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN); hoklyda@rua.edu.kh

Supports

French Agency for Development (AFD) through the project Towards Agroecological Transition in South-East Asia (ACTAE), Conservation Agriculture Network in South-East Asia (CANSEA)

The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (USAID), Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN)

UNCCD and the Cambodia Climate Change Alliance, Ecological Intensification and Soil Ecosystem Functioning (EISOFUN), Window for Research and Innovation Projects,