Jeunes Equipes Associées à l'IRD program (JEAI)

Summary form

Team (JEAI)

Acronym: **EcoRubber** Country : **Thailand-LaoPDR**

Full name **Soil functioning changes under tree cultivation: the case of rubber tree in North-East Thailand and Laos.**

Setting up date: JANUARY 2013
First/LAST name of the team leader: **Dr (Ms) Kiriya SUNGTHONGWISES**
Number of researcher/professor *(PhD level except particular context)* : **11 PhD + 6 Msc**
Number of PhD students associated to the team: **5 = 2 Lao Lecturers NUOL + 2 Lao researchers DALAM + 1 Thai researcher LDD**
Full budget requested from IRD: 50 000 €
(if approved by IRD, additional 25 000 € will be provided by KKU)

Home institution 1: **KKU:** Faculty of Agriculture, **Khon Kaen University**, Khon Kaen, **Thailand**
Home institution 2: **NUOL:** Fac. of Agriculture, **National University of Lao**s, Vientiane, **Lao PDR**
Home institution 3: **DALAM: Department of Agricultural Land Management**, Vientiane, **Lao PDR**
Home institution 4: **LDD: Land Department Development**, Khon Kaen, **Thailand**

Partner research unit **(add another block if several research units are involved)**

Full name: Institut d'Ecologie et des Sciences de l'Environnement de Paris **(IEES-Paris, ex-BIOEMCO)**
Code: UMR 242
First/LAST name of the unit director: **Prof Luc ABBADIE**
First/LAST name of the IRD correspondent: **Dr Christian HARTMANN**
Host structure and location:
Department of Agricultural Land Management (DALAM), Vientiane, Lao PDR

Full name: Ecologie fonctionnelle et Biogeochimie des sols (**ECO&SOL)**
Code: UMR 210
First/LAST name of the unit director: **Dr Jean-Luc CHOTTE**
First/LAST name of the IRD correspondent: **Dr Alain BRAUMAN**
Host structure and location:
Land Development Department (LDD), Bangkok, Thailand

■ ■ Research project

Title: **Soil functioning changes under tree cultivation: the case of rubber tree in North-East Thailand and Laos.**

Keywords: **tree plantation, rubber tree, soil biodiversity, soil quality, ecosystem services, carbon sequestration, socio economics issues**

■ Summary of the research project (half-page maximum)

Land use is changing rapidly in Thailand and LaoPDR: a fast expansion of commercial tree plantations is observed, particularly rubber tree (*Hevea brasiliensis*) plantations, due to the increasing demand for natural latex on the international market. **Despite the economic importance of rubber tree plantations in South-East Asia (SEA), their social and environmental impacts are still poorly studied.** In LaoPDR there is a transition from conservation forest to rubber tree whereas in Northeast Thailand the transition is from annual cash crops to rubber tree**. To determine whether rubber plantations induce environmental degradations or improvements, the scientific objective of this project is to specify the impact of these land use changes (forest or crop transition) on soil functions related to ecosystems services as well as socio agronomic issues.**

This project on the environmental consequences of rubber tree plantations (LUC) will be organized around four work packages: i) socio-economic consequences ii) soil functional diversity, iii) nutrient cycling and iv) carbon sequestration. The measurements will be undertaken in rubber tree plantations of different ages (chronosequence) or with different management practices. To study these complex and interrelated aspects, our project associates **Thai and Lao lecturers and researchers with complementary skills**: socio-agronomist, agricultural system specialists, tree physiologists, agronomists, soil ecologists, soil physicists and soil microbiologists. **The goal is to strengthen the capacity of this team, in order to study the environmental impacts of any other land use change in the future.** Moreover, the skills of this team will be useful beyond the borders of the two involved countries because ecology and particularly soil ecology is still poorly taught in SEA. To add an ecological flavour to agronomical sciences is particularly relevant in SEA, which undergoes constant land use changes du to economical constraints. **IRD's support will help providing a theoretical and practical background in soil ecology and in recent analytical techniques.**

Beside scientific publications, one of the main capacity building outcomes of this project will be (i) the reinforcement of Lao scientific community via the supervision of Lao PhD and masters students.(ii) the building up of a regional (Lao-Thai) young expert research team **able to address future environmental management challenges in SEA.** One of the expected key academic outcomes will include the development of a master module on soil functional ecology (with common curriculum at KKU and NUOL); a practical outcome will be the tentative design of practices for the sustainable management of rubber tree plantations and associated soil resources.

■ **Association with the partner research unit and coherence with its research program**
(origins, objectives and expected results of the partnership) (half-page maximum)

Our project is an extension of existing scientific collaborations between IRD and local research institutes. In Thailand, IRD-LDD collaboration started in 1995, focusing on soil characterization. The IRD-KKU collaboration started in 2005 about aspects related to rubber tree and rice agrosystems agronomy and ecology. In Lao PDR, collaboration was initiated in 2001 to assess the effects of land use (LU) and land use changes (LUC), primarily on soil erosion, water flows and the spread of contaminants and subsequently on plant-related ecosystem services such as slope stabilization, carbon sequestration or soil structural changes.

Currently, 4 IRD researchers and 2 engineers are posted in Thailand and in Lao PDR. They can advise and support the project in the fields related to soils and soil biological and ecological functioning. Moreover, in those two countries, a large part of the IRD programs have components related to tree plantations (rubber tree in Thailand, rubber and teak tree in Lao PDR).

The ambition of our team is to become one of the first (probably at the scale of South-East Asia) to work on the ecological impact of tree plantations in Thailand and Lao PDR. Our research program will complement the activities of the two involved French research units (UMR) dealing with ecology and soil ecology (IEES-Paris and Eco&Sols) and supplement their core skills with the analysis of socio-agro-economical aspects of LU and LUC. Partnership with IRD will increase the proposed team's theoretical background and technical skills in ecology, mainly through co-supervision of Master and PhD students and collective and individual trainings organized in Thailand, Laos and France.

An important outcome will be the development of modules on soil functional ecology common at KKU and NUOL (Master degree level); JEAI support is essential to implement such modules, especially to bridge the knowledge gap of the proposed team in soil ecology and to comply with the local administrative requirements.

■ ■ **Other activities: capacity-building, scientific facilitation, knowledge sharing, transfer of technology** (Team's project summary) (half-page maximum)

As part of the project's kick off meeting (Feb 2015), we will organize a 4-5-day thematic school in Lao PDR, a country considered as a hot spot of biodiversity (even though its is undergoing rapid land use change with a fast extension of cultivated areas). This thematic school will be an opportunity to exchange knowledge and share skills between all permanent members of Eco-Rubber. All members will present their field of research and senior French researchers will be invited to present recent conceptual and practical developments on soil ecology related to ecosystem services. This meeting will provide ECO-RUBBER members with shared body of knowledge that will form the basement upon which we will build up collaboration.

Collective trainings because the team gathers diverse disciplines the collective training will only focus on data analysis (statistical tools) and techniques relevant to the publication of scientific results (such as the use of free software for literature search). These trainings will consist in teaching made by non-permanent or senior advisors, of the team (ex: A. Pierret for statistics using R software), during two-day sessions, one or twice a year for the whole duration of the project. The use of common techniques and tools by all team members will facilitate future data exchange and scientific communication within the team and with the international scientific community.

Individual trainings will only focus on improving team members' knowledge on specifics tools in relation to their field of research (GIS, biological molecular tools, Near Infra-Red Spectroscopy, etc). They will be organised according to each member request. Whenever possible, locally organized training will be promoted (nematodes in Vietnam with the support of USTH and the LMI Rice), microbiology and NIRS in Bangkok with support from LMI Luses) and when necessary, we will apply for specific grants from DPF (BEST, ..) or NRCT (National Research Council of Thailand).

Planned knowledge sharing activities: Scientific seminars will be organized for KKU and NUOL students; presentations will also be organised for farmers, stake holders, *etc*., with contributions from LDD (Thailand) and DALAM (LaoPDR).

Organisation of an international scientific meeting: in 2017, by the end of the project, we plan to organise an international symposium on "Ecosystem Services of Tree Plantations". This workshop will be an opportunity to showcase our results and skills to an international audience, thus to increase our scientific visibility. It will also offer us opportunities to establish international collaborations with other institutions and establish durably the team in the SE context.

1- Description of the team (10 pages maximum)

1- Presentation of the team's origins and its general objectives

The team will present the background of the team's origins (creation or strengthening) and the objectives of the support. It will bring out the adequacy of the team members with its objectives. It will also describe its institutional objectives in a short medium and long term. It will be explained how the project ties into national or regional research priorities.

1. Background of the team's origins

a. Team members and involved institutions

Permanent members: 14 permanent people:
- Thailand: **7 lectures, 2 researchers**; all of them got a PhD diploma,
- LaoPDR: **2 lecturers, 3 researchers**; 4 of them got a master degree and will prepare a PhD during the project.

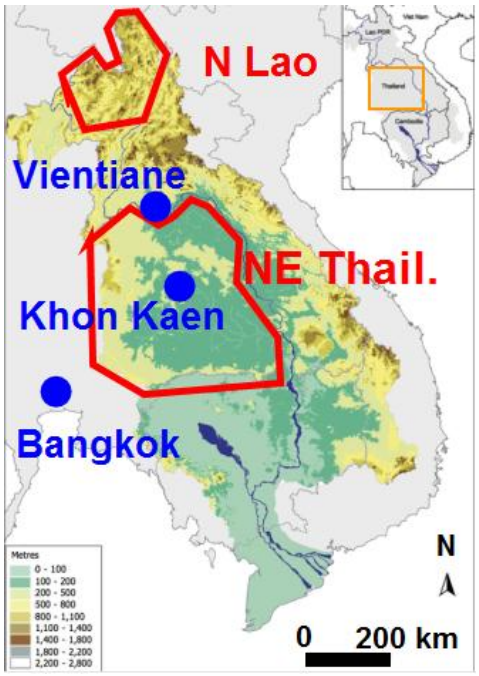
Students:
We expect the participation of 2 Thai PhD students, 3 Thai and 2 Lao master's students, respectively.

Advisors
8 senior researchers (half being Asian, and half being French) for the 4 work packages.

b. involved institutions

The participants come from 2 academic institutions and two technical research institutes.

Khon Kaen University (Thailand) and the National University Of LaoPDR (Vientiane).



Thailand has more than one hundred public and private universities with a total of more than two millions students (>3% of the country population). **Khon Kaen University (KKU)** was created in 1964 and is the largest public university of Northeast Thailand. It is recognized as the leader in teaching and research in a region that represents one-third of the whole country (see the map). It is a comprehensive university composed of seventeen faculties. It has an **international audience, with a curriculum** that has hosted during the last decade about **100 postgraduates (MSc & PhD) from 17 countries**, and nearly **300 trainees from 45 countries** from every continent for **short-term training courses.**

LaoPDR has three national universities and around thirty private higher education institutions for a total of sixty thousand students (1 % of the country population). The **National University of Laos (NUOL)** was funded in 1995 and is still the main university with 11 faculties and around 2,000 staff. NUOL is cooperating with various international universities from Australia (University of Sydney and University of Greenland),

Thailand (Khon Kean University, Chiang Mai University, etc..), Vietnam (Hanoi Agriculture University), The Philippines (University of Los Banos), etc. **NUOL does not yet deliver PhD diplomas**.

DALAM (Department of Agricultural Land Management) and LDD (Land Development Department)

DALAM was created in 2012 as a separate institute from NAFRI (National Agriculture and Forestry Research Institute, created in 1999), under the authority of the Ministry of Agriculture and Forestry and has less than one hundred staff. It is mandated to undertake survey, classification, zoning, protection, rehabilitation, management and development of agricultural land. More specifically it is in charge of the development and management of agricultural land based on sustainable green development, the formulation of laws, rules and legislations related to land use, planning, development and management. It has also the mandate to formulating plans and management measures to prevent soil erosion, degradation of soil quality, change in watershed ecosystem, deterioration of water sources, and adverse impacts on environment. DALAM is also in charge of a soil and plant analysis laboratory.

LDD was created in 1963, it is now under the authority of the ministry of Agriculture and Cooperatives. It is responsible for soil survey and classification, soil analysis, land use planning, conducting experiments and carrying out various aspects of land development and assisting farmers in soil and water conservation practices and soil improvement. This mission targets the following objectives (i) to increase abundance and fertility of land resources together with maintaining environmental quality to be a secure, safe and sustained production base (ii) to increase the potential and opportunity to access knowledge among staff, farmers, and communities in order to encourage network creation and self-reliance. It has around 2 000 staff and more than 30 experimental stations in all the provinces of the country.

c. Team origins

First step: from individual to informal group: the Franco-Thai project

Originally, **we were five young KKU lecturers** (<35 years at that time) with only master's degrees (from Thai universities) who were **selected by KKU to prepare our doctoral thesis (PhD) in France** (Universities of Avignon, Clermont-Ferrand, Montpellier, Paris VI). We completed our PhDs during the period 2005–2010 with funding from the French Ministry of Foreign Affairs in collaboration with the Thai Ministry of Research (Franco-Thai project). We all had IRD co-advisors and four of our research subjects were related to rubber trees in Northeast Thailand (tree ecophysiology, tree root system, soil functional biodiversity, intercropping effects on nutrient cycling); the last one was related to functional biodiversity of paddy fields located in Northeast Thailand.

Second step: from informal group to a KKU junior group

KKU and its faculty of agriculture were committed to promote a research group devoted to rubber tree production in Northeast Thailand and particularly on farmer's production as well as on its environmental consequence. This commitment was related to the on going extension of rubber tree plantations in Northeast Thailand and in neighbouring countries (Laos and Cambodia); and because KKU is the largest university in the region, local policy makers and rubber tree farmers have high expectations for knowledge sharing and relevant recommendations that KKU scientists can provide.

After getting our PhDs, we resumed our positions as lecturers at KKU. Based on our common background of having studied in France and mainly on rubber, we formed an informal working group further recognised under the name "Thai-French rubber project" by KKU, which provided a specific meeting room equipped with all facilities (computer, etc.) to work together and with our students.

Third step: constitution of a multi-institutional and regional research group on soil functional ecology related to agro-economy and ecosystem services

The executives of the Faculty of Agriculture supported our plans to apply for JEAI support. To strengthen our group, they also suggested we work with (i) researchers from LDD in order to strengthen our expertise in soil, and (ii) lecturers from NUOL in order to increase our scientific regional impact and researchers from DALAM to increase extension of our technical recommendations. KKU and LDD region 5 + DALAM are located at the same place, and less than 200 km lie between Khon Kaen and Vientiane (where NUOl is located). This geographic proximity, combined with mutual interest of NuOL + KKU ON ONE SIDE and LDD + DALAM ON THE OTHER SIDE, in agricultural sciences and their long bilateral partnership together and with IRD researchers, made this association particularly relevant for us.
Such multi-institutional and regional association around a common scientific research topic is highly innovative in the Thai/Lao institutional context and is fully in ,line with the current ASEAN (Association of South-East Asia Nations) policy to create regional cooperation and to facilitate South-South cooperation.

2. Objectives of the support.

a. Scientific objectives:

To develop in our universities and institutes **an integrated approach of agroecosystems using modern tools (molecular, NIRS, GIS etc.) in an ecological perspective.**. This objective will be achieved through:
(i) academic support such as creating a specific module on Soil Ecology at the Master's level in common between KKU and NUOL with co-supervision of PhD students, teaching, seminars, conferences, etc…
(ii) support for capacity **building** (individual trainings, thematic schools, technical support including the possibility of buying new equipment).

b. Institutional objectives:

- Create a pluri-institutional and inter-disciplinary research team on a regional scale dedicated to the study of environmental impacts of cash crops on soil resources and associated ecosystem services (tree plantations will be used as a model for this project as the trees are 'cash crops');
- Strengthen Laotian scientific and academic potential on soil science, soil ecology and ecosystem services linked to agriculture practices, using a process of "learning (research) while practising";
- Increase the independence of the young Southeastern researchers by providing experience in conducting international research projects with a high level of autonomy;
- Transfer the results obtained on the functioning of rubber tree plantations to farmers in collaboration with local institutions like LDD (Thailand) and DALAM (LaoPDR);
- Strengthen regional French-ASEAN cooperation in the context of ASEAN integration.

3. Relevance of the team with regard to its objectives

Proposed team members have complementary scientific skills (cf. next section) and most of the analytical and technical tools already exist in one of the institution.
Most of the members have a common academic history (master's at KKU, PhD in France) and on-going collaboration with IRD researchers.
All of them have already written papers or scientific reports in English and all of them are mostly (but not fully) fluent in spoken English (their master's or PhD studies were written English). Consequently they are able to communicate with the scientific international community and advisors. All of them have international experience (master's, PhD, training or seminar).
We could highlight that all of them have an excellent knowledge of the local agricultural practices because a part of their duty is devoted to knowledge transfer to stakeholders and farmers.
Moreover, the people of Northeast Thailand and Laos share the same culture, which explains why the Thai language is quite similar to Laotian. This common cultural background and especially the absence of language barrier is a key point for the success of this international team because they will not have to deal with cultural misunderstandings.
Thus, this team (i) **has a sufficient scientific background to work in a research team related to international scientific issues** such as environmental impact of agriculture (ii) **has already**

begin to develop relationships with the international scientific community (French but also Germany, Japan, Indonesia, Philippines, etc.).

4. Institutional objectives in a short medium and long term.

ECO-rubber researchers come from four institutions, with each institution having institutional objectives that are also complementary:

- **KKU: (i)** to make the research group visible and recognized in the national and international scientific community) **with high score at the Key Performance Index (KPI) (ii)** to develop a new master's module about soil ecology that will be original at ASEAN level and that takes into account the agro-economic context, including the perspective of payments for ecosystem services; and **(iii)** to suggest alternative practices for rubber plantations in the marginal context of Northeast Thailand (preserving both latex and wood production and soil sustainability and resilience).
- **NUOL: (i)** to increase the scientific level of the lecturers by getting PhD diploma and involving them in the international scientific community as this improvement will also increase the scientific level of the students; (**ii)** to improve the technical infrastructures for teaching and making research in the field of agriculture and ecology.

- **DALAM/LDD**: **(i)** to get information collected by national researchers on agro-ecological consequences of rubber extension (and deforestation in LaoPDR), **(ii)** to get a group of experts able to check the maintenance of environmental quality and soil resources in the context of fast land use changes, **(iii)** to provide relevant recommendations to farmers and stakeholders concerning deforestation and rubber tree plantation.

5. How the project ties into national or regional research priorities.

a. University research priorities

KKU: To replace retiring professors, Thailand launched a program named **Royal Golden Jubilee** (RGJ, http://rgj.trf.or.th/) aimed at attracting the most talented students to attain a PhD with international standards. To assure this program maintains high academic standards, only those Ph.D. advisors with good research records who have co-advisors or collaborators in recognized universities abroad will be awarded RGJ-PhD grants. To get RGJ grants for their students, **KKU must have recognized lecturers and professors.** Consequently, to evaluate the quality of its staff, KKU applies the system of the **Key Perfomance Index (KPI)** (see appendix) that rewards international publication and collaboration, successful fund seeking, and practical outcomes of the research. **The JEAI project will help us to increase our KPI score and allow us to get RGJ grants. The current "Junior team" will hopefully become an "Expert team" able to attract better students. In short this JEAI project will build up a sustainable and long lasting research team on environmental impact of tree plantation. .**

NUOL: the priority of the university is to improve the academic level of the lecturers and students, and to evaluate their activity with international standards of KPI (accurate data collecting and management using up to date statistical and computer techniques, setting up interdisciplinary teams, publications in peer reviewed journals, etc…). This project will allow the staff and students to be involved in interdisciplinary and international team while conducting their research in LaoPDR and thus simultaneously improve the knowledge on the quality of soil resource in the country that is lacking of accurate information.

b. Technical research institute priorities

LDD: The Ministry of Agriculture and Cooperatives has assigned LDD to increase its scientific level in order to also attain international standards of research. As rubber plantations have the highest expansion rate of all agricultural products, LDD/DALAM need to increase their skill to address the unpredictable consequences of this extension on soil resource sustainability and quality. Knowledge of the possible ecological consequences of this fast extension is also a national priority of the Thai research system.

DALAM: In December 2004, the Government of Lao PDR endorsed the National Agricultural Biodiversity Program (NABP) as a policy document. The primary objective of this program was to maintain the country's biodiversity since "this biodiversity should provide the key to poverty alleviation". The main objectives of NABP were to: 1. Improve biodiversity data and fill data gaps through basic and applied research; 2. Improve biodiversity management and monitoring. The 2010 report highlighted the lack of biodiversity surveys due not only to insufficient human capabilities but also to insufficient technical capability[*]. Indeed, Lao PDR is currently ranked 138 out of 187 countries by the United Nations for Human Development[†]; but simultaneously, this country is also one of the 10 "top movers" in the world in terms of progress on human development during the past 20 years. Therefore, this JEAI project fits perfectly with the practical needs and priorities of Laos: by improving research ability of the staff and facilitating the access to update technical and equipment facilities available at KKU and LDD kind to this partnership.

c. Regional priorities: ASEAN (Association of South-East Asia Nations) policy

The countries involved in this project **face an important regional issue in 2015.** At this time, they will participate in the establishment of the ASEAN economic community, which includes a policy[‡] to **develop common curriculum, exchange of students, scholarships in order to launch a unified education system in 2015,** etc. This explains why this project is crucial for the Asian institutions involved. Moreover, this project fits perfectly with the ASEAN official policy, which is to stimulate **South-South cooperation**: "In addressing issues pertaining to rural development and poverty eradication and in narrowing the development gap in the region, a more concerted effort by Member States in the spirit of 'ASEAN Help-ASEAN' has been stressed".

[*] "there were relatively limited research on biodiversity conducted due to the insufficient technical capability and lack of funds. For example, public investments in research and technology development was absent in the budget plan 2007-2008, hence aggravating funding constraints for research & development which is critical in enhancing technical capability development in the country." (p39):

[†] http://www.la.undp.org/content/lao_pdr/en/home/mdgoverview/

[‡] http://www.meti.go.jp/policy/trade_policy/asean/dl/ASEANblueprint.pdf (p70)

2- Presentation of the team's activities

The team will present the strategy and the planned activities in terms of capacity-building, scientific facilitation, knowledge sharing and transfer of technology. The team will explain how the implementation of these different activities will help structure the team and strengthen it.

Currently, the development of interdisciplinary research group is difficult because research institutes and faculties are dedicated to specific and mostly 'traditional' scientific domains that do not yet include Soil Ecology. The co-funding by IRD and KKU inside ECO-RUBBER will provide the financial possibilities for Lao and Thai partners to form, inside their faculties of Agriculture, an original multidisciplinary research group related to soil functional ecology at a regional scale.

To help reaching this objective, **KKU has committed itself to provide a budget equivalent to half DPF's budget. Consequently, we developed a strategy to fit the scientific, academic and practical objectives to a 75 k€ budget**.

Our strategy is:
1. To build common fundamental knowledge and skills by organizing a thematic school at the beginning of the project in order to exchange knowledge between all team members;
2. to promote interactions between people and disciplines by:
   - planning field work, collective trainings and seminars at periods where most of the team members can be working together at the same place and at the same time ;
   - organising common supervision of master and PhD students by researchers from different institutions and/or research domains;
   - setting up a module dedicated to soil functional ecology that takes into account ecosystem services and socio-economic aspects existing in Thailand and LaoPDR.

Because of the large participation of lecturers, we planed the ECO-RUBBER activities in order to respect their tight agenda (cf. Fig. 1). At the same time, lecturers have an easier access to master students, which participation will facilitate many field and laboratory works inside our project.

1. Research strategy
The research strategy is summarized in Figure5. The project will start with a survey of farmers' practices and soil characteristics in order to choose
(i) one chronosequence to study the long term impact of rubber tree on soil functioning
(ii) a set of fields based on the surveys of agricultural practices where the environmental impact of these practices will be assess

In parallel, an experimental agronomic layout will be set up in order to better address the impact of agricultural practices such as intercropping on soil and tree functioning.

Sampling procedures will be decided during the kick-off meeting in order to provide data that are relevant for all scientific fields and that can complement each other (same depths, or same position compared to the trees, etc).
Data acquisition: To avoid any basic mistakes or misunderstanding data acquisition, will be done under the supervision and cooperation with the different senior advisors (Lao/Thai and French).
Data analysis: initial data analysis will be done during collective trainings with the participation of all members and students so that data analysis could be done with similar procedures for each participants; doing like this we expect easy communication between people and easy and fast data sharing and collective paper writing.

2. Teaching strategy
A thematic school will be organised at the beginning of the project with a multidisciplinary scope (soil science, soil functional ecology and ecosystem services); lectures will be given by the

permanent researchers, some of the senior advisors and some well recognised French researchers in the field of soil functional ecology.
During this thematic school, we will plan the collective trainings and also identify the needs for individual trainings and plan their organisation during the project.
All along the project, we will set up a common module about functional ecology at Master level: this innovative knowledge will be introduced progressively in our lectures (KKU & NUOL), at the end of the project (academic year 2017-2018) we should have a module especially dedicated to soil functional ecology that takes into account ecosystem services and socio-economic aspects. ***This fit perfectly with the goal of KKU university to become a centre of excellence in Ecological sciences at ASEAN scale.***
Selected and motivated students attending our lecturers will contribute to the research work by collecting data and carrying out laboratory analysis (Master students) or will be more fully involved in the research project (PhD).

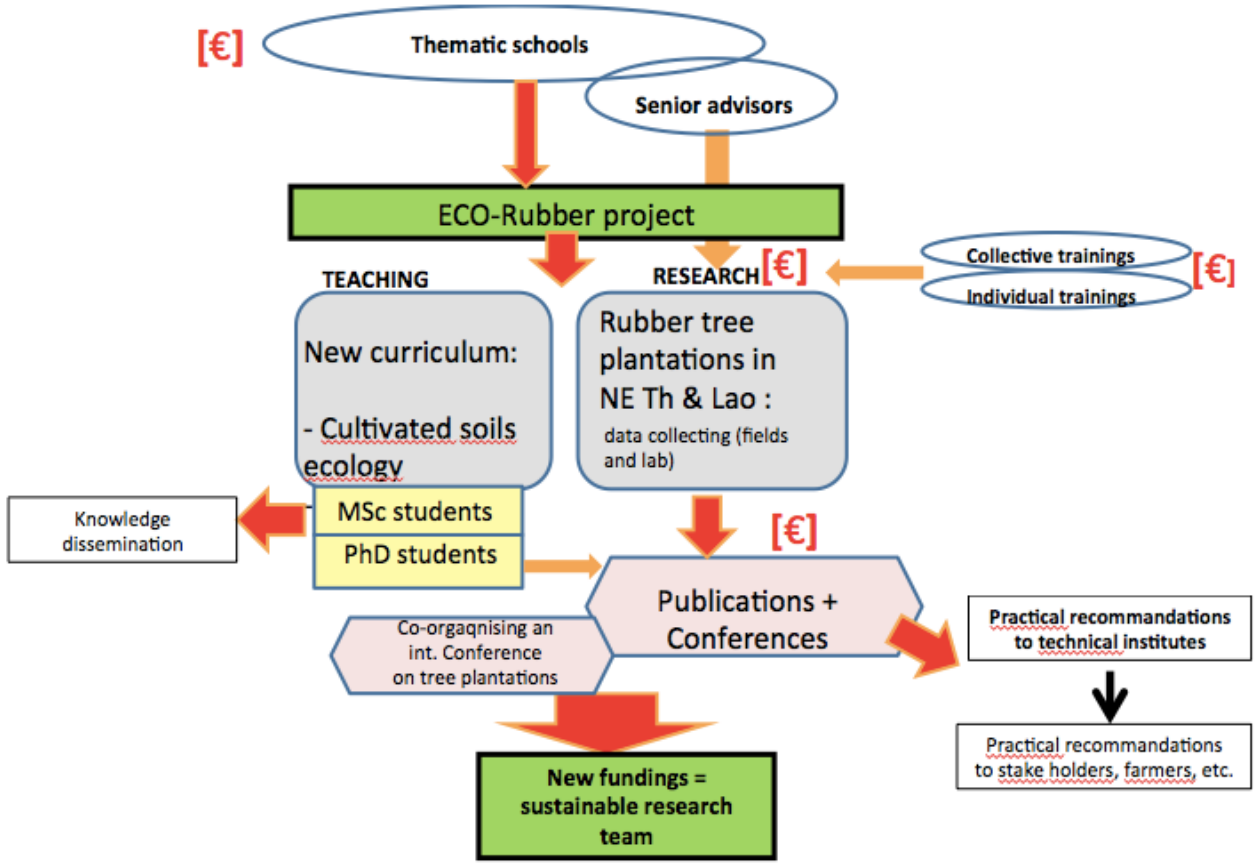


Figure 1. Research and training strategy of ECO-rubber team. Actions or activities funded by JEAI are indicated by [€]; JEAI budget consist in AIRD +KKU funding, i.e. 75 k€).

3. Planned activities

YEAR 1

1- **Organization of a kick-off meeting** * (4-5 days) of the JEAI ECO-RUBBER in Khon Kaen with the following organization

* For collective and thematic school, we will benefit from the expertise of IRD colleague (such as Alain Brauman, who have a recognize expertize in the organization of international thematic school (http://www.ecoltrop.ird.fr/microtrop2012.html).

a. Thematic schools based on lectures on **concepts and ideas related to soil functional ecology and ecosystem services**. The lectures will be given by permanent participants, their advisors and also invited senior researchers depending on the co-funding we will be able to get.
b. Collective training on "the use of public domain software for literature search"
c. Determination of a common sampling strategy for biotic and abiotic measurements
d. Plan the schedule of sampling and individual training of year 1

2) **Farmers' survey in Thailand and Laos** on agricultural practices and economical issues related to rubber plantation

3) **Individual training** based on the schedule and decision of the kick of meeting.

4) **Set up of the experimental agronomic site** (plantation of 5 differents intercrops; see scientific description)

NB: The site has already been chosen in 2014 by the KKU rubber team. The site of 5 ha is located in the an important site of rubber production. A first tree and soil characterization of the site will be undertaken in 2014

5) **Soil Sampling in the raining season** (Sept-Nov 2015)
   a. In the rubber chronosequence (this chronosequence has been defined in 2014 during a master thesis)
   b. In the experimental agronomic site (year 1)

6) First soil and biodiversity analysis

YEAR 2

1- Annual meeting year 2 (Laos-Vientiane)
   a. Module of soil ecology: Lectures on soil ecology, soil physics, ecological intensification
   b. Presentation of results of year 1
   c. Based on this results, schedule of year 2 in terms of farmer's survey, field sampling, collective and individual trainings*.
   d. 1nd Collective training on data analysis (univariate statistics)

2- **Classification of Thai and Lao farmer's practices** in ecological categories based on their level of intensity (tillage, use of insecticides, OM utilization etc..)

3- Sampling of rubber field
   a. In Thailand:
      i. In the experimental agronomic site (year 2)
      ii. In the different farmer's field (based on the classification done in § 2)
   b. In Laos: In farmer's field based also on the results of farmers' survey. In Laos, a special emphasis will be laid on comparing rubber trees with a forest site
   c.

4- Field and laboratory analysis

5- **2rd Collective training** on data analysis (multivariate analysis)

6- **Individual training** (techniques link to the monitoring of soil diversity)

YEAR 3

1- **Annual meeting year 3 (Khon Kaen)**
   a. Module of soil ecology: Final Lectures on soil ecology and ecological services
   b. Presentation of results of year 1+2
   c. Schedule of year 3 (sampling, valorization)
   d. Collective training on how to write an English paper

2- **Soil Sampling**
   i. Thailand : In the experimental layout of Buriram (year 3)
   ii. In Laos: end of farmer's field sampling

3- **End of Data analysis**

4- **Organization of "English Writing Meeting"** to stimulate publication of the data

5- **Organization of knowledge sharing meeting**** with Thai and Lao farmers

6- **Organization of an international symposium on "Ecosystem Services of Tree Plantation" at the end of our project in 2017.** This meeting will be an opportunity to showcase our results and skills to an international audience, thus to increase our scientific visibility. It will also offer us opportunities to establish international collaborations with other institutions and durably establish our team. This symposium will be organised in collaboration with other institutions such as:
   - Thai Universities involved in Rubber research such Kasetsart and Prince of Songkhla,
   - French Universities (Univ. de Clermont Ferrand, Université de Nancy)
   - The Hevea Research Platform in Partnership* (HRPP, KKU and IRD are associate member of this organization leaded by a colleague of CIRAD from ECO&SOLS

*** Individual trainings**: individual trainings will allow each member to increase his skills in up to date ecological techniques (molecular tools for biodiversity surveys, Near infrared spectroscopy for C sequestration, GIS, etc) These individual trainings will be decided in relation with the team advisors (Asian and French senior scientists based in Thailand and Laos). The cost of those trainings will be covered partly by the JEAI budget and will be complemented by other AIRD tools and grants (BEST, etc…).

*****Knowledge sharing***

- Presentations will be organised for the farmers, stakeholders. **It is noteworthy that such knowledge dissemination to farmer and stakeholders is already a current duty of most of the permanent team members..**
- Participation to international symposium linked to our scientific thematic (tree plantation organized by IUFRO†), soil ecology (Soil Ecology Society Conference), World Congress of Soil Science (WCSS) etc..

4. How the implementation of these different activities will help structure the team and strengthen it.

We consider that a structured team is a team where each member knows:

1. what is the goal of the team,

* A franco-thaie netwok of 15 higher education and research institutes working togethjer on Natural Rubber production and transformation.

† International Union of Forest Research Organizations

2. which position she/he has compared to the other members,
3. what she/he can bring to the team,
4. what she/he can expect from the team,

in order to efficiently reach the goal, and keep synergy and harmony between all team members.

The goal of our ECO-RUBBER team is to conduct agronomic research with an ecological perspective (integrated approaches) and to conduct this research with up to date technologies **tools**, so that these results can be published in **international ecological or agronomical peer reviewed journals**.

The different activities proposed in this project will promote interdisciplinary exchanges: the distribution of the young researchers within different scientific domains or institutions, which have different policies, does not promote the level of exchange needed in a scientific team. The activities described above will tackle this issue by **promoting dynamic exchanges between the researchers of ECO-RUBBER**. Even if the team members are working for different institutions and in two countries, they will communicate and meet regularly to participate firstly to the thematic school and secondly to the different collective trainings; during these meetings all members will interact and see what they can bring to reach the common scientific goal and what they can expect. Thirdly, members will also have to keep in touch to coordinate and realize the field and laboratory works (to be together for simultaneous soil and fauna sampling for example).

We will **favour multi-way scientific exchanges**, and not a one way, as it can sometimes be the case. For example, the local knowledge on farming practices and soil quality of the partners from LDD/DALAM is essential for the understanding of how changing activities affect soil quality (LDD IRD) and C turnover (KKU CIRAD). Similarly, knowledge of soil ecology (KKU NUOL IRD), farmers practices (LDD DALAM NUOL KKU) and rubber physiology (KKU-CIRAD) is essential to understand the nutrient soil status (NUOL DALAM LDD KKU) and microbial diversity (IRD-KKU) of the soil. It is clear that the value of the whole exceeds the value of the sum of each separate part of this project. In other words, by bringing together this group, there will be a real advance in scientific knowledge generation and in technological transfer, and also in learning and sharing knowledge about concepts of functional ecology that will be useful for our future research programmes.

3- Team's assets and weaknesses analysis

The team will analyse the team's assets and weaknesses and describe the strategy the team will implement to develop its outcomes and makes up for its weaknesses. Specify team's needs in terms of capacity-building.

1. The team's assets

a. Budget

Strong financial support from KKU that will provide 25 k€ if the project is accepted by AIRD (see the commitment letter).

Possibilities to fund - supplementary funding from diverse organisations: AIRD (grant BEST), French Embassy (PhD or master's students, travelling costs for thematic schools), or local NRCT funding (to cover operating costs), TRF (Thailand Research Fund agency support Thai and Laos PhD students via the support of the "Rubber network" of HRPP for PhD grant).

b. Teams members

A Thai-French identity: Members share a common background as group participants within the Franco-Thai project

Strong link with IRD and French research institutions: Our team is emerging from the constant support of IRD in Thailand and Laos and also Franco-Thai grants. Thus it is composed of young scientists who are recent PhD graduates under the supervision of researchers still based in the region or still having relations with us (C. Hartmann, A. Pierret, F. Do, P. Jouquet, C. Hammecker, etc…). Many lecturers from NUOL have also strong contact with France, one Lao advisor (Pr Silinthone…) is an official member of IRD CORA committee. We have thus developed trusting connections with IRD and previously hosting laboratories in France (IRD Bondy and Montpellier, Univ. of Avignon and Clermont-Ferrand) and we are very enthusiastic about continuing such international cooperation. We also already established friendly relations with the Lao member of the team during the preparation meetings that brought all of us together.

A multidisciplinary team able to tackle environmental issues: our team constitutes a large group with many disciplines involved that can consequently study different aspects now and in the future; and this large group should also be more sustainable than a small one: even if some members are absent or move to different positions, the group will be able to go forward.

Expertise on Rubber Science: rubber science is currently dominated by tree physiology, clone selection and agronomy. Due to the multidisciplinary aspect of our group, we have the potential to address original environmental issues that are not yet addressed by other Institutes. Indeed, our group has already expertise on tree physiology and soil biological activities under rubber tree plantations (4 PhDs in this field in Thailand, several reports by Lao lectures)

Soil physical characterization: there is a lack of soil physicists in South-East Asia, but LDD has some eminent specialist such as Mrs Siltacho who will join the team; this will allow a multidisciplinary approach which is the main originality of this project. In LaoPDR they are no researcher specialized in soil physics but DALAM has set up a soil physic section that can make classical characterization under the supervision of IRD coordinator (C. Hartmann).

A relatively good level in written English: all of us have already written theses, reports and papers in English.

Direct access to students: most of us are lecturers, thus we have facilities to identify good and motivated students able to work on our project.

No language barrier: North-East Thailand and LaoPDR share a common history; nowadays the Lao language is still currently spoken in North-East Thailand (where it is called 'Isaan' dialect). As we do not need English to communicate, this will be strong advantage to exchange students and to work in each other's field or laboratory.

c. Institutional support and facilities

Strong institutional support from KKU and NUOL to implement a new module on Soil Ecology: KKU has already provided a fully equipped office at the faculty of Agriculture for the team members, the advisors, lecturers and trainers and trainees.
KKU has already an evaluation system called 'Key Performance index' (KPI) that is rewarding research and teams that are able to fit with international standards, i.e. that have publications, get finding out of KKU, publish books or provide documents for stakeholders.
Scientific facilities: KKU and LDD have scientific facilities (up-to-date equipped laboratories) and easy access to rubber plantations and farmers. LDD has developed databases on soils (types, variability) and on rubber plantations (location and extension) and has recently developed with the help of LMI LUSES a molecular laboratory in Bangkok. Equipment existing in Thailand are accessible the Lao team members and their students as the distance between us is short (2-3 h by road) and there is no language barrier so even technicians and students of any level can speak together without any limitation.
Academic system is now unified at the scale of all ASEAN countries and frontiers are opened so that people can travail without administrative barriers. Universities in LaoPDR, Thailand and all the other ASEAN countries have unified their school's schedule. Thus, lecturers, researchers and students can more easily travel from one country to another.

2. Team's weaknesses

a. Funding:

International funds are now difficult to get for research projects

- in Thailand because it is considered an emerging country
- in LaoPDR because the laboratories are lacking some facilities.

Transportation in LaoPDR is costly**,** the rubber plantation located in North Laos (a region that is currently deforested and losing it biodiversity) can only be accessed by air

b. Scientific

The interdisciplinary approach is rather novel in Asian universities. Our research work is organized individually and consequently, we have few common publications.

Ecology is not yet taught and recognized in the universities.

Lack of Soil ecologist in LaoPDR

c. Students supervision

Access to student: Because most of the Thai and Lao students do not speak good English, we face many difficulties finding, especially in the agronomical sciences, PhD or even master's students who agree to be supervised by foreigners scientist

3. The strategy to develop our outcomes and makes up for our weaknesses.

a. To make up for our weaknesses we are going to:

- Funding: difficulty to raise funds we will use the 'JEAI' label as a proof of trust from IRD to apply to complementary and specific grants or scholarship (French embassy, Thailand Research Fund). For operating costs, the project will benefit for soil diversity analysis from a part of a project already funded (French Rubber association) but only in the first year (2015). Some of the cost, like soil analysis will be covered by LDD.

- *Scientific*: lack of interdisciplinary approaches and lack of teaching in ecology: This issue will be mainly address by the lectures given by the senior advisors who all have experience in interdisciplinary work.
Access to student (English language): *Rubber will promote co-supervisor of students in order to avoid the barrier language.* Moreover specific training in English will be delivered. We will use Lao and Thai languages as communicating languages for work in the field and laboratory.
Lack of Soil ecologist in LaoPDR: PhD from Lao scientist will be a priority of the ECO Rubber team

b. To develop our outcomes, we are going to:

1- Apply to become a Center of Excellence under the KPI systems* and thus get new funding to cover the operating costs and purchase of equipment,
* *KPI systems KKU has a policy to reward the researchers and research groups that have a high score at their KPI (Key Performance Index), If the team increase their production of scientific papers the ECO-RUBBER group will become a 'Center of Excellence' and will access to specific funding*

2- Apply for new funding and grants at the national and international level (French Embassy or the Golden Jubilee program of Thai Research Fund to enrol new PhD students from South-East Asia).

3- Increase knowledge transfer to society (stakeholders, farmers, etc.) through close contacts with technical institutes (NAFRI, RITT, etc.) and organisation of seminars and training.

4- Increase the capacity building of Lao partners: a part of the JEAI budget will devoted to the the development of the soil laboratory of DALAM that is currently benefitting from IRD expertise to get an international accreditation.

4. Team's needs in terms of capacity-building

(in this section we have summarized information already presented along the document as capacity building is one of the main objective of our project)

Collective trainings first devoted to data analysis, secondly to increase our skills in all aspects related to scientific papers writing in peer-reviewed journals (using R software to organise and analyse data; using univariate and multivariate statistical analysis, using bibliographic web tools like Web Of Knowledge, Endnote, Zotero or Mendeley; etc…).

Individual training Provide some team members with specific improvement of their technical skills *for soil diversity:* soil molecular diversity using barcoding of macrofauna, or high throughput sequencing analysis for bacteria or fingerprints technics)
For Nutrient cycling: use of Plant Roots simulator (see task 3),
For C sequestration: use of Near Infrared spectroscopy (see task 4)

4- Team's publications (that is, common publications to at least 2 team members)

International peer reviewed publications between two permanent asian members.

Boithias L., Do F.C., Isarangkool Na Ayutthaya S., Junjittakarn J., Siwaporn S. and Hammecker, C. 2012. Transpiration, growth and latex production of a *Hevea brasiliensis* stand facing drought in northeast Thailand: The use of the WaNuLCAS model as an exploratory tool. *Exp. Agr. 48(1):49-63.*

Do F.C., Pierret A., Couteron P., Lesturgez G., Boithias L., Isarangkool Na Ayutthaya S., Junjittakarn J., Gonkhamdee S., Maeght J. L., Hartmann C. and Nandris D. 2011. Spatial distribution of Hevea brasiliensis trunk phloem necrosis within a plot: aggregation but no evidence of constraint on cumulated growth. *For. Path. 41: 90–100.*

Hao, H.T., Hartmann, C., Apichart, J., Siwaporn, S., Promsakha, S., Richard, G., Bruand, A., Dexter, A.R., 2011. Slumping dynamics in tilled sandy soils under natural rainfall and experimental flooding. *Soil & Tillage Research* 114, 9-17.

International symposiums

Do F.C., Pierret A., Couteron P., Lesturgez G., **Isarangkool Na Ayutthaya S.**, Junjittakarn J., **Gonkhamdee S.**, Meaght J.-L., Hartmann C., Pannengpetch K., and Nandris D. **2006**. Rubber tree Trunk Phloem Necrosis (TPN) in Northeast Thailand: 2. Within-stand characterisation of affected trees. *Proceedings of the International Natural Rubber Conference – IRRDB annual meeting, 2006 November 13-17, Ho Chi Minh City, Vietnam, p. 157-170.*

Pierret a., Ribolzi O., Gonkhamdee S., Vigiak o., Isarangkool Na Ayutthaya S., Pannengpetch k., Sengtaheuanghoung O., Maeght j.-l., Bourdon E., de Rouw A., Do F., Nandris D., Valentin C., Noble A. D. (2009) Interactions between agriculture and soil hydrology: Challenges and opportunities for a sustainable management of environmental services in Southeast Asia. 2nd International Conference Biohydrology 2009 -A changing climate for biology and soil hydrology interactions - Bratislava, Slovakia. September 21–24, 2009..(Abstract available from:http://147.213.145.2/biohydrology/abstracts2009/Pierret_S3_K.pdf).

■ ■ 5- Permanent team members

	LAST Name	First Name	Higher degree (date)	Institution/ employer	Position in the team	Thematic field	% time
Task1:							
Ms	PROMKHAMBUT	Arunee	Ph.D. 2010	KKU	Task leader	Agro-economy	30
Mr	PHASOUYSAINGAM	Avakat	MSc 2010	NUOL	Lecturer + PhD	Agro-economy	90
Mr	SAYSONGKHAM	Sayavong	MSc 2012	DALAM	Researcher + PhD	GIS	50
Mr	CHANPHENGXAY	Alounsavath	MSc 2006	DALAM	Researcher	Soil Science	20
Task2							
Ms	NIMKINGRAT	Prakaijan	Ph.D. 2012	KKU	Task leader	Nematologist	30
Mrs	CHOOSAI	Chutinan	Ph.D. 2011	KKU	lecturer	macrofauna	25
Mr	WONGCHAROEN	Anan	Ph.D. 2011	KKU	lecturer	Macrofauna/fungi	20
Ms	PEERAWAT	Monrawee	Msc 2001	LDD	Researcher + PhD	Microbi./nemat.	90
Ms	SIBOUNNAVONG	Phoutthasone	Ph.D. 2012	NUOL	lecturer	Microbiology	30
Task3							
Mrs	**SUNGTHONGWISES**	**Kiriya**	**Ph.D 2008**	**KKU**	**Project leader Task leader**	**Nutrient cycling; eco-physiology**	**50**
Mrs	SILTACHO	Siwaporn	Ph.D. 2012	LDD	Researcher	Soil physics	20
Mrs	TAWEEKIJ	Sukanya	Ph.D. 2006	LDD	Researcher	Agronomy	20
Mrs	SISOUVAN	Phimmasone	MSc 2010	NUOL	Lecturer + PhD	Soil Science	90
Task4							
Ms	LAWONGSA	Phrueksa	Ph.D. 2010	KKU	Task leader	Carbon seq	30
Ms	GONKHAMDEE	Santimaitree	Ph.D. 2010	KKU	Lecturer 4	Root system	25
Mr	ISARANGKOOL NA Ayutthaya	Supat	Ph.D. 2010	KKU	Lecturer 4	ecophysiology	25
Mr	SOULIYAVONGSA	Xaysatith	MSc 2010	DALAM	Researcher + PhD	Soil Science	50

Task 1: socio-economic - **Task 2:** soil functional diversity - **Task 3:** nutrient cycling - **Task 4:** C sequestration

Note that:

1. all task leaders are lecturers ;

2. lecturers have 50 % of their time devoted to lecturing; thus à 50 % of their time devoted to the project means 100 % of their research time.

3. 'Lecturer + PhD' or 'Researcher + PhD' indicate a team member already having a position and allowed to prepare a PhD by its institution.

■ ■ 6- Non-permanent team members (host researchers, PhD students…)

Senior advisors

	LAST Name	First Name	Higher degree (date)	Institution/ employer	Position in the team	Thematic field	% time
Task1:							
Mrs	SACKLOKHAM	Silinthone	Prof	NUOL	advisor	Socio-economic	15
Mrs	CHAMBON	Bénédicte	Dr	CIRAD	advisor	Socio-agronomy	15
Task2							
Mrs	HANBOONSONG	Yupa	Ass. Prof.	KKU	advisor	Macrofauna	15
Mr	BRAUMAN	Alain	Dr	IRD Eco&Sols	advisor	Soil ecology	30
Task3							
Mr	TRELO-GES	Vidhaya	Ass. Prof.	KKU	advisor	Soil Science	15
Mr	DO	Fréderic	Dr	IRD Eco&Sols	advisor	Tree cophysiol.	15
Task4							
Mrs	VITYAKON	Patma	Prof	KKU	advisor	Soil Science	15
Mrs	PIERRET	Alain	Dr	IRD IEES Paris	advisor	Root C seq	30

Already identified students

Task3							
	Kaeojunla	Wasithi	BSc	KKU	MSc student	Nutrient cycling	100
Task4							
Ms	Puttaso	Porntip	BSc	KKU	MSc student	C. stock and root density in Thailand	100

■ ■ 7- CV's

For each permanent team member, specify: summary of research career, major publications, recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page for each item)

■ CV of the team leader: Assist Prof. Dr. SUNGTHONGWISES Kiriya

Current position:	**Lecturer**
Status	**Lecturer and Researcher**
Institution/employer	**Khon Kaen University**
Type of institution	**Public**
Discipline	**Biology/Physiology and biology of organisms**
Date of birth:	**10th January, 1979**
Town and country of birth	**Suphan Buri, Thailand**
Nationality	**Thai**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

2008-2013 - Growth and yield of peanut intercropping with cassava under rainfed condition at Roi-Et province.
- Reuse Wastewater from Natural Rubber Sheet Production in Northeast Thailand for Agriculture.
- Isolation of Phosphate-Solubilizing Bacteria from difference field crop productions.

2005-2008 Ph.D. (Thesis): Centre international d'études supérieures en sciences agronomiques, Montpellier SupAgro. France, Biological Systems Integration: Agronomy-Environment . Legumes for intercropping with rubber trees: Interaction of the rhizobial symbiosis with phosphorus availability in Northeast Thailand.

2004-2005 Working at KKU (Lecturer)

2000-2004 M.Sc. (Thesis): Agricultural Biotechnology (Kasetsart University, Thailand)

1996-2000 B.Sc.: Agriculture (Kasetsart University, Thailand)

■ Major publications (half-page maximum)

International journals ISI Web of Knowledge

Sungthongwises, K., C. Boonthai Iwai, A. Wongcharoen, A. Promkhambut and D. Lesueur. **2014.** Potential of Native Phosphate Solubilizing Bacteria Isolated from the Rhizosphere of Economic Crops and Vermicast in Northeast Thailand to Solubilize Insoluble Phosphates under *in vitro* Conditions. International Journal of Environmental and Rural Development. **Accepted and Process.**

Sungthongwises, K., M. Matsuoka, K. Ohnishi, S. Tanaka and C. Boonthai Iwai. **2013.** The Potential of Phosphate-Solubilizing Bacteria from the Eggplant Fields. ACTA HORTICULTURAE. **Accepted and Process.**

Sungthongwises, **K.,** M. Matsuoka, K. Ohnishi, S. Tanaka and C. Boonthai Iwai. **2012.** Isolation of Phosphate-Solubilizing Bacteria from difference field crop productions. International Journal of Environmental and Rural Development. 3: 150-154.

Sungthongwises, K., R. Poss and J.J. Drevon. **2011.** Effects of P on *Vigna unguiculata* cv. 305 and *Stylosanthes hamata* cv. Verano symbiosis in the field of a rubber-tree plantation. Asian Journal of Plant Sciences. 10: 357-364.

Sungthongwises, K., R. Poss and J.J. Drevon. **2009.** Relations among growth, nodulation, P efficiency and proton efflux for annual legumes. Asian Journal of Plant Sciences. 8: 335-343.

National journals

Sungthongwises, K., C. Choosai, N. Kaewjampa, S. Isarangkool Na Ayutthaya, S. Gonkhamdee and A. Wongcharoen. 2014. Effects of intercrops under rubber plantation on phosphate solubilizing bacteria diversity and efficiency of IAA production. Khon Kaen Agriculture Journal. **Accepted and Process.**

Sungthongwises, K., A. Polthanee and S. Kaewrahun. **2011**. Growth and yield of peanut intercropping with cassava under rainfed condition at Roi-Et province. Khon Kaen Agriculture Journal. 39: 375-379.

Sungthongwises, **K.,** M. Matsuoka, K. Ohnishi, S. Tanaka and C. Boonthai Iwai. **2011.** Effect of Crop productions on Diversity and Efficiency of Phosphate-Solubilizing Bacteria. Research Reports of Kochi University. 60: 267-275.

Conferences

Sasiwat Titapun[1] Chuleemas Boonthai Iwai[1*] Mongkon Ta-uon[1] and **Kiriya Sungthoungwises[1]**. **2011.** Reuse Wastewater from Natural Rubber Sheet Production in Northeast Thailand for Agriculture. Proceeding in The 2nd National conference on Soil and Fertilizer. May 11-13, 2011. Mae Joe University, Chiengmai.

Sasiwath Titapan, Chuleemas Boonthai IWAI**,** Mongkon Ta-oun and **Kiriya Sungthongwises 2010.** Reuse Wastewater from Natural Rubber Sheet Production in Northeast Thailand for Agriculture The 2nd ICERD International Conference on Environmental and Rural Development, Phnom Penh, Cambodia, 7-8 January 2010 Cambodia.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

Sungthongwises, K., C. Boonthai Iwai, A. Wongcharoen, A. Promkhambut and D. Lesueur. **2014**. Potential of native phosphate solubilizing bacteria isolated from the rhizosphere of economic crops and vermicast. The 5th International Conference on Environmental and Rural Development. 18-19 January 2014**.** Rajamangala University of Technology Thanyaburi (RMUTT). Pathum Thani, **Thailand**

Sungthongwises, K., C. Boonthai Iwai, A. Wongcharoen, A. Promkhambut, A. Brauman and D. Lesueur. **2012**. Abilities of Native Phosphate Solubilizing Bacteria Isolated from the Rhizosphere of Economic Crops in Northeast Thailand to Soluble Phosphates under *in vitro* Conditions. The 2nd Asian Conference on Plant-Microbe Symbiosis and Nitrogen Fixation. October 28-31, 2012. Hilton Phuket Arcadia Resort and Spa, **Thailand**.

Sungthongwises, K., M. Matsuoka, K. Ohnishi, S. Tanaka and C. Boonthai Iwai. **2012.** The Potential of Phosphate-

Solubilizing Bacteria from the Eggplant Fields. The 2nd Symposium on Horticulture in Europe (SHE 2012). 1st to 5 July 2012, Angers University, **France**.

Sungthongwises, K., M. Matsuoka, K. Ohnishi, S. Tanaka and C. Boonthai Iwai. **2012**. Isolation of Phosphate-Solubilizing Bacteria from Different Fields Crop Productions. the 3rd ICERD-International Conference on Environmental and Rural Development. January 21-22, 2012. Khon Kaen University, **Thailand**.

Sungthongwises, K. **2011**. Isolation of Phosphate-Solubilizing Bacteria from difference field crop productions in Kochi. International Workshop on Asian Field Science Network III. Field science toward resolution of environmental and food problems in Southeast Asia. October 18, 2011. Monobe Campus, Kochi University, **Japan**.

Sungthongwises K., S. Chanprame and S. Chanprame. **2004.** The Optimization of *Stylosanthes hamata* Transformation Using Particle Bombardment. *In* p. 35. Proceeding of AgBiotech Graduate Conference I (Abs.). March 18-19, 2004. Bangkok, **Thailand**.

Sungthongwises K., S. Chanprame and S. Chanprame. **2004**. The Optimization of *Stylosanthes hamata* Transformation Using Particle Bombardment. Proceeding of RGJ Seminar Series XXVIII (Abs.). May 6-7, 2004. **Thailand**.

Saetiew K., R. Koto, **K. Sungthongwises**, S. Sarawaneeyaruk and S. Chanprame. **2003**. *In Vitro* Antibiotic Resistance Determination of *Dendrobium* Orchid and *Stylosanthes hamata* for Gene Transformation, pp. 119. *In* Third National Horticultural Congress. Bangkok, **Thailand**.

Transfer of Technology

Sungthongwises, K. 2014. Soil and pest sustains management in rubber tree plantations. Donchang Village, Muang District, Khon Kaen province, March 29, 2014. **Thailand.**

Sungthongwises, K. **2013**. Knowledge transfer in the topic of « The selection of rubber tree clones and soil microbial management with fertilizer application in rubber plantations » to local farmers at Khon Kaen, Udon Thanee, Nongkhai, Bungkan and Buriram province, **Thailand**.

Training

Sungthongwises, K. **2013**. Hands-on introduction to the R environment. November 11-12, 2013, Institute of Chemistry, Hanoi, **Vietnam.**

Sungthongwises, K. **2013**. Workshop on writing scientific articles in English for international journals in the domain of environmental and agricultural science. 30th September to 4th October, 2013, Khon Kaen University, **Thailand.**

Sungthongwises, K. **2011**. Isolation of Phosphate-Solubilizing Bacteria from difference field crop productions in Kochi. International Workshop on Asian Field Science Network III. Field science toward resolution of environmental and food problems in Southeast Asia. October 18, 2011. Monobe Campus, Kochi University, **Japan**.

Sungthongwises, K. **2009.** Legumes for intercropping in Northeast Thailand. International Seminar on “The Overseas Training Course for Field Science 2009. October 13-24, 2011. Monobe Campus, Kochi University, **Japan**.

■ **CV 2: Dr. PROMKHAMBUT Arunee**

Current position:	**Lecturer**
Status	Tenured professor
Institution/employer	Khon Kaen University
Type of institution	Public
Discipline	**Biology/Physiology and biology of organisms**
Date of birth:	11th May, 1980
Town and country of birth	Sakon Nakhon, Thailand
Nationality	Thai
Work address	Program on System Approaches in Agriculture, Faculty of Agriculture, Khon Kaen University Khon Kaen, 40002, Thailand. Phone number: +66 4320-2366, +66 8 5754-0688
e.mail	**arunee@kku.ac.th**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

2011-2013 - Factors affecting farmers' adoption of growing crops after rice in rainfed agricultural systems in Khon Kaen province in Northeast Thailand: A study at household and provincial levels
- Possibility of growing upland crops after rice substituted second rice production in Northeast Thailand
- Integration of green manuring and animal manure in organic rice production

2004-2010 Ph.D. (Thesis) : Effect of waterlogging on growth, yield and quality of sweet sorghum grown before rice under rainfed and irrigated conditions. (Khon Kaen University, Khon Kaen, Thailand)

2002-2003 Research assistant : Using molecular technology for drought resistant improvement in peanut (Khon Kaen University, Thailand)

1999-2002 B.Sc. (Khon Kaen University, Thailand)

■ Major publications (half-page maximum)

International journals ISI Web of Khowledge

Promkhambut A., Polthanee, A., Akkasaeng, C. and Younger, A. **2011a**. Growth, yield and aerenchyma formation of sweet and multipurpose sorghum *(Sorghum bicolor* L. Moench) as affected by flooding at different growth stages. Australian Journal of Crop Science. 5(8):954-965.

Promkhambut, A., Polthanee, A., Akkasaeng, C. and Younger, A. **2011b**. A flood-free period combined with early planting is required to sustain yield of pre-rice sweet sorghum (*Sorghum bicolor* L. Moench). Acta Agriculturae Scandinavica, Section B Plant Soil Science. 61: 345-355.

Promkhambut, A., Younger, A., Polthanee, A. and Akkasaeng, C. **2010**. Morphological and physiological responses of sorghum (*Sorghum bicolor* L. Moench) to waterlogging. Asian Journal of Plant Sciences. 9: 183-193.

National journals

Kanchat, O., Kamla, N., Simaraks, S. and **Promkhambut, A**. **2013**. Importance of labor within community for intensive chinese radish production. Khon Kaen Agriculture Journal. 41 (Supplement 1) : 315-314.

Mondal, S., Haitook, T., Simaraks, S. and **Promkhambut A**. **2013**. Farmers' knowledge regarding organic vegetables cultivation in Northeast Thailand. Khon Kaen Agriculture Journal. 41 (Supplement 1) : 302-308.

Pannarach, W., Kamla, N. and **Promkhambut, A**. **2013**. The importance of household and community labors in tomato seed production under contract farming at Lad Na Piang village, Savatee sub-district, Mueang district, Khon Kaen province. Khon Kaen Agriculture Journal. 41 (Supplement 1) : 352-357.

Wongsalee, P. Rambo, A.T. Hayao, F. and **Promkhambut, A**. **2013**. Factors influencing the decline of traditional cross-stream earthen weir (thamnop) irrigation in Northeast Thailand : Comparison of a still-functioning and an abandoned thamnop in two villages in surin province. Khon Kaen Agriculture Journal. 41 (Supplement 1) : 309-314.

Promkhambut, A. **2002**. Integrated Farming: A case study of Mr. Boonmi Wongsudtho's farm. Khon Kaen Agriculture Journal. ( ): 148-154. (In Thai).

Conferences

Mondal, S., Haitook, T., Simaraks, S. and **Promkhambut A**. **2013**. Farmers knowledge, attitute and skill towards organic vegetable cultivation in Ban sam Hong and Ban Swang, Hoi Toei sub-district, Samsung district, Khon Kaen province, Northeast Thailand. Proceeding in the 12th Annual East-West Center International Graduate Student Conference on Asia Pacific Regoin, Febuary 14-16, 2013. Honolulu, Hawai, USA.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

Polthanee, A., **Promkhambut, A**. and Trelo-ges, V. **2012**. Effect of pre-rice mungbean and cattle manure application on growth and yield of organic rice. International Conference of Environmental and Rural Development. Khon Kaen **Thailand.** 21-22 January 2012.

Promkhambut, A., Polthanee, A., Akkasaeng, C. and Younger, A. **2010**. Pre-rice sweet sorghum as an alternative biofuel feedstock production in asian paddy fields. International Symposium on Agricultural Education for Sustainable Development (Ag-ESD). November 8-11 2010. Agricultural and Forestry Research Center, University of Tsukuba, **Japan.**

Transfer of technology

1. The 2nd International Training Program on Area Analysis for Agricultural Planning. Faculty of Agriculture, Khon Kaen University, Khon Kaen Thailand 25-31 March 2012.
2. The International Training Program on Agroecosystem Analysis for Agricultural Planning. Faculty of Agriculture, Khon Kaen University, Khon Kaen Thailand 20-26 March 2011

Training

Promkhambut, A., Younger, A., Polthanee, A. and Akkasaeng, C. **2010**. Morphological and physiological responses of sorghum (*Sorghum bicolor* L. Moench) to waterlogging. Occational student at School of Agriculture, Food and Rural Development, Faculty of Science, Agriculture and Engineering, Newcastle University, Newcastle upon Tyne, NE1 7RU, **United Kingdom** (November 2007-April 2008)

■ **CV3: PHASOUYSAINGAM Avakat**

Current position:	**Lecturer**
Status	Researcher
Institution/employer	National University of Laos/Faculty of Agriculture
Type of institution	Public
Discipline	**Agro-Forestry/Land use development and planning**
Date of birth:	1st November, 1981
Town and country of birth	Vientiane Capital, Laos
Nationality	Lao
Work address	Research Division, Faculty of Agriculture, National University of Laos. Nabong Campus. P.O. Box: 7322, Vientiane C, Lao PDR
e.mail	**touyavakat@gmail.com**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

Study background

2008-2010 University of Philippines Los Baños, Philippine (MSc. in Natural Resources Conservation)
2004-2008 Work in the Faculty of Agriculture as Lecturer and Research in Agro-ecosystem and Agroforestry
1999-2004 National University of Laos, Faculty of Agriculture, (BSc in Agronomy)

Research projects

2011 Conducted a research project on "Participatory, Learning and Action of Sustainable Natural Resources Management in Kham District, Xiengkhouang Province (SATO development framework in Laos). 1 year
2011 Conducted a research project on "Adapting under pressure: the resource squeeze and livelihood change in Laos, a case study in Meung Fueng and Konleung village, Fueng District, Viengchan Province, Laos". 6 months
2011 Conducting a research project on Population, habitats and Conservation Status of Asian Elephant in Nam Ha NBCA, Luang Namtha Province, Lao PDR. 3 years
2010 Consultant on Monitoring and Assessment on Forest and Land Use Zone for villages in National Production Forest in five provinces of Laos (Suford Project) 3 month
2010 Conducted a Master's thesis on "Assessment of Ecotourism's Contribution to Biodiversity Conservation and Income of local People in Nalan village, Luang Namtha Province, Lao PDR". 6 months
2008 Conducted a research project on "Impact of Electricity Hydro-power to Agricultural Activities and Natural Resource Management, a case study in five village in the downstream of Thean-Hinboun Hydro-power project" 1 year
2008 Conducted a research project on Landscape of Agro-Forestry "Landscape and Livelihood Change in a Sub-watershed of Nam Thone River, Bolikhamxay Province, Laos" 6 months
2004-06 Conducted a research project on Market Orientation of vegetable growth in Lao PDR, "case on Ban Hom, Hathsayfong district, Vientiane plain" 3 years

■ Major publications (half-page maximum)

National journal

Phasouysaihgam, A. 2012. Agricultural Landuse Development and Planning. Teaching book for Bachelor Degree in the Faculty of Agriculture, National University of Laos. pp120.

Phasouysaingam, A. S. Thongmanivong, L. Xayvongsa, K. Sombounkhanh. **2010**. Influence of Government Policies on Livelihoods and Landscape in the Nam Thone Watershed in Lao PDR. A Teacher's Guide on Agroforestry Landscape Analysis: Curricular Framework and Case Study Material, SEANAFE.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

Phasouysaingam, A. 2010. Sustainable Agriculture and Natural Resources Management by Using Participatory Action and Learning. The 8th international workshop on Natural Environment and Human Activity in South Asia and Indochina, to be held on Dec 22 and 23, 2012, Kyoto University, **Japan**.

Training

Phasouysaingam, A. **2013**. Appropriate Agriculture Practices for Livelihood Protection and Food

Security in the Disaster Area in Hom and Kasi district, Vientiane Province, hold on 18 January in Hom district, 22 January in Kasi distrcit, OXFAM Project. **Lao PDR**

Phasouysaingam, A. 2013. A case study on good agriculture practices for post-harvest handling and food safety for lettuce and papaya in Non Tea village and Duangbudee village, Xaythany district, Vientiane Capital. Workshop on “Good Agriculture Practices for Horticulture Market Chain”, The FAO Technical Cooperation Project: 25 and 28 January 2013. **Lao PDR**.

■ **CV 4: SAYAVONG Saysongkham**

Current position:	**Land Use Planning/ GIS Specialist**
Status	LUP/ GIS
Institution/employer	Department of Agricultural Land and Management (DALaM)
Type of institution	Public
Discipline	**Land Use Planning/ GIS**
Date of birth:	29th January, 1980
Town and country of birth	Borikhamxay, Laos
Nationality	Lao
Work address	Agricultural Land Use Planning Center (ALUPC), Department of Agricultural Land and Management (DALaM), Ministry of Agriculture and Forestry (MAF). P.O. Box: 4195, Vientiane Capital, Lao PDR
e.mail	**saysongkhams@yahoo.com**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

Study background

2010-2012 Kasetsart University, Thailand (MSc. In Soil Science and Management Technology).
2002-2006 National University of Laos, Faculty of Letters, (B.A degree)
1998-2001 National University of Laos, Faculty of Agriculture, (H. Diploma in Agronomy)

Research projects

2013 Training and Implementation for Participatory Forest and Agriculture Land Use Planning Allocation and Management (pFALUPAM) and GIS Tools Usage in Houaphan, Luangprabang and Attapua Provinces (supported by: TABI Project).
2005-2010 Surveyed, Allocation and land use planning for agriculture and forestry at district level in whole country.
2003-2005 Conducted a research project on Farming system with farmers in Phonxay district, Luangprabang province and Namor district, Oudomxay province (supported by : SIDA project, NAFRI).
2002 Conducted a reseach project on Management of Sloping land in Northern part of Lao PDR.

■ Major publications (half-page maximum)

National journal

Sayavong, S. K. Sangkhasila, P. Srijantr**. 2012.** Land Use Planning for Efficient Agricultural Uses in Viengphoukha District, Luangnamtha Province, Lao PDR.

National conferrence

Sayavong, S. K. Sangkhasila, P. Srijantr**. 2011.** Finding the Suitable Area for Efficient Major Economic Crops in Viengphoukha District, Luangnamtha Province, Lao PDR.

Participation to symposium

Sayavong, S. 2005. International Workshop on Public Participation in Integrated Watershed Management for Sustainable Development from 07 – 17 December, 2005, Thanh Hoa, Vietnam.

Training

Sayavong, S. 2014. Area analysis for agricultural planning from 23 – 29 March 2014, Faculty of Agriculture, Khon Kaen University, Thailand.
Sayavong, S. 2013. Decision Support System (DSS) for Climate Change Adaptation in Rainfed Rice Area (CCARA) hold on 20 August 2013 in IRRI-Laos Office, NAFRI Compound, Lao PDR (supported by: IRRI, JIRCAS).
Sayavong, S. 2012. Hands-on introduction to the R environment from 10 – 12 October 2012, ALUPC/ DALaM, Lao PDR (supported by: IRD project).
Sayavong, S. 2009. Soil Survey and Classification and Land Evaluation from 20 -29 July 2009, Land Development Department, Thailand (supported by: ACMECS).
Sayavong, S. 2008. Geo-information for National Disaster Management and Disaster Risk Reduction from 09 June - 07 August 2008, Cibinong Bogor and Yogyakarta, Indonesia (supported by: TCDC).
Sayavong, S. 2007. Agricultural Economic Data Analysis for Commodity Outlook and Early Warning Information from 11 – 21 December 2007, Kasetsart University, Thailand (supported by: AFSIS).

Sayavong, S. 2007. Agrometeorological Crop Monitoring and Forecasting with the Crop Monitoring Box from 14 – 21 March 2007, MAF, Lao PDR (supported by: FAO).

Sayavong, S. 2006. Soil Analysis and Land Evaluation from 18 July – 01 August 2006, National Institute for Soils and Fertilizers (NISF), Hanoi, Vietnam (supported by: SIDA project).

TASK 1

■ **CV 5 : Mr CHANPHENGXAY Alounsawath**

Current position: **Soil scientist**
Status Researcher
Type of institution Public
Date of birth: 15th September, 1968
Born Vientiane Province
Nationality Lao
Work address Department of Agriculture Land and Management,
Agriculture Land Use Planning Center, Lao PDR.
Phone number: +856 20 22886248; +856 21 770075;
e.mail **Alounsawath@gmail.com**
AIRD partnership **No**

■ Summary of research career (half-page maximum)

Study status

2002-2006: BSc (Major in Agronomy) Graduated from National University of Lao Faculty of Agriculture "Nabong Campus"

1986-1989: Graduated from National University of Lao Faculty of Agriculture "Nabong Campus"

Work status

2006-2014 : Working at Agricultural Land Use Planning Center (ALUPC), I joint worked with the Management of Soil Erosion Consortium project(MSEC) and the Institute Research Development(IRD). And then I have worked in Soil survey and land use planning unit (soil scientist). And then I have worked in soil Water and Nutrient management unit.

1991-2002 : Worked at Soil Survey and Land Classification Center(SSLCC).

1989-1991 : Worked at Provincial Agriculture and Forestry Office (Khammouan Province)

Participation to symposium

October, 7-22, 1997:	Training workshop on modelling global change impacts on tropical landscapes and biodiversity. BIOTROP-GCTE Southeast Asian Impects Centre (IC-SEA).
November, 26, 2006:	Training Workshop on the farmers on Nutrient Management Support System for Corn . at Ban hai village Nasaythong district Vientiane Capital of Laos. (Supported by: NuMaSS project).
April, 9-12, 2007:	Training workshop on Evaluation of Soil Fertility and Soil Test Interpretation, at Agricultural Research Centre.
November, 26-December, 21, 2007:	Training Workshop Basic Research Analysis on Statistic. at Land Agriculture Research Centre. (Supported by: Lao-IRRI project).
August, 7-8, 2008:	Training Workshop on Specific Nutrient Management of Rice. at Land Agriculture Research Centre. (Supported by: NuMaSS project).
May, 19-July, 17, 2008:	Training course on Dryland Farming Techniques (sponsored by the ministry of Commerce and organized by Agricultural University of Hebei).
May, 3-16, 2009:	ASEAN training course on Sustainable Slope Land Cultivation and Management. (Under the ASEAN-Japan south-south cooperation project)

TASK 2

■ **CV 6:** **Dr. NIMKINGRAT Prakaijan**

Current position:	**Lecturer**
Status	Tenured professor
Institution/employer	Khon Kaen University
Type of institution	Public
Discipline	**Entomology and Nematology**
Date of birth:	02nd July, 1979
Town and country of birth	Sisaket, Thailand
Nationality	Thai
Work address	Department of Plant Science & Agricultural Resources, (Division of Entomology), Faculty of Agriculture, Khon Kaen University Khon Kaen, 40002, Thailand. Phone number: +66 4336 2108, +66 8 8594 7440
e.mail	**npraka@kku.ac.th**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

Study status

2012: Doctor degree of Agriculture, Christian Albrechts University, Germany (Genetic improvement of cold temperature activity and desiccation tolerance of the entomopathogenic nematode *Steinernema feltiae* (Filipjev)
2009: Working at KKU as lecturer
2005: Master degree of Science (agriculture) Saga University, Japan (Purification of novel protein in *Spodoptera litura*)
2003: Bachelor degree of Science (agriculture) Khon Kaen University, Khon kaen, Thailand (Edible Insect)

■ Major publications (half-page maximum)

Nimkingrat P., Khanam S., Strauch O. and Ehlers, R.-U. **2013**. Hybridisation and genetic selection for improvement of low temperature activity of the entomopathogenic nematode *Steinernema feltiae*. BioControl DOI 10.1007/s10526-012-9497-4

Nimkingrat P., Strauch O. and Ehlers R.-U. **2013**. Hybridisation and genetic selection for improving desiccation tolerance of the entomopathogenic nematode *Steinernema feltiae*. Biocontrol Science and Technology DOI 10.1080/09583157.2012.758238

Nimkingrat P., Uhlmann F., Strauch O. and Ehlers R.-U. **2013**. Desiccation tolerance of entomopathogenic nematodes of the genus Steinernema. Nematology DOI 10.1163/15685411-00002692.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

Nimkingrat P., Strauch O. and Ehlers R.-U. **2012.** Genetic selection for low temperature activity in *Steinernema feltiae.* Proceeding of the the 31st International Symposium of European Society of Nematologists. Adana, **Turkey**.

Nimkingrat P., Strauch O. and Ehlers R.-U. **2012.** Desiccation tolerance of *Steinernema* spp. and its genetic improvement in *S. feltiae.* Proceeding of the the 31st International Symposium of European Society of Nematologists. Adana, **Turkey**.

Nimkingrat P., Strauch O. and Ehlers R.-U. **2011**. Desiccation tolerance among different isolates of the entomopathogenic nematode *Steinernema feltiae* (Filipjev). Proceeding of the 63th International Symposium on Crop Protection (ISCP). Ghent, **Belgium**.

Nimkingrat P., Strauch O. and Ehlers R.-U. **2011.** Desiccation tolerance of the entomopathogenic nematode *Steinernema feltiae* (Filipjev). Proceeding of the the 13th European Meeting of the IOBC/WPRS Working Groups "Insect Pathogens and Insect Parasitic Nematodes". Innsbruck, **Austria**.

Workshop and Training

Knowledge transfer in the topic of « Intergrated Pest Management in Marigold » to local farmers at Mahasarakam province, April, 2013. **Funded by National research council Thailand (Organizer). Thailand**.

SPS Awareness International Workshop, August, 2008. **Funded by Australian Government and Bionet aseanet (Co-Organizer and participant). Thailand**.

Arthropod Preservation, Curation and Data Management International Workshop, August, 2008. **Funded by Australian Government and Bionet aseanet aseanet (Co-Organizer and participant). Thailand**.

Young cultural ambassador program, Khon Kaen. 2008. **Funded by KKU (Organizer). Thailand**.

FAO Regional Vegetable IPM Programme. July, 2007. **Regional Training on Biological Control (Organizer)**

International Agronomy Workshop. May, 2006. **Integrated agronomic practices to improve/sustain cane productivity (Co-organizer and participant)**.

■ **CV 7:** **Dr. CHOOSAI Chutinan**

Current position:	**Lecturer**
Status	Researcher
Institution/employer	Khon Kaen University
Type of institution	Public
Discipline	**Biology/Physiology and biology of organisms**
Date of birth:	26th October, 1973
Town and country of birth	Nakhon Ratchasima, Thailand
Nationality	Thai
Work address	Department of Plant Science & Agricultural Resources, Faculty of Agriculture, Khon Kaen University Khon Kaen, 40002, Thailand. Phone number: +66 4336 2108, +66 8 9279 6949
e.mail	**chucho@kku.ac.th**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

Study status

- Biological activity in paddy fields. The role of soil engineers in ecosystem functioning. Ph.D. Thesis, 2009-2011
- Detection and differentiation of phytoplasma associated with sugarcane white leaf disease in sugarcane and insect vector using molecular techniques. M.Sc. Thesis, 1996-1998

Research project

- Diversity and activity of soil invertebrates in paddy field ecosystem. Leader of research project, 2011
- The studies of ecology, behavior, efficiency of disease trasmission of new insect vector of sugarcane while leaf disease and potential of its control. Co-worker of research project, 2009
- The roles of soil invertebrates in soil improvement and bioindicator in an ecosystem of Para Rubber area. Co-worker of research project, 2008-2009
- The diversity of insects in an agricultural management systems of para rubber area. Leader of research project, 2006
- The studies of disease transmission cycle of sugarcane white leaf in host plant and insect vectors. Co-worker of research project, 2005
- The efficiency monitoring of sugarcane stem borer parasiting and genetic variability of inbreeding egg parasitoid was (Hymenoptera: Trichogrammatidae) of sugarcane stem borer. Co-worker of research project, 2005
- Detection and identification of insect vectors associated with sugarcane white leaf disease and efficiency of disease transmission. Co-worker of research project, 2004-2005
- The efficiency monitoring of sugarcane stem borer parasiting and genetic variability of egg parasitoid wasp (Hymenoptera: trichogrammatidae) of sugarcane stem borer for commercial production. Leader of research project, 2004
- The data base of butterflies biodiversity in Khon Kaen University. Leader of research project, 2001

■ Major publications (half-page maximum)

International journals ISI Web of Knowledge

Jouquet, P., Traore, S., **Choosai, C.**, Hartmann, C. and Bignell, D. **2011.** Influence of termites on ecosystem functioning. Ecosystem services provided by termites. European Journal of Soil Biology. 47: 215 – 222.

Choosai, C., Jouquet, P., Hanboonsong, Y., and Hartmann, C. **2010.** Effects of earthworms on soil properties and rice production in the rainfed paddy fields of Northeast Thailand. Applied Soil Ecology. 45: 298 – 303.

Choosai, C., Mathieu, J., Hanboonsong, Y., and Jouquet, P. **2009.** Termite mounds and Dykes are biodiversity refuges in paddy fields in north-eastern Thailand. Environmental Conservation. 36: 71 – 79.

Jouquet, P., Hartmann, C., **Choosai, C.**, Hanboonsong, Y., Bruner, D., and Montoroi, J.P. **2008.** Different effects of earthworms and ants on soil properties of paddy fields in North-East

Thailand. Paddy and Water Environment. 6: 381 – 386.
Jouquet, P., Mathieu, J., **Choosai, C.**, and Barot, S. 2007. Soil engineers as ecosystem heterogeneity drivers. In: Munoz, S.I. (Ed.). Ecology Research Progress. Hauppauge, New York, US: Nova Science Publishing, pp. 187 – 199.
Hanboonsong, Y., Ritthison, W., **Choosai, C.**, Sirithorn, P. **2006.** Transmission of sugarcane white leaf phytoplasma by *Yamatotettix flavovittatus*, a new leafhopper vector. Journal of Economic Entomology. 99*:* 1531 – 1537.

National journals

Hanboonsong, Y., Ritthison, W., **Choosai, C. 2005.** Molecular detection and transmission of sugarcane white leaf phytoplasma in leafhoppers. KKU Research Journal 10: 13 – 21. (in Thai)
Hanboonsong, Y., **Choosai, C.**, Panyim, S., and Damak, S. **2002.** Transovarial transmission of sugarcane white leaf phytoplasma in the insect vector *Matsumuratettix hiroglyphicus* (Matsumura). Insect Molecular Biology. 11: 97-104.
Wongkaew, P., Hanboonsong, Y., Sirithorn, P., **Choosai, C.**, Boonkrong, S., Tinnangwattana, T., Kitchareonpanya, R., and Damak, S. 1997. Differentiation of phytoplasma associated with sugarcane and gramineous weed white leaf disease and sugarcane grassy shoot disease by RFLP and sequencing. Theoretical and Applied Genetics. 95: 660 – 663.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

1. International Conference on Ecological Researches on Rubber Tree and Water Relations, 19-21 May **2009.**
2. International Conference on Sanitary and Phytosanitary Capacity Building Program (SPS CBP) on Awareness and Entomological Collection Techniques, 18-25 August **1998**.

Transfer of technology

1. Classification of Insects.

■ **CV 8:** **Dr. WONGCHAROEN Anan**

Current position:	**Lecturer**
Status	Tenured professor
Institution/employer	Khon Kaen University
Type of institution	Public
Discipline	**Biology/Physiology and biology of organisms**
Date of birth:	13th April, 1976
Town and country of birth	Khon Kaen, Thailand
Nationality	Thai
Work address	Department of Plant Science & Agricultural Resources, Faculty of Agriculture, Khon Kaen University Khon Kaen, 40002, Thailand. Phone number: + 66 43 343114
e.mail	**wanan@kku.ac.th**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

2010-2013 Diversity of endophytic fungi of rice
Model simulation of rice blast disease
Soil microorganism diversity under rubber tree plantation
Disease of rubber tree in northeast Thailand
2007-2010 Ph.D (Ecosystem diversity), University of Paris VI, France.
2001-2004 M.Sc (Plant Pathology), Khon Kaen University, Thailand.
1994-1998 B.Sc (Agriculture), Khon Kaen University, Thailand.

■ Major publications (half-page maximum)

International journals ISI Web of Knowledge

ngcharoen, A., Pando, A., Nandris, D., Hanboonsoon, Y., Hartmann, C. and Rouland-Lefevre, C. **2011**. Biological activity of soils under rubber trees (*Hevea brasiliensis*) affected by trunk phloem necrosis. Forest Pathology. 41 : 41-47.

National journals

ngcharoen A. **2004.** Genomic DNA fingerprints of Streptomyces spp. From compost which producing antibiotics inhibit Phytopathogenic bacteria. AgBiotech Graduate Conference I. 18-19 March 2004. Rama Gardens Hotel, Bangkok, Thailand.

ımmabenjapone, P. and **Wongcharoen, A**. 2004. Properties of secondary metabolites from Streptomyces spp. which inhibit the growth of phytopathogenic bacteria. Proceeding of Annual Agricultural Seminar for Year 2004. Khon Kaen University, Thailand. Page. 466-479.

ngcharoen A., Thummabenjapone, P., Pachinburavan, A. and Saksirirat, W. 2003. Biodiversity of Streptomyces from compost which capable to inhibit the growth of economic important phytopathogenic bacteria. Proceeding of Annual Agricultural Seminar for Year 2003. Khon Kaen University, Thailand. Page. 559-573.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

The 3rd International Conference on Environmental and Rural Development

Training

Long-term Preservation and Management of Microbial Resources with Agricultural Importance

Transfer of technology

Basic plant disease diagnosis and management

■ CV 9: PERAWATCHARA/ Monrawee

Current position:	Researcher at Office of Soil Biotechnology
Status :	Researcher
Institution/employer :	Land Development Department / Ministry of agriculture and cooperative. Bangkok, Thailand.
Type of institution :	public
Discipline :	Soil Science
Work address:	Land Development Department / Ministry of agriculture and cooperative 2003/61 Phahonyothin Rd. Ladyao Chatuchak / Bangkok Thailand 10900. Phone number: 66-02-579-0679. Cell phone number: 6689-130-1315.
E-mail:	monraweepeerawat@gmail.com
IRD partnership:	Fellowship IRD BEST on "Soil microbial density and activities in different rubber chronosequence.

■ Summary of research career

Study background :

1998-2001: M.Sc. (Agriculture) Chiang Mai University, Chiang mai, Thailand / Field of concentration: Horticulture (Plant Breeding) / Thesis: Growth, Development and Improvement of Philippines Violet (Barleria spp.)

1993-1996: B.Sc. (Agriculture) Chiang Mai University, Chiang Mai, Thailand / Field of concentration: Horticulture (Ornamental plant)

Scholarships :

1998: Partially support fellowship, The Royal Project Foundation

2007: Training Program for Young Leaders (Agriculture), Japan International Cooperation Agency(JICA)

2013: Fellowship IRD BEST on "Soil microbial density and activities in different rubber chronosequence."

Work experiences :

2003-2005 : Lecturer at Surat Thani Ratchabhat University. The subjects include Biology, Plant tissue culture and Environmental science.

2002-2003 : Research assistant at Multiple Cropping Center, Chiang Mai University

Research project :

2005-Present : Researcher at Office of Soil Biotechnology : research of the microbial activator in term of effective microorganisms and Liquid organic fertilizer for decomposing organic wastes to produce humus-like substance for improving soil properties such as aeration water holding and increasing nutrient absorption / work with farmers in the process of converting farms in to Organic Agriculture in order to improve their quality of life and to stop the excessive use of chemical pesticides and fertilizers.

Relevant professional experience and responsibility :

1. Identification of Cultivars and Validation of Genetic Relationship by Isozyme Analysis.
2. In Vitro Mutagenesis and Molecular Marker Analysis of Ornamental Plants.
3. Markers for Biodiversity Research and Breeding Applications.
4. Study the microbial activator in term of effective microorganisms and liquid organic bio fertilizer for decomposing organic wastes to produce humus-like substance for improving soil properties.
5. Work with farmers in the process of converting farms in to organic agriculture in order to improve their quality of life and to stop the excessive use of chemical pesticides and chemical fertilizer.

■ Major Publications

Perawatchara, M. and Krasaechai, A. (2002) Varietal Improvement of Barleria spp. Journal of Agriculture 18(1): 12-17.

Oral Presentation:

Perawatchara, M. and Krasaechai, A. (2002) Genetic inheritance of Philippine violet (Barleria cristata Linn.) 1st National Horticultural Congress, Bangkok, Thailand.

Poster presentation:
Perawatchara, M., Dararat H., D., Vanlada S., Siangjeaw P., and Chaveevan L. (2007) Protease and Cellulase Production and Phosphate Solubilization from Potential Biological Control Agents Trichoderma Viride and Azomonas Agilis. 14th World Fertilizer Congress, Chiang Mai, Thailand.

Junrungreang S., Nuanjun P., Monrawee P., Nisa M., Surachai S.(2011) Pilot project of biochar production from pyrolysis of municipal solid waste. 2nd Asia Pacific Biochar Conference, Kyoto, Japan

CV 10: Dr. Phoutthasone Sibounnavong

Current position:	**Lecturer**
Status	**Researcher**
Institution/employer	National University of Laos
Type of institution	Public
Discipline	**Biotechnology in Plant Pathology, Mycology and Biocontrol of Plant Diseases, Biofertilizer, Bio-fungicide and Bio-insectide**
Date of birth:	20th September, 1984
Town and country of birth	Vientiane Province, Lao PDR
Nationality	Lao
Work address	Plant Protection Division, Department of Plant Science Faculty of Agriculture, National University of Laos Vientiane 7322, Lao PDR. Phone number: +856 20 55948489; +856 **030** 5767925
e.mail	**Phoutthasone.noul20@gmail.com, ssibounnavong@gmail.com**
AIRD partnership	**No**

■ **Summary of research career (half-page maximum)**

2013-2014 - started as lecturer at Plant Protection Division, Department of Plant Science, Faculty of Agriculture, National University of Laos

2009-2012 Ph.D. on Biotechnology in Plant Pathology (**Outstanding Thesis**): Biological activities of antagonistic fungi to control Fusarium wilt of tomato
International college, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand.

2007-2009 MSc in Biology, major on Mycology and Plant pathology, Central Luzon State University, the Philippines **(Oustanding thesis).**

2002-2006 BSc in Agriculture, major on Plant Science, National University of Laos

Research Publishcations

Sibounnavong, P. 2012. Screening of Emericella nidulans for biological control of tomato Fusarium wilt in Lao PDR. International Journal of Agricultural Technology 8(1):241-260. (TC index journal IF = 0.2).

Sibounnavong, P., Sibounnavong, P.S., Kanokmedhakul S. and Soytong, K. 2012. Antifungal activities of *Chaetomium brasilense* CB01 and *Chaetomium cupreum* CC03 against *F. oxysporum* f. sp. *lycopersici* race 2. Journal of Agricultural Technology 8(3): 1029-1038. (TC index journal).

Sibounnavong, P Unartngam, J. and Soytong K. 2012. Genetic variation of *Fusarium oxysporum* f. sp. *lycopersici* isolated From tomatoes in Thailand using pathogenicity and AFLP markers. African Journal of Microbiology Research. Accepted for publication (ISI index journal).

Sibounnavong, P., Charoenporn, C., Kanokmedhakul, S., Soytong, K. 2012. A role of Emericella rugulosa as a biocontrol agent to control Tomato fusarium wilt. African Journal of Agricultural Research. Accepted for publication (ISI index journal).

Sibounnavong, P., Kanokmedhakul, S. and Soytong, K. 2011. Antifungal metabolites from antagonistic fungi used to control tomato wilt fungus Fusarium oxysporum f sp lycopersici. African Journal of Biotechnology 10(85):19714-19722. (ISI index journal).

Sibounnavong, P Keoudone, C., Soytong, K., Divina C.and Kalaw, S.. 2010. A new mycofungicide Emericella nidulands against tomato wilt caused by Fusarium oxysporum f.sp. lycopersici. International Journal of Agricultural Technology. Vol 6(1): 11-18.

Sibounnavong, P., Kalaw, S.P., Divina, C.C. and Soytong, K. 2009. Mycelial growth and sporulation

of Emericella nidulands, a new fungal antagonist on two culture media. International Journal of Agricultural Technology. Vol 5(2): 317-324.

Sibounnavong, P., Soytong, K., Divina, C.C. and Kalaw, S.P. 2009. In-vitro biological activities of Emericella nidulands, a new fungal antagonist, against Fusarium oxysporum f.sp. lycopersici. International Journal of Agricultural Technology. Vol5 (1): 75-84.

Sibounnavong, P., Cynthia, C.D., Kalaw, S. P., Reyes, R.G. and Soytong, K. 2008. Some species of macrofungi at Puncan, Carranglan, Nueva Ecija in the Philippines. International Journal of Agricultural Technology 4(2): 105-115.

Sibounnavong, P., Cynthia, C.D., Kanokmedhakul, S. and Soytong, K. 2008. The new antagonistic fungus, Emericella nidulans strain EN against Fusarium Wilt of Tomato. International Journal of Agricultural Technology 4(1): 89-99.

Sibounnavong, P. 2006. Application of microbial products for cultivation of organic crop production. International Journal of Agricultural Technology 2(2): 177-189.

■ **CV 11: Dr. SILTACHO Siwaporn**

Current position: Soil scientist
Status: public researcher
Institution/employer: Land Development Department
Type of institution: Public
Discipline: Earth sciences/Solid earth and superficial layers
Date of birth: 15 September 1973
Town and country of birth: Bangkok, Thailand
Nationality: Thai
Work address: Land Development Department Regional Office 5, Mittraparp Rd., Khon Kaen, 40000, Thailand
Phone number: + 66 4324 6758
E-mail: aom_siwaporn@yahoo.com
AIRD partnership: No

■ Summary of research career (half-page maximum)

- Efficacy of Pulping Wastewater and Distillery Slop as Potassium Fertilizersfor Baby Corn Planted in Ubon Soil Series. M.Sc. Thesis.
- Effect of liming on physical properties in paddy field of acid sulfate soil. Co-worker of research project.
- Soil mineralogy and micromorphological feature of some soil series for cassava plantation in Thailand. Co-worker of research project.

■ Major publications (half-page maximum)

International journal ISI Web of Knowledge

Hao, H.T., Hartmann, C., Apichart, J., **Siwaporn, S**., Promsakha, S., Richard, G., Bruand, A., Dexter, A.R., **2011.** Slumping dynamics in tilled sandy soils under natural rainfall and experimental flooding. Soil & Tillage Research. 114: 9-17.

National journal

Siltacho, S. 2004. Effect of different physical properties of some soil series on soil moisture; Report of Land Development Office, n°5, Department of Land Development, Bangkok, 22 p

Conference

Siltecho S., Hammecker C., Sriboonlue V., Maeght J.L., and Trelo-ges V. **2010**. Effect of land use on the soil physical properties and water budget in a small water shed in NE. In proceeding of the 19th World Congress of Soil Science, August 1-6, 2010. Brisbane, Australia.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

■ **CV 12: Dr. TAWEEKIJ Sukanya**

Current position: Technician
Status: researcher
Institution/employer: Land Development Department (LDD)
Type of institution: Public
Discipline: Biology/Physiology and biology of organisms (Agronomy)
Date of birth: 23 November 1974
Town and country of birth: Sakon nakhon, Thailand
Nationality: Thai
Work address: Land development office region 5, Land Development Department, Ministry of Agriculture and Coorperative, Khon Kaen 40000, Thailand
Phone number: +66 4324 4965, +66 8 4428 8957
E-mail: spromsakha@yahoo.com
AIRD partnership: No

■ Summary of research career (half-page maximum)

-Soil improvement
  -saline soil
  -hard pan
-Nutrient cycling
  -green manure decomposition
  -groundnut stover decomposition
-Plant tissue culture
  -vetiver grass
  -banana
-Weed management

■ Major publications (half-page maximum)

International journal ISI Web of Knowledge

Hao, H.T., Hartmann, C., Apichart, J., Siwaporn, S., **Promsakha, S**., Richard, G., Bruand, A., Dexter, A.R. **2011**. Slumping dynamics in tilled sandy soils under natural rainfall and experimental flooding. Soil & Tillage Research 114: 9-17.

Promsakha na sakonnakhon, S., G. Cadisch., B. Toomsan., P. Vityakon., V. Limpinuntana., S. Jogloy and A. Patanothai. **2006.** Weeds-friend or foe? The role of weed composition on stover nutrient recycling efficiency. Field crops research. 97: 238-247.

Promsakha na sakonnakhon, S., B. Toomsan., G. Cadisch., E.M. Baggs., P. Vityakon., V. Limpinuntana., S. Jogloy and A. Patanothai. **2005.** Dry season groundnut stover management practices determine nitrogen cycling efficiency and subsequent maize yields. Plant and soil. 272: 183-199.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

■ **CV 13: Ms SISOUVANH Phimmasone**

Current position:	**Lecturer**
Status	Researcher
Type of institution	Public
Discipline	**Soil Science**
Date of birth:	6th Agustus, 1979
Born	Vientiane Capital City
Nationality	Lao
Work address	Department of Plant Science, Faculty of Agriculture, National University of Laos Vientiane 7322, Lao PDR. Phone number: +856 20 2377-6068; +856 21 870048; +856 21 870053; +856 21 870132;
e.mail	**Phimmasone2004@yahoo.com.au; cozmiss@gmail.com**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

Study status

2008-2010: MSc (Major in Soil Sciences) Graduate School, Indonesia Bogor Agricultural University. (Thesis on combine using of inorganic with organic fertilizers on tomato yield and Oxisol fertility)

1998-2003: BSc (Major in Agronomy) Faculty of Agriculture, National University of Laos. (Special problem on Socio-economic development, Vientiane province, Lao PDR)

Research projects

2012: Different Potential of Rubber and Multiple Crops Production for Food Security and Poverty Reduction in Luangnamtha Province, Lao PDR (supported by: SEARCA)

2011: Efficiency of combine using organic and inorganic fertilizers on cucumber yield, Faculty of Agriculture, National University of Laos (supported by: SNV project)

2011: Changing and adaptation in Smallholder Fisheries Livelihood in Vientiane Province, Lao PDR (supported by: ACIAR Australia)

2005: Researching on Agronomical Diagnosis of rice production system, Faculty of Agriculture, National University of Laos (supported by: PAFA France Project)

■ Major publications (half-page maximum)

National journal

Agronomical Diagnosis of rice production system (2005) Journal of Faculty of Agriculture, National University of Laos.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

2012: Improving Food Quality and Safety through Good Agricultural and Postharvest Practices in Fresh Produce, at Mekong Institute, Khon Kaen, **Thailand**.

2012: Workshop on developing course design, Faculty of postgraduate studies, University of health science, **Lao PDR**.

2011: Internship program for young researchers on Indo-China in the field of life sciences, Graduate school of life and environmental sciences, Tsukuba University, **Japan**.

2008: Seminar national on Soil and mining in Bogor Agricultural University, **Indonesia.**

2008: Seminar International on competition between Bio fuel and Food Security, Challenge to current Agriculture development in Indonesia, Bogor Agricultural University and international convention centre Bogor. **Indonesia**.

2005: Training course on wetland ecology and management in the lower Mekong basin, Salaya, Nakionpathom,**Thailand**.

2004: Training on basic chemistry, Faculty of Agriculture, National University of Laos, **Lao PDR.**

2004: Training on basic chemistry, Ladsamongkoun University, Kalasin, **Thailand**

■ CV 14: Dr. LAWONGSA Phrueksa

Current position:	**Lecturer**
Status	Tenured professor
Institution/employer	Khon Kaen University
Type of institution	Public
Discipline	**Biology/Molecular and cellular biology**
Date of birth:	19th May, 1982
Town and country of birth	Nakhon Ratchasima, Thailand
Nationality	Thai
Work address	Department of Plant Science & Agricultural Resources, (Land Resources and Environment Section), Faculty of Agriculture, Khon Kaen University Khon Kaen, 40002, Thailand. Phone number: +66 4336 4639, +66 8 7650 7646
e.mail	**phrula@kku.ac.th**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

2008-2013 - Isolation and characterization *Pseudomonas* species from rice and maize rhizospheres by molecular techniques and phenotypic characteristics.
- Examination of 2,4-diacetylphloroglucinol (DAPG) produced by *Pseudomonas* species isolated from rice rhizosphere against fungal and bacterial pathogens.
- Investigation of genotypic diversity of *Pseudomonas* species isolated from rice and maize rhizospheres.
- Assessing the impact of vermicomposting on microbial diversity for sustainable agricultural system
- Investigation of allelopathic effect of *Tamarindus indica* L. leaf residues on organic matter decomposition and soil carbon sequestration.

2005-2008 Ph.D. (Thesis): Biomerit Research Centre. Ireland. Molecular basis of *Pseudomonas*-host interactions in biocontrol of phytopathogens

2011-2013 Working at KKU (Lecturer)

2003-2010 Ph.D. (Thesis): Biotechnology (Suranaree University of Technology, Thailand)

1999-2002 B.Sc.: Agriculture (Soil science) (Khon Kaen University, Thailand)

■ Major publications (half-page maximum)

International journals ISI Web of Knowledge

Lawongsa, P., Boonkerd, N., O'Gara, F. and Teaumroong, N. **2012**. Biocontrol of Phytopathogen by *Pseudomonas fluorescens* R21, Isolated from Rice Rhizosphere in Thailand. International Journal on Environmental and Rural Development. 3:189-195.

Watcharin Y., **Lawongsa, P.**, Wongkaew, S., Teaumroong, N., Boonkerd, N., Nomura, N., Tittabutr, P. **2012**. Improvement of peanut rhizobial inoculant by incorporation of plant growth promoting rhizobacteria (PGPR) as biocontrol against the seed borne fungus, Aspergillus niger. Biological control. 63:87-97.

Lawongsa, P., Boonkerd, N., Wongkaew, S., O'Gara, F. and Teaumroong, N. **2008**. Molecular and phenotypic characterization of potential plant growth promoting Pseudomonas from rice and maize rhizospheres. World Journal of Microbiology and Biotechnology. 24:1877-1884.

Conferences

Saenjan, P., Ro, S., **Lawongsa, P.** and Tulaphitak, D. **2011.** Effect of sulfate containing fertilizer on methane emission from rice soil and global warming potential. Proceeding of The Second National Soil and Fertilizer Conference. Chaing Mai, Thailand, 11-13 May 2011 Thailand.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

Lawongsa, P., Boonkerd, N., O'Gara, F. and Teaumroong, N. **2012**. Biocontrol of phytopathogen by *Pseudomonas fluorescens* R21 which was isolated from rice rhizosphere in Thailand. The 3rd ICERD International Conference on Environmental and Rural Development, January 21-22, 2012. Khon Kaen University, **Thailand.**

Saenjan, P., Ro, S., **Lawongsa, P.** and Tulaphitak, D. **2011.** Effect of sulfate containing fertilizer on methane emission from rice soil and global warming potential. The 2nd National Soil and Fertilizer Conference. 11-13 May, 2011. Chaing Mai, Thailand, **Thailand**.

Lawongsa, P., Boonkerd, N., O'Gara, F., Wongkaew, S. and Teaumroong, N. **2010**. Investigation of 2,4-diacetylphloroglucinol (DAPG) produced by *Pseudomonas fluorescens* isolated from rice rhizosphere in Thailand. The 1st Asian Conference on Plant-Microbe Symbiosis and Nitrogen Fixation, (Poster presentation). September 20-24, 2010. Aoshima Palmbeach Hotel, Miyazaki, **Japan**.

Lawongsa, P., Boonkerd, N., O'Gara, F., Wongkaew, S. and Teaumroong, N. **2008**. Phenotypic and molecular characterization of potential plant growth promoting *Pseudomonas* from rice and maize rhizospheres. The 162nd Society for General Microbiology Spring Meeting, (Poster presentation). March 31 – April 3, 2008. Edinburgh International Conference Centre, **Scotland**.

Training

Lawongsa, P. **2012.** Training workshop on T-RFLP. October 9 – November 10, 2012. University of Hohenheim, Stuttgart, **Germany**.

Lawongsa, P. **2008.** Training workshop on research methods in the life sciences for postgraduates, Brookfield Health Sciences Complex. April 24 – 25, 2008. University College Cork, Cork, **Ireland**.

■ **CV 15: Dr. GONKHAMDEE Santimaitree**

Current position:	**Lecturer**
Status	Tenured professor
Institution/employer	Khon Kaen University
Type of institution	Public
Discipline	**Biology/Physiology and biology of organisms**
Date of birth:	07th June, 1975
Town and country of birth	UbonRachathani, Thailand
Nationality	Thai
Work address	Department of Plant Science & Agricultural Resources, Faculty of Agriculture, Khon Kaen University Khon Kaen, 40002, Thailand. Phone number: + 66 4334 2949, +66 8 9148 1616
e.mail	**gsanti@kku.ac.th**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

2010-2013 - Effect of wood vinegar mixed with herbicide application on weed control for chemical-safe aromatic rice production.
- Weed management technologies by bio-control on dry direct-seeded rice: Leader of research project.
- Effect of wood vinegar rate mixed with herbicide application on weed control for efficiency in aromatic rice.
- Weed management for rubber tree yield improvement in the Northeast

2007-2010 Ph.D. (Thesis): ACADEMIE D'AIX-MARSEILLE UNIVERSITE D'AVIGNON ET DES PAYS DE VAUCLUSE. FRANCE and KHON KAEN UNIVERSITY, THAILAND
Agronomy science
Analysis of interactions between rubber tree (*Hevea brasiliensis* Mull. Arg.) and inter-crop roots in young plantations of Northeast Thailand.

2004-2007 Working at KKU (Lecturer)

2002-2004 Working at KU (Researcher)

1999-2002 M.Sc. (Thesis): Agriculture (Kasetsart University, Thailand)

1994-1998 B.Sc.: Agriculture (Kasetsart University, Thailand)

■ Major publications (half-page maximum)

International journals ISI Web of Knowledge

Do F.C., Pierret A., Couteron P., Lesturgez G., Boithas L., Isarangkool Na Ayutthaya S., Junjittakarn J., **Gonkhamdee S.**, Maeght J.-L., Hartmann C. and Nandris D. **2011**. Spatial distribution of *Hevea brasiliensis* trunk phloem necrosis within a plot: aggregation but no evidence of constraint on cumulated growth. Forest Pathology. 41: 90-100.

Gonkhamdee S., Pierret A., Maeght J.-L., Serra V., Pannengpetch K., Doussan C. and Pagès L. **2010**. Effects of corn (*Zea mays* L.) on the local and overall root development of young rubber tree (*Hevea brasiliensis* Muel. Arg.). Plant soil. 334: 335-351.

Polthanee, A., **Gonkhamdee, S.** and Phoemsana, K. **2006**. Effects of cutting rice and weeds on subsequent weed growth and grain yield of dry direct – seeded rice. **J.ISSAAS**. 12: 21-26.

National journals

Jothityangkoon D., Manownok J., **Gonkhamdee S.** and Dejbhimon K. **2012**. Using biochar as soil amendment, wood vinegar as priming agent in relation to rice seedling development. Khon Kaen Agriculture Journal. 40: 241-249.

Gonkhamdee S. Polthanee A., and Phoemsana K. **2011**. Effect of weed control and split application of chemical fertilizer on growth and yield of KDML 105 in dry direct seeded rice. Khon Kaen Agriculture Journal. 39: 347-352.

Gonkhamdee S., Maeght J.-L., Do F. and Pierret A. **2009**. Growth dynamics of fine *Hevea brasiliensis* roots along a 4.5-m soil profile. Khon Kaen Agriculture Journal. 37: 265-276.

Conferences

Gonkhamdee S., Maeght J.-L., C. Do F. and Pierret A. **2008**. Observation of the growth dynamics of fine *Hevea brasiliensis* roots using a 4.5-m access-well. *In* oral presentation of the "IRRDB Natural Rubber Conference 2008", Selangor, October13-15 2008, **Malaysia.**

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation

to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

Pierret A., Doussan C., Pagès L., Do F.C., **Gonkhamdee S.**, Maeght J.-L., Chintachao W. and Nandris D. **2007**. Is impeded root growth related to the occurrence of rubber tree Trunk Phloem Necrosis (TPN)? Preliminary results from NE Thailand. Proceedings of the IRRDB Annual Meeting, 2007 November 12-16, Siem Reap, **Cambodia,** p. 489-498.

Do F. C., Pierret A., Couteron P., Lesturgez G., Isarangkool Na Ayutthaya S., Junjittakarn J., **Gonkhamdee S.**, Meaght J.-L., Hartmann C., Pannengpetch K., and Nandris D. **2006**. Rubber tree Trunk Phloem Necrosis (TPN) in Northeast Thailand: 2. Within-stand characterisation of affected trees. Proceedings of the International Natural Rubber Conference – IRRDB annual meeting, 2006 November 13-17, Ho Chi Minh City, **Vietnam**, p. 157-170.

Training

Gonkhamdee, **S**. **2011**. Specialist on Field Crop and Veggies Herbicide Training, Pisanulok, 3-5 April 2011, **Thailand**.

Gonkhamdee, **S**. **2011.** Paticipant on Crop production under saline stress participants, 13 Nov. – 22 Dec. 2011, The Hebrew University of Jerusalem, The Robert H. Smith Faculty of Agriculture, Food & Environment, Division for External Studies, Rehovot, **State of ISRAEL**.

TASK 4

■ **CV 16: Dr. ISARANGKOOL NA AYUTTHAYA Supat**

Current position:	**Lecturer**
Status	Tenured professor
Institution/employer	Khon Kaen University
Type of institution	Public
Discipline	**Biology/Physiology and biology of organisms**
Date of birth:	2nd January, 1975
Town and country of birth	Bangkok, Thailand
Nationality	Thai
Work address	Department of Plant Science & Agricultural Resources, Faculty of Agriculture, Khon Kaen University Khon Kaen, 40002, Thailand. Phone number: 66-43-203-055
e.mail	**isupat@kku.ac.th**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

Study status

2010 Ph.D. (Thesis): Change of whole-tree transpiration of mature *Hevea brasiliensis* under soil and atmospheric droughts: analyze in intermittent and seasonal droughts under the framework of the hydraulic limitation hypothesis.
Ph.D. (Plant physiology), University Blaise Pascal, Clermont Ferrand &
Ph.D. (Agronomy), Khon Kaen University, Khon Kaen

2000 M.Sc. (Thesis): Influent of calcium-boron on carbohydrate reserve, protein and fruit set of mango cv Nam Dok Mai Tawai.
M.Sc. (Horticulture), Kasetsart University, Bangkok

1996 B.Sc. (Special problem): Effect of paclobutrazol supply through grafting root stock on the flowering of mango cv Nam Dok Mai.
B.Sc. (Agriculture), Kasetsart University, Bangkok

Research projects

2012 The research group of "developing of knowledge for the rubber tree in northeast region" (Head of group; Khon Kaen University)

2012 The research group of fruit tree (Head of group; Faculty of Agriculture, Khon Kaen University)

2011 The research group of ornamental plant (Head of group; Faculty of Agriculture, Khon Kaen University)

2009 Studies on pummel production model in northeast: case study from 'Thong Dee' pummelo production at amphoe Baan Thaen and Potential development on red-flesh pummel for pummel identity of Chaiyaphum province (Thailand Research Fund; TRF)

2007 Production situation and developing of 'Thong Dee' pummelo cultivars production of farmers in Amphoe Ban Thaen, Chaiyaphum Province (Thailand Research Fund; TRF)

2005 Effect of irrigation on growth and yield of rubber tree. (Head Project; National Research Council of Thailand)

2003 Potential of *Cordyline* ssp. for commercial production. (National Research Council of Thailand)

2003 Effect of irrigation follows soil water tension on growth and production of mango and guava. (Young researcher funding; Khon Kaen University)

Total publication both national and international publications from above projects now are 22 publications, for only international publication are 11 publications.

■ Major publications

International journals ISI Web of Knowledge

Isarangkool Na Ayutthaya S. and Do F.C. **2012**. Latex yield of Hevea brasiliensis poorly indicates soil drought. Acta Horticulturae. (*In press*)

Junjittakarn, J., Limpinuntana, V., Pannengpetch, K., **Isarangkool Na Ayutthaya, S.**, Rocheteau, A., Cochard, H. and Do, F.C. **2012**. Short term effects of latex tapping on micro-changes of trunk girth in *Hevea Brasiliensis*. Australian Journal of Crop Science. 6:65-72.

Boithias, L., Do, F.C., **Isarangkool Na Ayutthaya, S.**, Junjittakarn, J., Siltecho, S. and Hammecker, C. 2012. Transpiration, growth and latex production of a *Hevea brasiliensis* stand facing drought in northeast Thailand: The use of the WaNuLCAS model as an exploratory tool. Experimental Agriculture. 48:49-63.

Isarangkool Na Ayuuthaya S., Do F.C., Pannangpetch K., Junjittakarn J., Maeght J.-L., Rocheteau A. and Cochard H. **2011.** Water loss regulation in mature Hevea brasiliensis: effects of

intermittent drought in the rainy season and hydraulic regulation. Tree Physiology. 31: 751-762.
Junjittakarn, J., Limpinuntana, V., Do, F.C., Pannengpetch, K., **Isarangkool Na Ayutthaya, S.**, Rocheteau, A. and Cochard, H. **2011**. Vapour pressure deficit affects diurnal girth fluctuation of rubber trees (*Hevea brasiliensis*). Australian Journal of Crop Science. 5: 1622-1630.
Junjittakarn, J., Limpinuntana, V., Do, F.C., Pannangpetch, K., **Isarangkool Na Ayutthaya, S.** and Cochard, H. **2011**. Effect of trunk locations on micro-change of trunk girth in mature rubber trees (*Hevea brasiliensis*). Asian Journal of Plant Sciences. 10:140-146.
Do F.C., **Isarangkool Na Ayutthaya S.** and Rocheteau A. **2011.** Transient thermal dissipation method for xylem sap flow measurement: implementation with a single probe. Tree Physiology. 31: 369-380.
Do F.C., A. Pierret, P. Couteron, G. Lesturgez, L. Boithias, **S. Isarangkool Na Ayutthaya**, J. Junjittakarn, S. Gonkhamdee, J. L. Maeght, C. Hartmann and D. Nandris. **2011**. Spatial distribution of Hevea brasiliensis trunk phloem necrosis within a plot: aggregation but no evidence of constraint on cumulated growth. Forest Pathology. 41: 90–100.
Isarangkool Na Ayutthaya, S., F.C. Do, K. Pannengpetch, J. Junjittakarn, J.-L. Maeght. A. Rocheteau and H. Cochard. **2010.** Transient thermal dissipation method of xylem sap flow measurement: multi-species calibration and field evaluation. Tree Physiology. 30:139-148.

National journals

Isarangkool Na Ayutthaya, S., K. Pannangpetch, F.C. Do, J. Junjittakarn, J.-L. Maeght, A. Rocheteau, and H. Cochard. **2010**. Simple environmental models to estimate tree transpiration of Hevea brasiliensis. Khon Kaen Agriculture Journal. 38: 337-348.
Supat Isarangkool Na Ayutthaya, Anoma Dongsansuk, Rumchart Taepongsorut and Teerayut Nakdang. 2007. The relationship of climates and Growths of Rubber tree cv. RRIM600 under Irrigation system. Khon Kaen Agriculture Journal. 35 (Suppl) 118-125.

Conferences

Isarangkool Na Ayutthaya, S., Junjittakarn J., Do F.C., Pannengpetch K., Maeght J., Alain Rocheteau A. and Nandris D. **2007.** Drought and Trunk phloem necrosis (TPN) effects on water status and xylem sap flow of Hevea brasiliensis. *In* Proceedings of the CRRI&IRRDB International Natural Rubber Conference 2007. 12-13 November 2007. Siem Reap, **Cambodia**. p. 75-84.

■ Recent activities in terms of capacity-building, scientific facilitation, knowledge sharing (participation to symposium, expertises…) and transfer of technology (half-page maximum)

Participation to symposium

1) National Horticulture Congress since the first to twelfth, total participations in this group congress are 9 times with submitting of manuscripts.
2) International Natural Rubber Conference, Nov 13-14, Ho Chi Minh City, **Vietnam**
3) International Rubber Conference, 12-13 November 2007. Siem Reap, Cambodia. (Oral presentation)
4) The IRRDB Natural Rubber Conference & Annual Meetings, 13-17 October, 2008. Selangor, Malaysia (Oral presentation)
5) International Workshop: Ecohydrology of Plant in Water-Limted Environments, 15-19 September 2008. University of Western Australia, Perth, **Australia**. (Oral presentation)

■ **CV 17: SOULIYAVONGSA Xaysatith**

Current position:	**Deputy chief of soil laboratory**
Status	Researcher
Institution/employer	Department of agricultural land utilization and management (DALUM), Ministry of agriculture and forestry. Lao PDR.
Type of institution	Public
Discipline	Soil science
Date of birth:	26st Dec, 1980
Town and country of birth	Vientiane Capital, Laos
Nationality	Lao
Work address	Soil laboratory unit, Department of agricultural land utilization and management (DALUM), Ministry of agriculture and forestry. Lao PDR. Nongviengkham village, Xaitany district, Vientiane capital, Lao PDR. Phone/Fax: 856 21 770075.
e.mail	**Xaysatith1@hotmail.com**
AIRD partnership	**No**

■ Summary of research career (half-page maximum)

Study background

2007-2010 MSc. (soil science), Kasetsart University, Bangkhen campus, Bangkok, Thailand.
1998-2003 BSc. (Crop production), Faculty of agriculture, National university of Laos.

Work Experiences

2004-2005 Assistant researcher, cash crop unit, Rice and cash crop research centre, National agriculture and forestry research institute (NAFRI), Lao PDR.
2005 – 2007 Assistant researcher of soil improvement unit, agriculture land research centre. NAFRI. Laos.
2007 up to now soil laboratory unit, DALUM, Laos.

Research projects

2011-2013 fertilizer rate for rice production on acidic soil, Pek district, Xiengkhouang province. Lao agriculture research fund (LARF).
2011- 2014 Marketing and production improvement project, Australian centre for international agriculture research (ACIAR) and NAFRI Laos.
2011-2014 Developing multi scale to climate change adaptation strategy for farming community. ACIAR, CSIRO Australia and NAFRI Laos.

■ Major publications (half-page maximum)

National journal

- Improvement of acid soil in Pek district, Xiengkhouang province for maize production. Vol.27, Lao agriculture journal. NAFRI

International journal

- Predicting Phosphorus Buffer Coefficients of representative Maize soils in Laos. Vol.44 No.2

Participation to symposium

Training

17 Sep.2013 Characterizations of spatial variation in water availability, soil nutrient and rice yield prediction for rainfed lowland rice. ACIAR.
4-6 Mar. 2013 Agro-economic estimation on farm level, NAFRI.
8-12 Jul.2013 Introduction to the characterization of soil nematodes, an important soil bio indicator. IRD.
2-4 Apr. 2014 The characterization of the activity of the soil microbial comunity, IRD.

2- Research program

Thematic fields of the JEAI

- ☐ Development and governance
- ☐ Vulnerabilities, inequalities and growth
- ☐ Boundaries, and social and spatial dynamics
- ☐ Infectious diseases, emerging and neglected diseases in particular
- ☐ Vulnerability and climate change
- ☐ Productions and food safety
- ☐ Sustainable energy and transport
- ☐ Health-plant interactions
- ☐ Nutrition
- ☐ Lifestyle diseases
- ☐ Water resources
- ☐ Risks and natural hazards
- X Ecosystems and biodiversity

Description of the research program

The description of the research program should include an overview of the state of the practice and indicate how the project will generate new knowledge. The description should include objectives, hypothesis, methodology, expected results, bibliographical references and should specify the distribution of activities between the different team members. (10 pages maximum)

BACKGROUND AND RATIONALE

Rubber: a model to study the impact of land uses changes on soil environment in SEA

The agrarian transition is one of the most important factors that have influenced socioeconomic and environmental shifts over the last few centuries. This transition has played a major, often negative role in determining shifts and losses in biodiversity, particularly at the ecosystem level. The situation in South East Asia (SEA) today illustrates particularly well the changes induced by this transition (Castella et al., 2007). In most part of the upland of Southeast Asia, the agriculture has gone from being largely based on "forest-subsistence agriculture" until the sixties, to a system dominated by an agriculture that is increasingly intensive. The agrarian transition in Southeast Asia is now entering into a new phase. Soaring prices of fossil energy observed since some decades and the reduction of known stocks has provoked a shift from food crops to those which respond to the increasing demand for alternative products such as natural latex from rubber trees.

Importance of rubber tree in Thailand and LaoPDR

Nowadays rubber is cultivated worldwide, the production is heavily concentrated into Asia, where over 90 % of the world's natural rubber is being produced. FAO statistics (http://faostat3.fao.org/home/index) indicate that in Thailand, compared to the area of natural forest (19 million ha) the harvested area of rubber plantations occupies today 2 million ha and produce about 40% of the total rubber used in industry (10 Mt). Contrary to the common belief, smallholders represent the large majority of rubber producers with more than 1.5 million of family farms involved in rubber, and most of them have less than 4 ha of surface area (Thai Office of Agricultural Economics, 2012).Moreover, as the prospects are favorable (ANRPC 2010), rubber plantations are now expanding in Asia thereby contributing to a major land use change. In Thailand, the expansion of plantations in the last ten years (Figure 1) to less suitable eco-climatic areas has come at the cost of yield reduction (cf. figure below), which questions the sustainability of this type of plantations in adverse conditions (see § below). In Thailand rubber replaces other cash crops like cassava or sugar cane, in Laos the

new plantations are often implemented to the detriment of natural spaces (pioneer dynamics). In Laos the strong market – until March 2011 - demand for natural rubber and an abundance of land has encouraged foreign investors from the region (China, Thailand and Vietnam to promote rubber planting in almost all areas of Lao PDR (Alton C. et al., 2005). The steady increase in rubber prices – until March 2011 - and benefits of a long term perennial cash crop suggest that rubber may be an appropriate crop for Lao upland farmers On the other hand, the rapid rush to plant rubber and the plummeting prices of natural rubber since early 2011 raise many environmental and social concerns. Rapid expansion of rubber causes large-scale loss of forest resources and watershed destruction, particularly important in Laos where rural food security is directly related to forest health. ***Despite this economic and ecological importance of rubber tree plantation in SE Asia the environmental impact of this type of plantations and the ecosystem services they provide are still poorly studied*** [*] ***and constitute the aims of this project.***

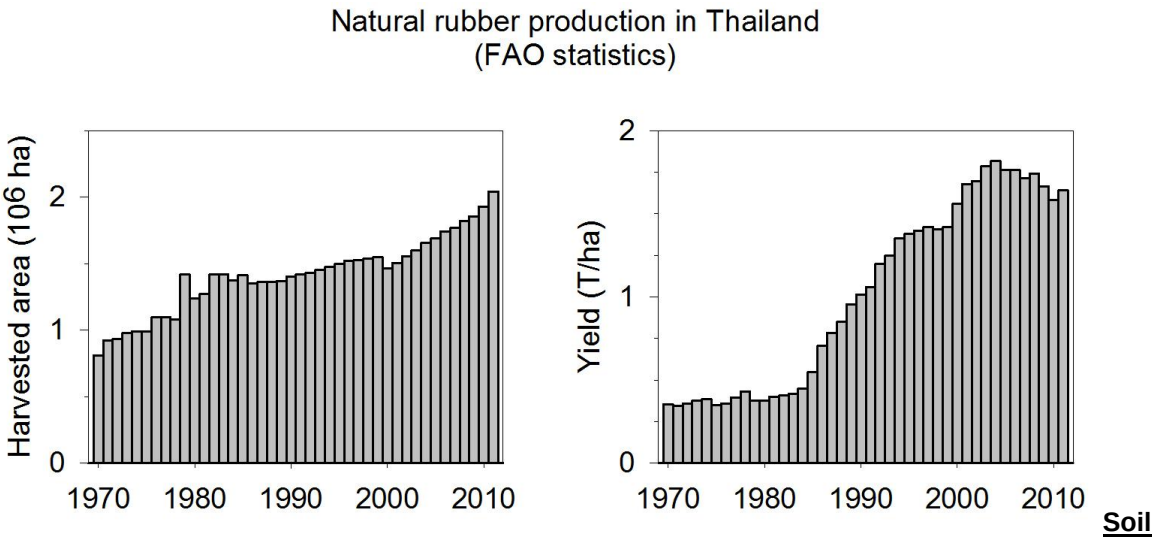
Two complementary ecosystem models for the project: NE Thailand (Khon Kaen area) and N Laos (Luang Namtha)

Nowadays, in Thailand, the current ever-increasing demand for natural rubber coincides with the low availability of lands in traditional areas because of competition with oil palm in particular. Moreover, this dynamic is a sub-regional challenge that concerns all the countries of the Greater Mekong Sub-region (GMS). Also, Thai government implements a policy aiming at extending the rubber plantation to sub-optimal regions or non-traditional areas such as north and northeast Thailand (see fig 1). Rubber tree development in this region has boomed during the past two decades[†]. However, North-East Thailand presents some challenging particularities (i) Climate: the average annual rainfall is less than 1,300 mm with a severe dry season while the favorable biotope usually admitted for rubber tree is well distributed annual rainfall of about 1,800-2,000 mm (ii) soil fertility: most of the soils in NE Thailand have low fertility (sandy, acidic, low CEC, low nutrient reserves, low water holding capacity) Furthermore, the uplands often present severe physical and/or chemical degradations due to deforestation and the cultivation of cassava or sugar cane. **The expansion of rubber tree in this particular adverse ecological context represent a potential problem in term of soil sustainability but could also could represent an opportunity in term of soil rehabilitation** (reduce tillage, low input of mineral fertilizers, maintenance of soil moisture).

In NW Laos (in the province of Luang Namtha), biophysical conditions are marginal for rubber production too: the cool climate represents a limitation which imposes to use specific clones acclimatized and breed in Yunnan (Lefroy et al., 2010); overall, soils are shallow, with generally moderate resource quality and steeply sloping topography (Manivong and Cramb, 2007). The shift from forest to rubber in sloping areas seems to induce severe environmental drawbacks like biodiversity loss (Lao forest is considered as a worldwide hotspot of diversity), increase of erosion (Alton C. et al., 2005). ***In summary, the environmental issues in NE Thailand and Laos address complementary questions (soil rehabilitation in NE Thailand, putative soil degradation in Laos. These two locations will provide more generic results to ECO-RUBBER project.***

[*] On more than 796 citation in WOS for « Environmental OR Ecological impact of tree plantations" only 2.5% (less than 20 publications) originated from SE Asia (7% in Africa)

† For the period of 2003 - 2006 Thailand has increased the area planted in the North by 48,000 hectares and in the Northeast by 64,000 hectares



Soil

Impact of land use change on Ecosystem Services in rubber plantations

To address this issue, the bottleneck is the absence of knowledge on **the influence of agricultural practices over biological processes within the soil.** Such a goal can be achieved with researches aiming at better evaluate "soil quality" changes, soil quality being "the capacity of soil to function within ecosystem boundaries to sustain biological productivity and maintain environmental quality" (Doran and Parkin, 1994). This implies an assessment of how cultivated soils perform functions linked to ecosystem services (MEA, 2005) such as for a rubber plantation provisioning services (wood or latex production), regulating (C sequestration), supporting (nutrient cycling), supporting services (functions necessary for production and sustainability of the 3 previous ones like soil diversity), cultural services.

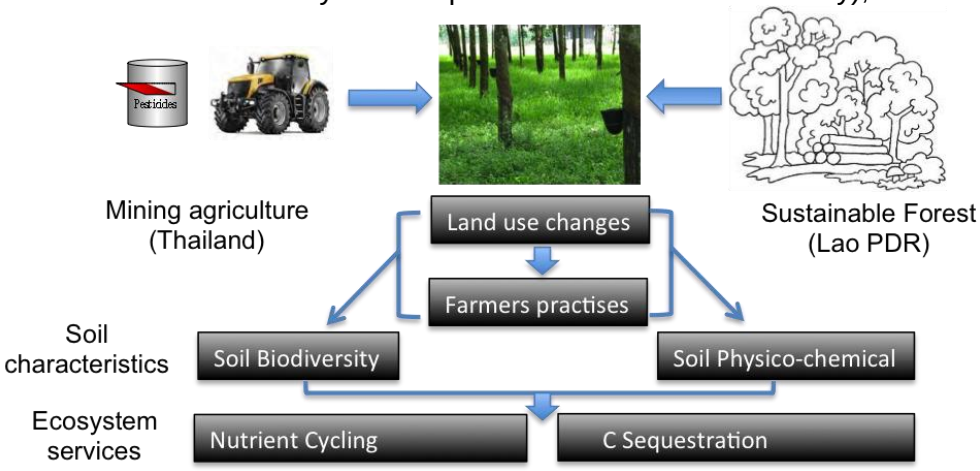


Figure 2: scheme of the proposal link between land uses changes and ecosystem services

The most important aspect of soil quality assessment is to study the linkage among the components of the soil system (fig 2): 1) soil management practices, 2) observable soil characteristics 3) soil processes and 4) the performance of soil functions. Its goal is to address how the production system (tillage, planting, fertilization, intercropping) changes biological diversity and soil characteristics, which in turn change farm environmental quality over the long term. It should be underlined that soil quality cannot be defined only by the absence of degradations but also addresses the ability of soil to perform desired functions Thus, ***the project will study how ecosystem services such as soil biodiversity, C sequestration and nutrient cycling evolved depending on land use changes and management system (Figure 3).***

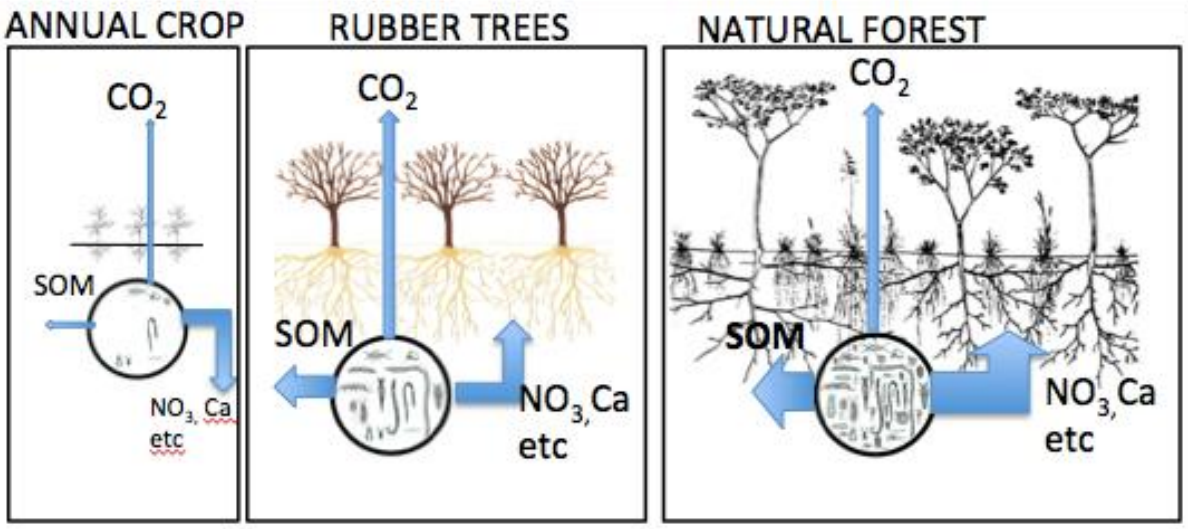


Figure 3: Schematical hypothesises on the consequences of land use changes on i) soil biological activity (including biomass and diversity of roots +soil fauna) 2) recycling or leaching of mineral elements and 3) carbon sequestration through soil organic matter (SOM) production. Soil fauna is represented in the magnification glass and arrows correspond to fluxes.

Do rubber plantations have a "positive" or "negative" impact on the soil environment?

Tree plantations have been criticized for their environmental and social impacts-particularly in the tropics, where plantations have replaced natural forests, degrading water and soil resources. The conversion of primary forests on the one hand, and of agricultural land, on the other hand, differently affects and impacts ecosystem goods and services, particularly biodiversity and water resources.. Like any other form of land use, the development of a tree plantation leads to changes in ecosystem characteristics and fluxes (Samndi et al. 2006; Oyebande et al. 2010). However, compared to annual monocrops, tree plantations seem to have positive impacts on soil environment by bringing changes in edaphic, micro-climatic, and biological components of the eco-system (Ogunkule and Awotoye 2011; Attoe and Amalu 2005; Shukla, 2009). Literature on rubber tree plantations is still scarce and controversial. Some studies highlight the positive impact of rubber trees on soil conservation (Njar et al., 2011; Yasin et al. 2010) studying changes in soil properties of rubber trees in Indonesia show that the age of rubber tree strongly affected the physical and chemical properties of soil. Organic carbon and total nitrogen contents decreased in the young rubber tree plot and then increased in the older one. A similar pattern was also found for selected chemical properties of soil (pH, P olsen, etc.). Rubber tree plantations on arable lands have been also shown to be an effective way to enhance carbon sequestration (Johnsen et al. 2001; Zilberman and Sunding 2001). However other studies show negative effect of rubber tree corresponding to significant decline of soil organic C and microbial biomass (Zhang et al. 2007). Concerning the soil biodiversity, this topic has been poorly investigated in rubber tree plantations. One of the few studies (Gilot and al., 1994) conducted in Ivory Coast, clearly indicated that soil fauna diversity and density vary with rubber production but this trend originated from the dead biomass of the original forest, a case which is not observed in NE Thailand (but could be confirmed in N Laos). Moreover no equivalent studies were undertaken for the microbial community despite their importance in soil functions. ***So this controversial issue concerning soil environmental impact of long-term rubber plantations is mainly due to the lack of integrated studies involving physical, chemical and biological aspects.***

Rubber farmers livelihood

Thai government has promoted the introduction of rubber tree to NE Thailand in order to increase farmer's income. In fact income from rubber plantation in some communities can be as high as 25,000€ per annum (Jitjan et al., 2009). Some institutional sources (Office of

Agricultural of Economics) indicated a shift from cassava and sugarcane areas to rubber. However, no study tackles the respective economic performance of these different cash crop systems in Thailand whereas in Lao PDR. One study (Phanthasith et al., 2013) concerns this topic. ***Therefore this project will characterize the main agricultural practices implemented by rubber farmers in Thailand and Laos, and determine their economic performance compared to traditional cropping systems.***

Intercropping in rubber plantation

Beside organics amendments, intercropping is a key agricultural practice conducted during the 4-5 first years of the plantations (figure 3). Many experiments have indicated that intercropping of rubber with different crops can bring both agronomic and financial benefits (Laosuwan et al., 1988), we make the hypothesis that it can also provide some ecosystem services. One of the numerous reasons for practicing intercropping may also be the increase of associated tree productivity. Recent results obtain by the group leader (Sungthongwises, 2009 and 2011) clearly show that introduction of legumes in the intercrop seems to be a valuable option for improving soil nutrient availability in young rubber plantations of Northeast Thailand. The most probable advantage is that component crops in the intercrop can complement the trees and that environmental resources can be used more efficiently than by sole crops (Tan et al., 1969; Watson, 1989). However the degree of success of intercropping depends on several factors such as soil nutrient and water content (Clermont-Dauphin et al., 2012). Plantings on poor soil and in areas of marginal rainfall cannot be expected to support the demands of an intercrop without detriment to rubber trees. Anyway, there are still few references on the potential indirect advantages that might be associated with the introduction of an interrank legume or crop cover. ***Intercropping will be the model of agriculture practice studied in priority during the project (Figure 4).***

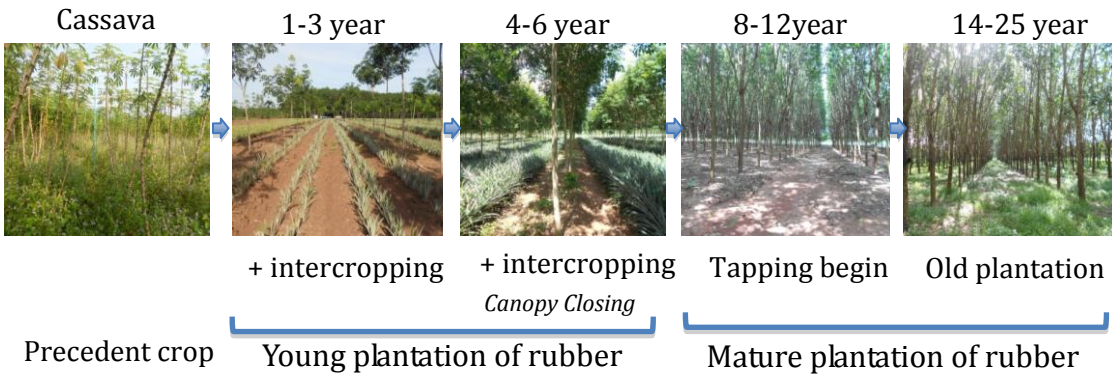


Figure 4: exemple of rubber trees chronosequence with intercropping before canopy closure.

ECO-RUBBER OBJECTIVES

General objective : to determine, via a multi-disciplinary approach, the impact of rubber tree plantations on soil biofunctioning and on related ecosystem services (nutrient cycling, C sequestration)

Specific objective: to characterize the impact of agricultural practices in rubber tree plantations on soil sustainability

GENERAL HYPOTHESES

1- the shifting from annual cash crop to rubber tree will increase the soil functional biodiversity and the related ecosystem services (nutrient cycling and C sequestration)

Justification: tree plantation on degraded soil should slowly modify soil functioning by changing the soil climate (limit the excess of light and temperatures) soil characteritics (water transfert via root developement) soil nutrient contents (roots exsudation, litter fall)

2- Sustainable Agricultural practices (reduced tillage, organic fertilization used of cover crop) will buffer the negative impact of adverse soil ecological context (case of NE Thailand) or deforestation (Laos) on rubber plantation

Justification: table 1 shows that rubber plantations in Khon Kaen area deal with a problem of sustainability regarding the soil and climate constraints. In this context, good management practices such as organic amendements for nutrients supplies, cover crop for soil moisture preservation and nitrogen supply, reduced tillage for maintening soil functional diversity will be a viable strategy to attenuate these ecological adverse conditions.

Table 1: pedoclimatic conditions for rubber

	Optimum	Khon Kaen characteristics
Pluviometry	1500 mn/y	1200 mn/y
Dry season	Max 4 months	6 months
Soil	Deep + clayey	Deep but sandy

Project originality

1- Associate ecological, agronomical and social approaches to address the sustainability of rubber planation in ecological adverse condition
2- Set up of a long term rubber observatory of agricultural practices in rubber plantation

MAIN METHODOLOGICAL PRINCIPLES OF THE PROPOSAL

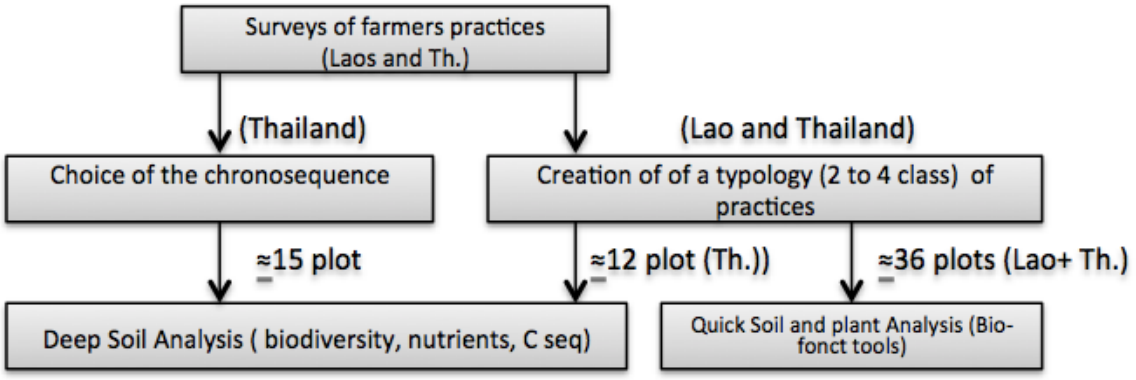


Figure 5: Experimental strategy link to farmers surveys.

1- FARMER SURVEYS

Because soil functioning depends mainly on agricultural practices, a special focus will be done during this project on the inventory of farmers practices (see fig. 1) which could modify the soil functioning (tillage, intercropping, fertilizers, OM management etc..) this survey will allow the creation of a typology of agricultural practices link to their potential impact on soil functional diversity.

2 - CHRONOSEQUENCE STUDY

Chronosequences are an important and necessary tool for studying temporal dynamics (cumulative effect, ecological successions) of plant communities and soil development across multiple time-scales Thus we have to survey the soil evolution within the major stages of the tree plantation (Figure 4):This chronosequence has already been chosen in 2014.

2- IMPACT OF INTERCROPPING

Because intercropping represent an important issue of this project, the specific impact of this practice on soil functioning could not be addressed within the farmer's fields because of the pedoclimatic variability. Thus; the impact of the intercroping (3 legumes and 2 cash crops) will be assessed using an experimental layout (4 randomize bloc). The impact of on rubber growth, roots developement, soil physico-chemical characteristics, soil biodiversity (microbial, nematodes and macrofauna), C sequestration will be assessed during the 3 years of the project. The selection of the legumes and cash crops will be done according to the first results of the farmers survey and the recommendation of the Rubber Research Institute of Technology in Thailand (RRIT). Because of the field size area needed for this survey (~4 hect) we choose a field site located in the south of the Khon Kaen province (Buriram) where a young plantation of this size of rubber has just been set up. ***The KKU team schedule to maintain this experimental layout after the project on order to assess the long term impact of intercropping on soil services.***

3- COMMON METHODOLOGICAL PRINCIPLES:

The project will apply a common strategy for biotic and abiotic measurements: The sampling strategy will be the same for all the physical and biological measurements. to allow a mapping of physical, microbial, biochemical soil variables to better determine their relationships.

The dynamic impact of rubber plantation on soil services (maintenance of soil biodiversity, C seq, Nutrient cycling) will be assessed on one chronosequence corresponding to a set of plantations with increasing ages (see figure 3).[*].

Impact of agricultural practices on soils functions and soil ecosystem services will be done using field functional indicators (BIO-FONCT-TOOLS). This project implies the characterization of numerous fields, which is both time consuming and expensive using common methodologies. This project aim to select quick, low cost and easy to use functional bio indicators (see methodological paragraph) in order to set up a comparative approach on a lot of fields

The two sites (NE Thailand and Laos) will not be studied simultaneously: we will first concentrate our forces in the first half of the project on the chronosequence and experimental site of NE Thailand where all the methodologies will be set up. The idea is to establish a "methodological basic tool package" (see biofonct tools) linked to the study of the ecosystem sustainability of rubber plantation and let the Lao scientists who participate to this study, apply these methodologies in their own context.

[*] *Luang namtha in NW Laos, where these study will be implemented, rubber tree plantations were estabilished in 1994.*

PROJECT ORGANIZATION

The ECO-RUBBER project will be organized around the 3 ecosystem services targeted by the project.

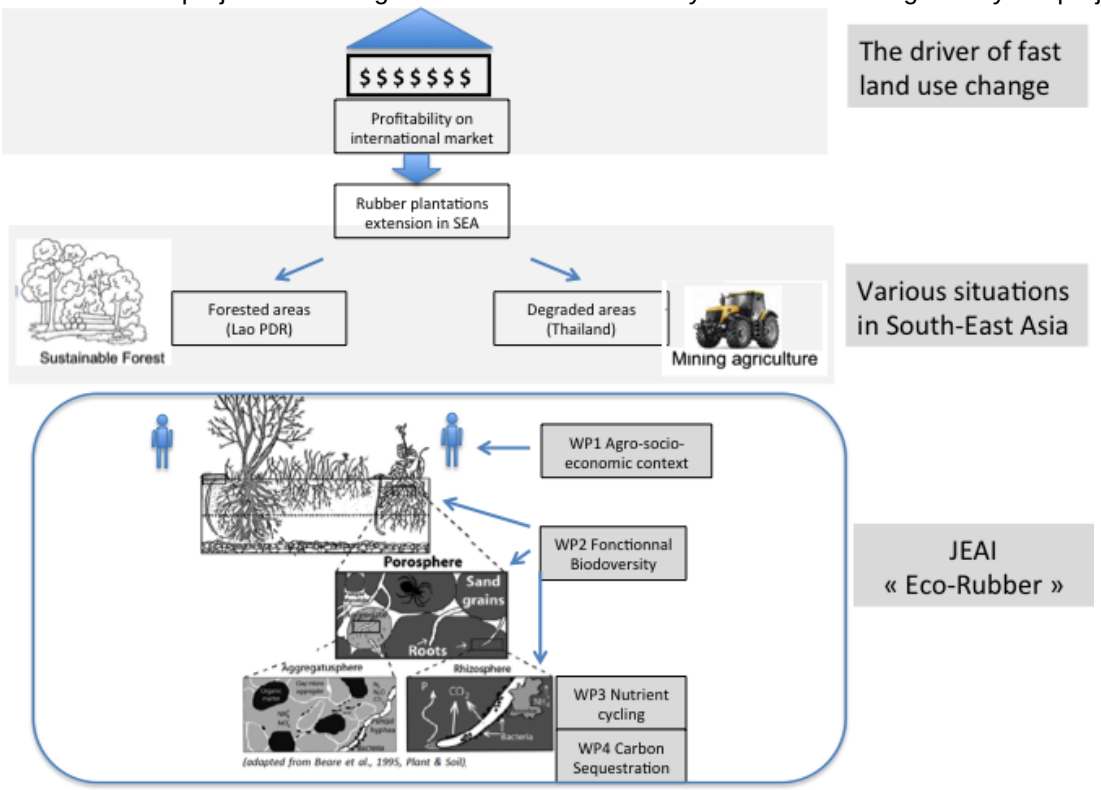


Figure 6: Schematical view presenting the organization of the project in 4 tasks.

Task 1: Agro-socioeconomic survey of rubber plantation in Northeast Thailand and Laos. This task will focus on the inventory of rubber extension zones, Identification of experimental sites to study the soil changes and identify the cultural practices and land-use history through survey among the farmers in each experimental site.

Task 2: Soil diversity and activity of soil organisms with a special emphasis on the main soil functional indicators *i.e* soil fauna engineer, free-living nematodes and soil microbial functional groups (linked to the N and P cycles). The goal is to understand how soil management and soil environmental parameters could explain the observed pattern of soil functional biodiversity.

Task 3: Nutrient cycling: analyze the distributions of soil and leaf nutrient content and the impact of agriculture practice (listed in task 1) on the bioavailability of the two key nutrients namely N and P. Because nutrients availability (and all the others ecosystem services) is strongly influenced by soil physical characteristics, soil physical parameters will also be studied in this task. A special emphasis will be laid in this task on the impact of intercropping on soil nutrient cycle (N and P).

Task 4: C. sequestration will analyze soil organic carbon change (C stock, roots biomass, soil respiration) in the different rubber sites and will identify alternative management option to increase C soil sequestration**.**

PROJECT DESCRIPTION BY TASK

TASK 1: AGRO-SOCIOECONOMIC SURVEY OF RUBBER TREE EXTENTION IN NORTHEAST THAILAND AND LAO-PDR

Objectives

1. Zoning of rubber producing areas based on biophysical conditions and rubber development
2. Characterization of agricultural practices at different stages of rubber plantations and in different biophysical conditions
3. Identification of impact of changes in cropping system to farm management

Questions

1. What are the economic performances of rubber-based cropping system as compare to traditional upland cropping system
2. How does the change in agricultural system impact farm management and farmers' livelihood system?
3. What are the main agricultural practices at immature and mature stages and their eventual links with rubber tree productivity?

Methodologies

1- Regional identification of the experimental site

In order to select a site representative of the main socio-economic conditions, during this preliminary field survey, information will be collected (Surawanich, S. 2010) from different institutes* concerning farming systems, land constraints and labor issues. The selected site has to be representative of the practices of the area selected in order to be able to extend the results of the study.

2- Farmers' Survey on agricultural practices and rubber tree production

Information related to rubber production and main agronomic practices will be collected to target the location presenting the characteristics required. Land-owners of the fields will be in-depth interviewed using semi-structured interview (SSI), which will mainly focus on cultural practices such as historical land use, type of planting material, rubber clone name, age of rubber, planting method, fertilization, weeding management, insect and disease management, intercropping, tapping system, yield, problems in rubber production in the area etc. The respons of this survey will be statistically analysed in order to create a typology of the practices undertaken

3- Comparison (rubber vs others crops) of socioeconomic performances of farm household Rubber farmers studied in this part will be selected at the provincial level of site selected in §1. Multi-stage sampling methodology will be used to select the studied sites. SSI will be used to search for production cost, profit and labor management (source of laborers, output sharing, and gender analysis), working habits (change from day time to night time for tapping) and its impact on household relationship for rubber plantation and marketing of each household. Group interview with key informants and direct observation will be done to cross check the information. This study will also be done in Lao PDR in order to compare social and economic performances as well as cultural practices in both countries.

Output

- Characterization of the main agricultural practices in NE Thailand and Laos

* Such as Rubber Research Center, Land Development Department (LDD), provincial district Agricultural Extension Office

- Classification of farmer's practices in different classes (low, medium and high intensity) based on their potential impact on soils functions
- Identification of the chronosequence site
- Comparison of economic performances between based cropping system (cassava, sugar cane and rubber)

Nota Bene: in all the following tasks we will described field and laboratory technologies

1-Field measurements (Functional indicators of the agro-system BIO-FONCT-TOOLS*) : this project will help to define quick but reliable functional indicators of the different soil functions targeted in this project (OM mineralization, nutrient cycling, soil fauna activities, C sequestration, humus descriptions, soil fertility). These measurements will be done in all the fields*

2-Extensive laboratories analysis : *these methodologies which are time consuming and expensive will be done only in :*

a. *the 2 rubber's chronosequences ((3 ages + former crop) x 3 replicates x 2 countries): 24 plots*
b. *the intercropping experimental site (5 treatments x 4 bloc): 20 plots*
c. *2 class of agricultural practises (2 class X 2 (immature /mature) X 3 replicate X 2 countries : 24 plots**

* this extensive analysis in the 2 class will be undertaken only if the budget allocated is sufficient

TASK 2: SURVEY OF SOIL BIODIVERSITY AND BIOLOGICAL ACTIVITY

Objectives

Characterize the soil functional diversity in rubber tree plantations within different management systems and determine the origin of its pattern (management or soil physical characteristic)

Questions

1. To what extend soil biodiversity is affected by age of plantation, intercropping)?
2. Whitin the studied trophic groups (bacteria, nematodes and soil fauna), what are the most impacted by farmer's practices?
3. Is there a link between the overall microbial and fauna diversity and the soil functioning (soil respiration, nutrient cycling, etc.)

Methodologies

1- Fields measurements (Bio-fonct tools) : because soil engineers such as termite ants and earthworms have been shown to play a key role in soil functioning (Lavelle et al., 1994), this trophic group will be targeted in the field analysis

Macrofauna activities:

- Measurements in soil quadra ($50cm^2$) of earthworms cast, termite degraded wood, ants, termite nest (soil and tree nest)
- Characterisation of the humus index: This analyse is performed in order to recognize and name the humus index. In a 20x20 cm qudra, the different layer (horizon) will be remove one by one andcaracterized. (Horizon OL, OF and OH, Jabiol et al. 2007). These observations have to be done at the beginning of the rainny season.
- Bait-lamina test: The bait-lamina-strip test system (http://www.terra-protecta.de) is available ready for the field test with define substrate in 16 holes (we can fill the holes of the bait-lamina-test strips with any substrate) the advantage of is to provide a comparable, quick and inexpensive screening of the soil biological activity. The standardization of the system allows to compare the feeding activity of soil organisms under different management techniques.

2- Laboratories methodologies

Principle: because the characterization of the huge soil biodiversity is not feasible, we will focus on the three broad functional groups (Lavelle and al. 1994) called

- Microorganisms (bacteria and fungi) which are the chemical engineers of the soil. Overall bacteria will be targeted in terms of density (quantitative PCR, Majeed et al., 2012), catabolic activities (micro-respirometric Campbell et al., 2003) Bacteria link to nutrient cycling (nitrogen fixing bacteria, nitrifiers and phosphate solubilizing bacteria) will be particularly targeted in the intercropping fields works with legumes.
- Nematodes will be the target group because of their ecological importance in the soil food web and they constitute one of the best indicators of soil biological functioning. The nematodes survey will be done using methodologies described by Villenave et al. (2010).
- Ecosystem engineers (earthworms, ants, termites), which regulate the availability of resources for other soil organisms. This measurement will be conducted using the classical methodology described by (Anderson & Ingram, 1993; ISO 23611-51) and if possible with DNA barcoding (Decaëns, 2010) for certain groups (earthworms and ants).

To determine if the biodiversity pattern originated from soil management or soil physical parameters, data analysis will be conducted with the R language and environment for statistical computing (for classical multivariate analysis) and CANOCO software for redundancy (see Floch et al., 2009)

Feasibility: The team harbors specialists of each organism (see team involved) and most of the technologies (microrespirometric tools, DGGE techniques, QPCR) are available in KKU or the LDD. The lamina bait test will be test this year in another project (YARA praoject).

Output

- First global characterization of soil biodiversity in a rubber chronosequence
- Determination of biological indicators link to farmer's practises
- Better understanding of the relationship between diversity and activities

TASK 3 NUTRIENT CYCLING AND ECOLOGICAL INTENSIFICATION IN RUBBER PLANTATION

Objective

1. Identify the nutrient constraint of the rubber tree plantation
2. Specify the type of intercropping which constitutes a valuable option for improving soil nutrient availability

Question

1. What is the long-term impact of rubber tree plantations on soil nutrients contents (N and P in priority).
2. To what extend agricultural practices like intercropping may improve the soil fertility and modify the bioavailability of nutrients for the rubber tree.

Methodologies

1st Question: relative to the long term impact of rubber tree the following data will be collected over the years in each treatment:

Fields methodologies

- Trunk girth, predawn leaf water potential, root distribution of Rubber trees stand.
- Harvested and non harvested biomass, predawn leaf water potential of the interrank crop.
- Plant Roots simulator Plant Roots simulator : PRS is a resin membrane allowing ions exchange. This process is introduced in the soil in order to mesure the ion content with very small perturbation. Cations of the membrane will absorb anions from the soil like: NO^{3-}, $H_2PO_4^-$, HPO_4^{2-},SO_4^{2-}… The soil nutriments are then easily identifiable.
-

Laboratories methodologies

- Soil NPK analysis and water potential in ranks and interranks, over depths
- N15 measurements of trunk, leaves and soil

2nd question relative to the impact of the interrank management of immature rubber trees will be investigated in agronomic site. The following data will be collected in each situation:

- Soil nutrient availability (using PRS)
- Nutrient foliar diagnosis
- Trunk girth of a sample of trees
- Biomass of harvested products and biomass of residues

Expected output

- Evaluation of farmers management effects on rubber plantation sustainability in the study area
- Identification of strategies for their improvement
- Contribution to the modeling of nutrient and water relationships between species in agroforestry systems

Task 4 carbon sequestration

Objective

1. To asses C footprint of rubber plantations (RP) in NE of Thailand as compared to RP in other regions of TH and Laos
2. To study the impact of the diversity of rubber's practices on C seq. with special focus on intercropping and tapping systems.
3. To study the mechanisms of C sequestration in soil with focus on inputs of C in the soil from the trees (litter fall, fine roots turnover, root residues) and the impact of macro- and micro-fauna.

Questions:

1. What is the C sequestration in rubber plantations in NE Thailand as compared with that in other regions of Thailand and Laos and other ecosystems in NE Thailand and NW Laos?
2. How C sequestration in rubber plantations is affected by soil and climatic variables?
3. Base on C footprint assessment could we identify existing rubber based cropping systems or management technics (tapping systems, intercropping, organic matter) developed by farmers that perform better than other in terms of C sequestration?

Methodologies

1- Fields measurements

Root length density and root biomass: Destructive sampling will be used to estimate root length density down to a depth of 1 m and will be processed and analyzed according to the protocol described in Gonkhamdee et al. (2010)

Root decay: air dried root residues will be inserted in soil using fine nylon bags at different depths for one year to establish the half-life of root material at the soil depth investigated.

Soil respiration: Soil gas emissions will bee evaluated in a 20 cm-wide collars with portable system chamber (Li-Cor Inc., Lincoln, NE, USA)

2- Laboratory measurements

Carbon and nitrogen content and C/N rate. will be evaluated with a Near Infra Red Spectroscopy (NIRS) according to Brunet et al. (2008)

Litter quality: will be assessed using van Voeast methodologies and NIRS

Feasibility: most of the equipment is already available in Thailand, however for CO_2 emission a Licor will be purchased with co-funding from other projects (LMI LUSES, French rubber industrial consortium (IFC). The NIRS measurements will de done at LDD (a NIRS has recently been purchased) and data analysis will be done in cooperation with UMR ECO&SOLS in Montpellier (Bernard Barthes)

Output

- C footprint assessment in rubber plantations of NE Thailand and NW Laos
- Identification of best practices for soil C sequestration management in rubber plantations

MAIN OUTPUT OF ECO-RUBBER

At the end of the project, the team will be able to determine the changes in major soil services in the rubber tree plantation and to identify the influence of agricultural practices on these changes.

Such results will be used to determine what kinds of studies are needed in the specific context of Laos to assess the ecological success of Rubber tree plantation.

More specifically, this project will help to define:

- if rubber tree represent a “sustainable” alternative in NE Thailand compare to others endogenous crop (cassava, sugar cane) and in Laos compared to forest
- If rubber tree plantation improve in a dynamic perspective the soil quality (Nutrient availability, soil biodiversity)
- Define the best agricultural practice in terms of ecosystem services (rubber production included)
- Characterize the biotic indicators of sustainability of the Rubber plantation linked to the ecosystem services studied (C. sequestration and nutrient cycling)

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3- Budget

Already available equipment and needs

	Already available resources	To share with another structure (specify)	To get
Premises	YES	---	----
Big equipment	Nutrients cycling tools, e.g. Atomic absorbtion, Nitrogen analysis appratus (micro-Kjeldahl), Spectrophotometer, , Autoclave Water retention curves and water infiltrability	DGGE machine (LMI) PCR machine (LMI) Fast DNA spin (LMI) Microplate reader (IFC)	Freezer (-80 C°) Incubator Shaker (KKU)
Small equipment	EC and pH meter, Centrifuge, Refrigerator (-20 C°) ET	Electrophoresis (LMI) Microrespirometer (IFC)	GPS (JEAI) Soil auger (JEAI) Soil core (JEAI) Moisture can (JEAI) Root scanner (JEAI) Chlorophyll meter (JEAI)

Financial resources and needs in thousand euro (specify)

Needs		Already available resources (specify the origin, especially co-funding by host institution)	Requested from IRD (50.000€ maximum)
Overhead	**waived by KKU**		**0 k€**
Small equipment (8 k€)	Field (GPS, augers, bulk density cylinders, sieves, etc..), Laboratory (pH meter, chemicals, etc)	**1 k€ (KKU) 2 k€ (IFC)**	**5 k€**
Local missions/ field work expenses (11 k€)	(gasoline, labours,..)	**4 k€ (KKU) 2 k€ (TICA)**	**5 k€**
International missions (6 k€)	(transportation, accommodation)	**2 k€ (KKU)**	**4 k€**
Trainings (24 k€)	Collective/individual	**6 k€ (KKU) 4 k€ (DPF-BEST)**	**14**
organization of symposium/workshops (28 k€)	Meeting room rental, food, accommodations, , etc..	**9 k€ (KKU) 10 k€ (miscellaneous)**	**9 k€**
Other expenses (specify) (Analysis – 29 k€)	ANALYSIS Soil analysis	**3 k€ (KKU) 4 k€ (TICA) 9 k€ (IFC)**	**13k€**
Total	**106 k€**	**TOTAL 56 k€ 25 k€ (KKU)* 6 k€ (TICA) 11 k€ (IFC) 4 k€ (DPF-BEST) 10 k€ (miscellaneous)**	**50 k€**

TICA: Thailand International Cooperation Agency
IFC: Institut Français du Caoutchouc

Complementary information (**€**):

Type of expenses	Designation	specification	JEAI IRD	KKU	IFC	LDD-TICA	Autres BEST..	Autres BEST..)
Small equipment	Lamina baits test	for OM deg	2000					
	PRS	Nutrient ctcling	1500		750			
	small field equipment		1250	625				
	(auger, density, cylinders)							
Local Mission	transport-gazoline perdiem	12 by year	5400	1700		1000		
International mission	Symposium participation	1 by year	4000	2000				
Training	Collective	5	6250	3125				
	Infdividual	6	8000				4000	4000
meetings	Annual meetings	3	3750	1875				
	final Symposium	1	5000	5000			10000	10000
Analysis								
Biodiversity analysis	bacterial diversity	33 samples	3000		5200			
	bacterial activities	207 samples	1000		1000			
	nematodes	33 samples	2000	2000	2000			
	Soil Fauna	207 samples	4000	1000	1000			
Soil physical	Chemical (CNP + NIRS)	207 samples	2500			1250		
	Physical	207 samples	500			1500		
Total			50150	17325	9950	3750	14000	14000

Budget breakdown per year

Désignations - Items	Montants / Amounts (euros)			
	Year 1	Year 2	Year 3	Year 4*
Fonctionnement – Running costs	6	4	3	
Petit équipement – Small equipment	2	2	1	0
Trainings	5	5	4	0
Missions locales / Missions sur le terrain Local missions / Field work expenses	2	2	1	0
Missions internationales International missions		2	2	0
Symposium + Workshop			4	5
Total	15 (30% du budget)	15 (30% du budget	15 (30% du budget)	5 (10% du budget)

* : The last batch of the funding (10%) is transferred to the JEAI after reception of the final report (end of the 3rd year).

Justify budget request (3 pages maximum)

Main principle

The current budget is ambitious and based on some expected funding like French embassy or Best for individual trainings. We will readjust the project (number of sites analyzed, type of analysis) according to the real budget allocated during the kick off meeting

Eco-Rubber is nested in a group of project that are financed (IFC Bio-Rubber) or evaluated (ANR Heveadapt) therefore most of the equipment necessary for the experiments is not covered by the budget. Most of the budget of Eco-Rubber is devoted to analysis (25%), and to capacity buildings (training and small equipments) and to local field mission.

Because KKU will fund this project (if selected) to half of the amount by AIRD, we will be able to devoted a part of the budget allocated to small equipment (field and lab) to help to the implementation of a soil laboratory in NuoL.

Equipment and facilities

Most of the lab equipment necessary for this project is available in the different institutes or partners of the project. LDD provides a laboratory for soil analysis in region 5, KKU provided laboratories facilities for nematode extraction, and soil fauna analysed (microscope, stereo microscope) whereas the LMI molecular platform located within the LDD Bangkok has all the basic equipment for soil microbiota analysis; DNA extractor (fast DNA), fingerprinting techniques (DGGE) etc. The microbial density and activities of microorganisms will be measured with microrespirometer funded by the IFC project. Because of budget constraints we will not purchase a specific equipement for CO2 field measurement (link to task 4 C. Sequestration) a Li-COR CO2/H2O Analyser. This equipment will be ask in others projects like heveadapt

Co-financing

- KKU provided 25k€ according to the commitment letter and 10 k€ for the participation of its lecturer to participate to symposia
- IFC (french Rubber association) will provides 10 k€ on the project « hevea-rubber » (PI : A. Brauman) mostly devoted to analysis of the bacterial diversity using high throughput technologies or metagneomic approachs (6000 € for 33 samples based on genoscreen invoice). The IFC program does not provide any expenses for the Lao, only the JEAI proposal
- LMI LUSES will help to fund only collective training

Field expenses

ECO-RUBBER required both field and lab work. Most of the field expenses concerned the task 1 for the farmer surveys.. Because it was not possible to calculate the exact number of field days per person du to the important number of tasl and persons involved in the project, the level of expenses should be considered as an approximation. Anyway, LDD and KKU people does not request any per diem when they go to do field works (these expenses are taken by their own institutions) and most of the expenses concerns the payment of gas, driver, daily workers and accommodation. etc. Anyway most of the expenses will concerned the Lao field the second year (see time table).

International mission

KKU has a policy (see co-funding) to fund their own lecturers for one symposium a year (if they present their work). This explain why the amount a international mission request to the JEAI is very low (1 per year). Anyway the last year we supposed that a lot of partners will try to attempt international symposia. Because of the weak amount devoted to the international trio a PHC program (program Hubert Curien) will be submited to the french embassy in case of success of this proposal. This project will help to fund french scientist to give ecological lecturers and seminar in order to increase the theoretical background in ecology of the partners.

4- Partnership with an IRD research unit

To be filled in by the research unit correspondent (3 pages maximum)

4-1 Background of the association

Here, it is described:

- the origins of the relationships with the team or some of the team members,
- the different stages or the different forms it has taken
- the partnership between the institution of the research unit and the institution(s) where the team members are employed, if any
Analyse the outcomes and the major achievements that justify this JEAI proposal.

The JEAI team ECO-rubber is an new evolution of a long scientific collaboration between IRD and its Thai and Lao partners.
In Thailand the relations with LDD started in 1995 when Roland Poss (soil chemist) was based at the soil analysis laboratory, working on 'Alleviation of infertility of upland Acid soils in south East Asia' project (1995- 2001) and was join by myself (soil physicist) in 1999. This project was co-funded by LLD; our research was mainly conducted in North–East Thailand inside an LDD experimental station. In 2001, Roland Poss was replaced by Olivier Grunberger (soil geochemist) for a new project : «Improving the management of Salt Affected soils (case of the Saline Patches in Rainfed paddy Fields in North East Thailand)» (2001- 2007). This project was also co-funded by LDD but was conducted in a farmers' paddy field close to Khon Kaen. I took this opportunity of this new location to contact the Faculty of Agriculture of Khon Kaen University. This resulted in a Franco-Thai project (2005-2010) funded by the French Embassy and the Thai ministry of research ('Improving soil and water management in the undulating ecosystem of Northeast Thailand") that allowed five lecturers to get their PhD in France. During that time, the IRD and LDD keep on their collaboration with a project intituled 'impact assessment of planting rubber trees on sandy soils in North-east' (2007-2013) still with LDD co-founding and that took into account mainly water transfers.
The IRD-LDD collaboration resulted in several individual and collective trainings about technical aspects (electronic microscopy, GIS, writing scientific papers, etc.) and scientific aspects (scientific training in French laboratories ranging 2 weeks to 3 months, at IRD but also others French institutes such as CIRAD, INRA, etc.).
These entire different collaborations end with 30 papers co-published in peer reviewed international journals.
During this time, we tried to increase the direct scientific collaboration between this technical institute, the LDD and the university, KKU but we face important administrative constraints. Indeed, LDD is under the authority of the ministry of Agriculture and Cooperatives, while KKU is under the authority of the ministry of Research. Despite these constraints, we were able to maintain some scientific contacts and collaboration between the different institutions (IRD, LDD and KKU), which has resulted to achieve some significant outcome such as an international symposium on the management of tropical Sandy Soil co- organised by IRD, LDD and KKU (200 persons from 20 countries) and under the framework of the International Union of Soil Science and the supervision of two PhD thesis with KKU partners (Pr. Yupa and Pr. Wittay)
In Laos, collaboration started in 2001 at NAFRI (National Agriculture and Forestry Research Institute) with the project leaded by Christian Valentin (IR

).
From a scientific point of view this is a successful project with many exchanges with French senior scientists. It is noteworthy that during the last decade, this project trained also more than 70 Master students from the Faculty of Agriculture of NuOL but none of them could unfortunately continue their academic cursus in foreign universities to get a PhD (there is not yet a PhD diploma at NuOL).

Major achievements, which justify this JEAI proposal

- A team with a real identity. The common background of this team, their long lasting relationship with French and particularly IRD scientist, the recent constitution in KKU of a junior team devoted to the study of rubber plantation, the scientific complementarity of this team (very roughly KKU more devoted to biological science, LDD to soil science and NuOl to agronomic and social science) make this proposal relevant and with an important scientific potential.

- Eco-rubber a good strategy to strength the Lao scientific community in environmental science link to agriculture. In Laos, it was not possible (Nuol does no deliver PhD diploma) for Master students to get their PhD. To overcome this important issue**, a new collaboration strategy (this project) was decided in relation with our Thai partners: associates lecturers from NuOL in a common research project conducted in collaboration with KKU and LDD.** In that case they would be trained by their involvement in co-organising the research project in Thailand, by participate to thematic schools and collective trainings. Conversely, they cold use this knowledge to adapt their own lectures at NuOL and give lectures at KKU concerning Lao situation. They would be responsible of organising the JEAI field and lab work in Lao, and take this opportunity to use their data to prepare their own PhD diploma.

- An institutional pressure to develop regional scale projects: This analysis of the partnership in Thailand and Laos within the last 10 years demonstrates a strengthened of this collaboration between the IRD and their Thai and Laotian partners. In the same way, the collaboration between regional institutes (Thai and Laotian) becomes more pregnant du partly to the political necessity of Thai institutes to develop south partnership under the framework of the ASEAN (the ASEAN policy will be implemented in 2015). Therefor, there is a both a political and scientific opportunity to develop a regional cooperation.

- JEAI ECO-RUBBER complete current IRD Tools in the SE Asia area: In 2012, AIRD launched to new tools of partnership, i.e. PPR SELTAR and LMI-LUSES. These tools are intended to stimulate the regional cooperation and create a favourable scientific environment that associates Asian and French senior researchers with younger researchers, post-doctorates, and students. These tools already create a stimulating scientific network at a regional scale. Anyways if these tool are appropriate to strength the capacity buildings (collective training, workshop, etc.) of the team, they could not support any current research project. In a context of scarcity of research funds in Asia (and in all the world) this project will fill a gap and will allow supporting an emerging team in the emerging field of ecology.

- Ecology a good tool to overcome the discipline boundaries: soil ecology is first a voluntary process, which implies to take into account the biotic and abiotic component of a soil. This team has all the technical abilities to do so but need a theoretical framework to go beyond their own disciplines. This is why this project is scientifically relevant and important in a context where Ecological science is not yet taught at the academic level.

■ ■ 4-2 Terms of the association

Make a detailed description of the strategy the research unit will implement to help structure the team and to support the capacity building of the team members for the next 3 years.

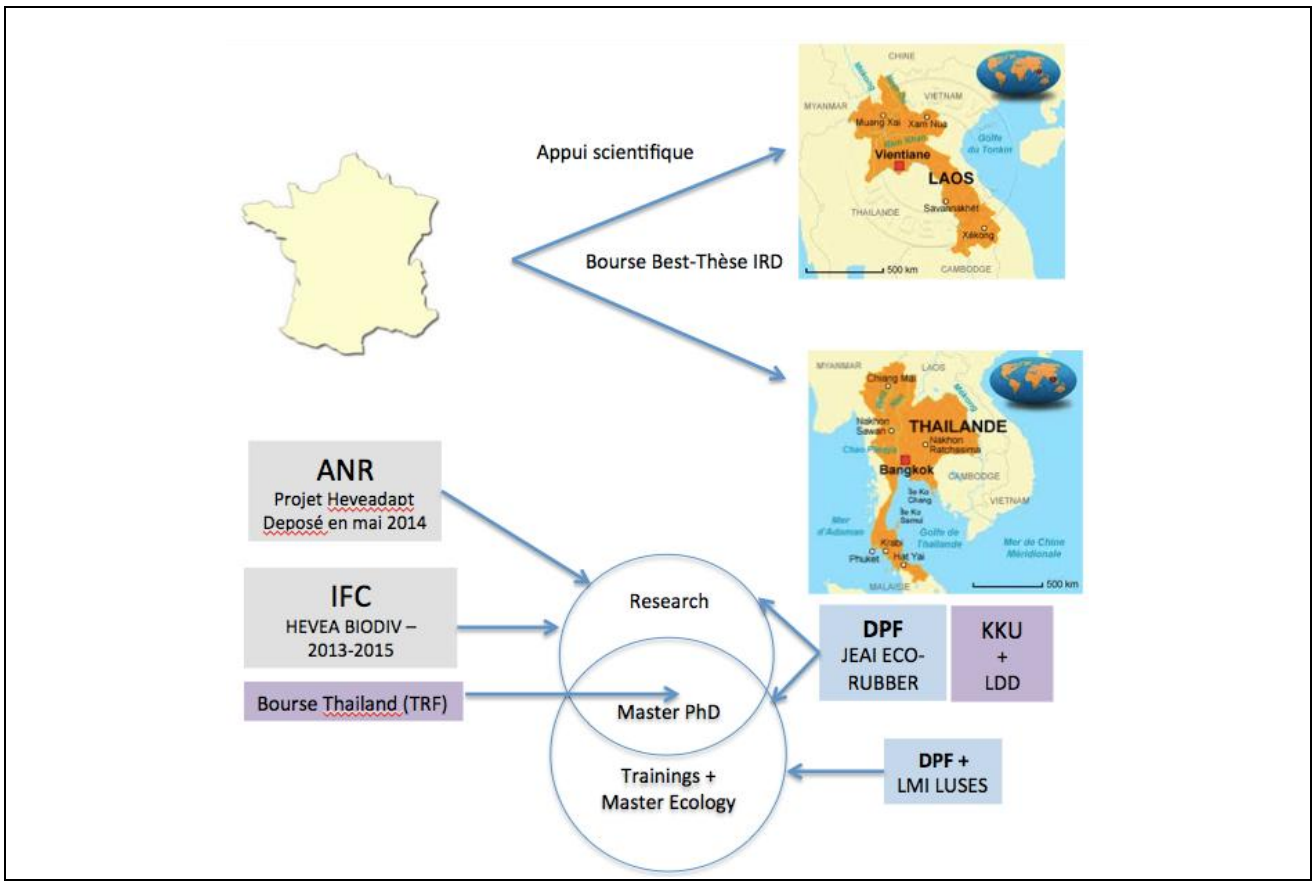
The team is ready and operational: all the researchers of this project know each other and have already worked or studied with some of the other members. This pre-existing link is a major plus for ECO-rubber as it means that the group will be immediately operational and the start up time will be reduced to the minimum. I would like to stress that during the discussion to prepare this project, the team has already listed the characteristics of the plantations that are needed for this project and has already made a work plan to identify in the next month the possible plantations. Thanks to this first rough identification, it will be faster for them to select the geographical zones where the agronomical and soil surveys will be conducted as soon as the budget will be made available. This demonstrates their high motivation for conducting this project and also their autonomy.

Presence of a multidisciplinary IRD (and CIRAD) team on soil environmental science: The current presences of 10 IRD researchers belonging to the LMI LUSES (UMR ECO&SOLS and Bioemco)

and involved in soil ecological science is a good guaranty of success. If some of them posted in Thailand and Lao begin some collaboration with KKU or NuOL such as Alain Pierret (C sequestration) C. Hartmann, (soil physical scientist) Alain Brauman (soil microbiologist) and Henri Robain (soil variability). Any of them are posted in Khon Kean or in Nabong (where NUol is located), which constitutes a good guarantee of autonomy for the team. Each of IRD researchers associated with the JEAI team is a specialist of one of more aspects of this project and they will ensure the transfer of competence and actively participates in the capacity building of the ECO-RUBBER team. IRD scientist will help to consolidate this research team by asking BEST fellowship, PhD grant (French embassy, AIRD or TRF fund see figure below). ECO-RUBBER team will have access to the molecular platform of the LUSES project located in the LDD at Bangkok for some define analysis like quantitative PCR (microbial density) or microrespirometric measurements (microbial activity). All this multidisciplinary team (from soil physic, to microbiology and agronomy) has the ability to give lectures, supervise students with Asian colleagues and could logistically easily reach the partners in KKU or Vientiane.

A project nested in other project (figure below):

- IFC (French rubber association) on biodiversity of Rubber planation funded in 2013 (PI A. Brauman)
- The LMI LUSES on environmental impact of LU changes
- The PPR SELTAR (C. Valentin)
- The ANR Hevea adapt (agrosbiosphere) which will be submitted in March 2013 (PI P. Thaler)
- The HRPP (hevea Research Platform in Partnership) (PI R. Thaler) All this project will contribute with their own specificity to the project. The expected results of this association is to specify for the first time using a multi integrated approached the environmental consequence of rubber plantation in Thailand and Laos.
-



Administrative information

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Position: Director General
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■ Thematic field:

- ☐ Development and governance
- ☐ Vulnerabilities, inequalities and growth
- ☐ Boundaries, and social and spatial dynamics
- ☐ Infectious diseases, emerging and neglected diseases in particular
- ☐ Vulnerability and climate change
- ☐ Productions and food safety
- ☐ Sustainable energy and transport
- ☐ Health-plant interactions
- ☐ Nutrition
- ☐ Lifestyle diseases
- ☐ Water resources
- ☐ Risks and natural hazards
- X Ecosystems and biodiversity

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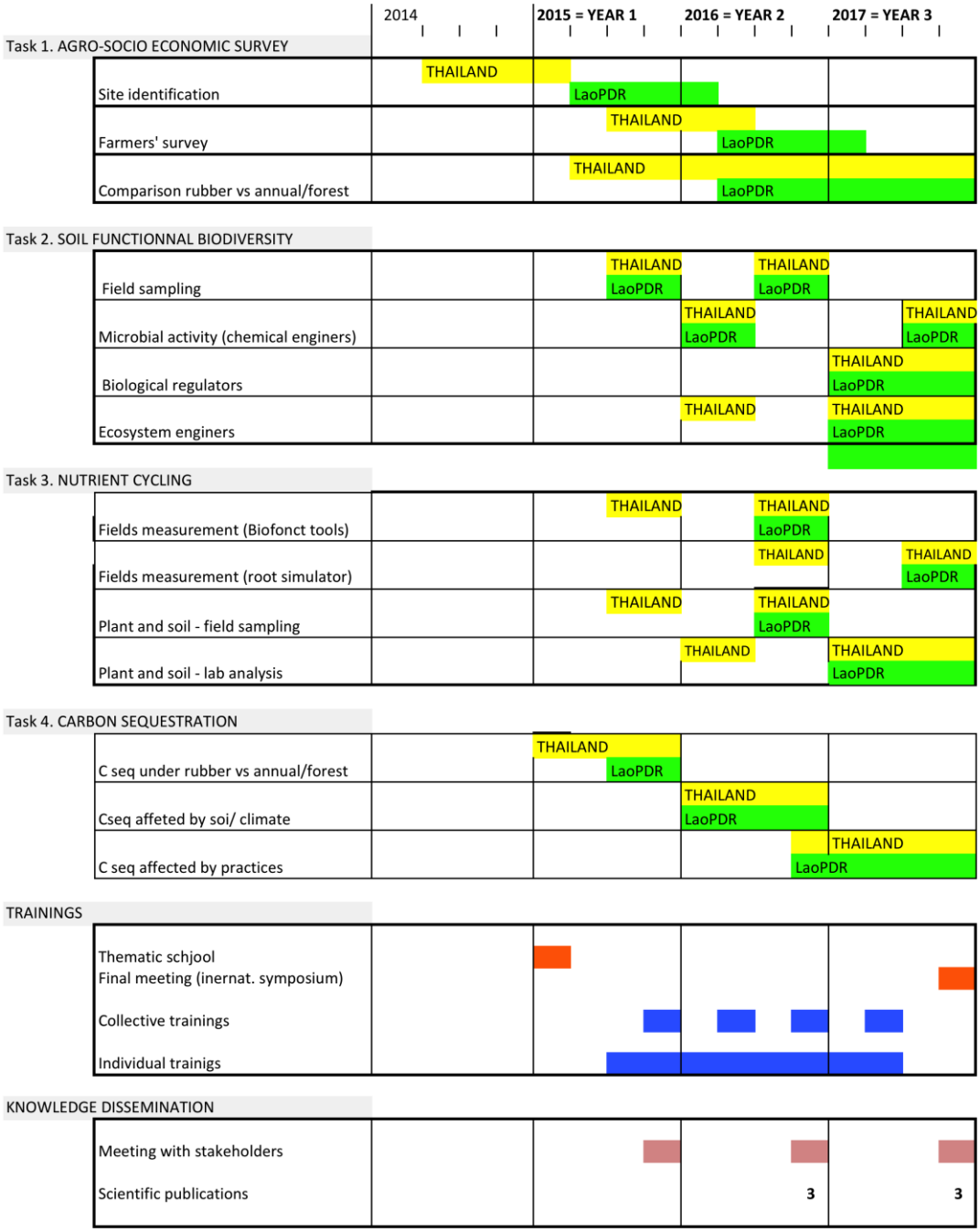
ECO-RUBBER TIMELINE FOR PROPOSED ACTIVITIES



Most of the activities will be conducted firstly in Thailand and will start some months later in Laos; this is because acces to the field and thus set up the procedures and equipment are easier in Thailand.

Field activities will be conducted during the rainy season (second semester) and will be scheduled so that a maximum of participants can be working together; this will be considered as 'team building' activity increasing the team structuration and synergies between all permanent and temporary members.

Collective and individual trainings will be scheduled more precisely during the thematic school planned at the beginning of the project.

Khon Kaen University
Meang, Khon Kaen, 40002
Thailand

Khon Kaen, April 10, 2014

Object: Explaining motivation and interest in the project

Dear Sir or Madam,

I would like to submit the attached summary form proposal 2014, entitled "Evolution of soil ECOlogical functioning under tree cultivation: the case of RUBBER tree plantations in North-East Thailand and Laos", in order to apply for the Jeunes Equipes AIRD Program (JEAI) in France.

I am a research lecturer at the Department of Plant Science and Agricultural Resources (Agronomy Section) at the Faculty of Agriculture of Khon Kaen University. I hold a Ph.D. in biological systems integration from the University of Montpellier II in France. The title of my thesis is "Legumes for intercropping with rubber trees: interaction of the rhizobial symbiosis with phosphorus availability in Northeast Thailand". After obtaining my Ph.D. under a Franco-Thai program in 2008, I have continued to acquire knowledge in agronomy, geosciences, hydrosciences and environment. Moreover, I have pursued training in recent years on the isolation of phosphate-solubilizing bacteria from different field crop productions in Japan with support from the Japan Society for the Promotion of Science. The project was developed under the invitation program for young East Asian researchers in field science for the resolution of environmental and food problems in Southeast Asia.

I am especially interested in the ecology of rubber tree plantations in Northeast Thailand and Laos. Rubber plantations in these areas are currently expanding despite rather adverse growing conditions compared to the traditional plantation areas. To determine if rubber plantations constitute an environmental degradation or an improvement, the scientific objective of the team is to answer the question "what is the long-term impact of rubber trees on soil functioning and soil quality" in interaction with different research fields. To study these complex environmental

questions, our project associates complementary Thai and Lao researchers: social scientists, agricultural system experts, tree physiologists, agronomists, soil ecologists, soil physicists and soil microbiologists. The Jeunes Equipes AIRD Program (JEAI) will bring young and senior researchers to collaborate on research and capacity-building activities under supervising members of the AIRD. Soil ecology is still poorly studied in Southeast Asia. The IRD's support will be oriented towards the development of recent analytical techniques (molecular characterization of microbial diversity, etc.) and will also provide an ecological theoretical background.

I have been chosen by the team as the leader to run this project because I am a good communicator as well as a very well organized person. I also have developed a strong collaboration with the Institute of Research for Development (IRD) under the joint project in Partnership: LMI LUSES (Dynamic of Land Use changes and Soil Ecosystem Services), INRA SupAgro Montpellier and Land Development Department (LDD). Moreover, I have experience in giving lectures on the principles of crop production to Japanese students of Kochi University and Tottori University. The JEAI leadership would be a first step for me towards leading an international team on rubber at Khon Kaen University.

The project will result in scientific publications, improved student supervision and the emergence of a strong community of Thai and Lao researchers able to answer future environmental questions. One of the expected key outcomes will include a proposal for sustainable agricultural practices for the management of rubber tree plantations and associated soil resources. I am convinced that further research on the soil functioning changes under tree cultivation in the case of the rubber tree in Northeast Thailand and Laos is highly promising and urgently needed.

Name and address of the applicant:

Assist. Prof. Dr. (Ms) Kiriya SUNGTHONGWISES
Department of Plant Science and Agricultural Resources,
Faculty of Agriculture, Khon Kaen University,
Muang, Khon Kaen 40002,
Thailand
Telephone # 043-342949
Fax # 043-364636
E-mail: skiriy@kku.ac.th

I hereby certify that the above information is complete and correct to the best of my knowledge, I will make all the necessary efforts to successfully complete the research project described and commit myself to work regularly with the hosting research team for the whole term of the grant awarded.

Research correspondent:

Dr. Christian Hartmann IRD - UMR 211 "BIOEMCO"
IRD office
c/o National Agriculture and Forestry Research Institute (NAFRI)
P.O. Box 4199
Ban Nongviengkham, Xaythany District
Vientiane, Lao P.D.R.
E-mail: christian.hartmann@ird.fr

Yours sincerely,

Kiriya Sungthongwises

Assist. Prof. Dr. Kiriya SUNGTHONGWISES

Applicant

IRD
Institut de recherche pour le développement

iEES Paris
Institut d'écologie et des sciences de l'environnement de Paris

Soutien au projet de JEAI "ECO-Rubber -
Soil functioning changes under tree cultivation: the case of rubber tree in North East Thailand and Laos porté par Mme Kirya Sungthongwises et Christian Hartmann

Le projet 'ECO-rubber' répond aux priorités nationales du Laos et de la Thaïlande, deux pays encore largement dépendants de leurs revenus agricoles, et donc du maintien durable d'un potentiel de production élevé de leurs sols.

Au Laos, pays resté longtemps fermé (1975-1995), il répond aussi au besoin, bien identifié par le Président de l'IRD et le DGD-S lors de leur visite en mars 2011, et par le Directeur du DER, en janvier 2013, de promouvoir l'émergence d'équipes de recherche de niveau international (diplôme de PhD pour les enseignants/chercheurs, augmentation du nombre d'étudiants en master, développement des suivis de terrain, amélioration des équipements de terrain/laboratoire, etc...). Ce projet mobilise ainsi de jeunes chercheurs du DALaM-NAFRI, partenaire de l'IRD depuis 1998 et hôte des équipes depuis 2001. Ce besoin s'avère particulièrement aigu dans les domaines agricoles. Il importe notamment d'identifier, étudier et prévenir les risques environnementaux liés aux changements rapides d'usages des sols, liés à la transition entre des cultures annuelles de subsistance et des cultures pérennes commerciales.

En Thaïlande, le projet répond à l'objectif de l'Université de Khon Kaen (KKU) de lancer une formation de troisième cycle concernant l'écologie des sols, à la faveur d'une approche intégrée s'apparentant aux UMR françaises. Comme aucune formation de ce type n'existe à l'heure actuelle à l'échelle de l'ASEAN, association de dix nations en Asie du Sud-est qui souhaite unifier à partir de 2015 les systèmes d'enseignements, y compris de Troisième cycle, et mettre en place des centres d'excellence régionaux, KKU ambitionne d'occuper cette place pour l'écologie des sols avec le soutien de l'IRD et des deux UMR Bioemco ainsi que Eco&Sols.

L'équipe sera dirigée par Mme Kirya Sungthongwises dont Robert Arfi (DER) et moi avons pu évaluer le très bon niveau scientifique, le dynamisme et l'ouverture vers l'international.

Ce projet sera animé du coté IRD par Christian Hartmann qui a développé depuis plusieurs années un partenariat fort avec les institutions laotiennes et thaïlandaises de ce projet. Il a co-encadré la thèse de deux chercheurs de cette équipe et a co-publié plusieurs articles avec ses membres. Il a également organisé en 2005 un symposium international (>200 participants) avec les institutions partenaires (KKU et LDD) et le soutien de la FAO. Au-delà de ses qualités scientifiques et des gestionnaires d'équipe, il a déjà montré ses capacités à travailler avec les équipes de la région tout en associant ses collègues de l'IRD, des universités et instituts français de recherche, et de la communauté scientifique internationale. Il a donc ma totale confiance pour animer avec succès ce projet ambitieux et important pour notre Institut en Asie du Sud-Est dont la dimension régionale correspond bien aux objectifs du PPR Seltar.

Enfin, il faut noter que Vientiane et Khon Kaen sont reliés par des voies rapides, permettant de couvrir la distance (200 km) en moins de trois heures.

En conclusion, je soutiens ce projet de JEAI sans réserve.

A Emei Shan, Sichuan, le 21 avril 2014

Christian Valentin
Directeur adjoint de l'UMR iEES-Paris

Khon Kaen University
Meang, Khon Kaen, 40002
Thailand

Commitment letter for the AIRD Institution

Mr. Christian Devaux
Director of DPF - AIRD
Institut de Recherche pour le Dèveloppement
Immeuble Le Sextant
44, boulevard de Dunkerque CS 90009
13572 Marseille cedex 2, France

Dear Sir,

Subject: Letter of commitment for cofinancing the JEAI «Evolution of soil ECOlogical functioning under tree cultivation: the case of RUBBER tree plantations in North-East Thailand and Laos»

I, the undersigned Prof. Weerachai KOSUWON Vice-President for Research and Technology Transfer Affairs at Khon Kaen University, confirm the commitment to fund 50% top up of the JEAI project titles « Soil functioning changes under tree cultivation: the case of rubber tree in North East Thailand and Laos» if selected by the AIRD as part of the call for proposals 2014.

W. Kosuwon

(Prof. Weerachai KOSUWON)
Vice-President for research and Technology
Transfer Affairs acting for
President of Khon Kaen University
April 2014

Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

National University of Laos
Faculty of Agriculture
Nabong Campus

Date: 21 APR 2014

Recommendation Letter

To Dr. Christian DEVAUX
Director of DPF - AIRD
Institut de Recherch pour le Développement
Immeuble Le Sextant
44, Boulevard de Dunkerque Cs 90009
13572 Marseille cedex 2, France

Dear Sir,
Subject: Letter of Commitment for confinancing the JEAI "Impact of tree plantations on soil functioning"

I, the undersigned Assoc. Prof. Dr. Oudom Phonekhampheng, Dean of the Faculty of Agriculture, National University of Laos, confirms to support in human resource needed for the JEAI project Titles "Impact of tree plantations on soil functioning" if selected by the AIRD as part of the call for proposal 2014. I would very grateful to assign:

1. Mr. Avakat Phasouysaingam Vice-Director of Research Division, Faculty of Agriculture
2. Ms. Phimmasone Sisouvanh Vice-head of Soil and Fertility Unit, Department of Agronomy, Faculty of Agriculture

Our faculty believes this project is major importance to strengthen our collaboration with IRD and develop a joint research team with Khon Kean University in the field of soil functional ecology applied to teaching curriculum and agriculture development.

Sincerely yours,

Dean, Faculty of Agriculture

สาທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ

ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

Ministry of Agriculture and Forestry
Agricultural Land Use Planning Centre (ALUPC)
Ph. 020 22210788 / Fax 021 770075

- Ref. 169 /ALUPC. 2014

NAFRI and now DALAM have had collaboration with IRD for nearly 15 years on various issues related to sustainable soil and water management in LaoPDR. Consequently we would like to give our support to the project entitled “Soil functioning changes under tree cultivation: the case of rubber tree in Northeast Thailand and Lao” that could reinforce our long-term partnership with IRD and also our regional scientific cooperation. Consequently, if this project gets JEAI funding, DALAM will provide support with human and technical resources.

Information Provided by:
Name: Oloth Sengtaheuanghoung
Position: Deputy director
Organization: ALUPC

Date: April 22, 2014

Oloth SENGTAHEUANGHOUNG

No. 706

Land Development Regional Office 5,
Mittraparp Rd., Khon Kaen,
Thailand 40000
Tel:66-43-246668 Fax: 66-43-243913

22 April 2014

To whom it may concern:

Land Development Regional Office 5 (LDRO 5) is under Land Development Department (LDD), Ministry of Agriculture and Cooperatives. The responsibilities of LDRO 5 comprised of researching on soil improvement technology, soil surveying and land use at farm scale, analyzing soil and plant, and transferring technology to farmers. The responsible areas are covered 8 provinces of Northeast of Thailand.

LDRO 5 has collaborated with IRD for many years in frame work of different Thai-French cooperative projects to tackle the problems of agricultural development in Northeast Thailand.

This project titled "Soil functioning changes under tree cultivation: the case of rubber tree in North-East Thailand and Laos", which is submitted to IRD, is one of the significant projects for scientific work. The project is a collaboration of four agencies including IRD, KKU, LDD, and NUOL. We believe that the relevant staff of LDRO 5 will be able to gain knowledge and experience from this cooperation that would help improve the professional abilities and would be of great benefit to the LDRO 5 as well. Therefore, LDRO 5 agrees to support soil analysis as we have facility in our laboratory.

Sincerely yours,

(Pinyo Suwanchana)
Director of Land Development Regional Office 5

APPENDIX 1

(ANNEXE 1)

Réponse aux rapporteurs du projet 2013

Le projet 'Eco-Rubber' ci-joint est une nouvelle soumission du projet présenté en 2013, alors classé premier sur la liste complémentaire.

Depuis un an, la jeune équipe s'est réunie à plusieurs reprises pour poursuivre la réflexion sur l'orientation scientifique et les modalités de mise en œuvre du projet, et faire évoluer le texte de présentation de manièreà répondre aux interrogations et suggestions des rapporteurs.

Les rapports ayant été rendus en français, j'ai été chargé en tant que correspondant IRD de rédiger la réponse aux rapporteurs et de préciser les évolutions intervenues depuis l'an passé :

1 – Réponse aux rapporteurs :

Rapports de synthèse des évaluations du projet JEAI ECO-RUBBER

Rapport 1 :

Note de l'évaluateur 1 : A avec beaucoup de point fort
Une toute petite réserve (B) est émise pour l'association entre les institutions des deux pays qui ont chacun leur mode de fonctionnement/intérêt et dont la vision et l'intégration Enseignement/Recherche semblent sensiblement différentes. Pas du tout alarmante

Le projet associe deux universités et deux instituts de recherche finalisée. Ces deux structures ont effectivement des visions différentes ; comme en France, les chercheurs ne sont pas astreints à enseigner, en revanche ils accueillent les étudiants dans leurs laboratoires et sur leurs terrains expérimentaux. Ce sont donc des pratiques complémentaires.

A partir de la rentrée universitaire 2015, les systèmes d'enseignement des 10 pays de l'ASEAN seront unifiés afin de permettre une équivalence des enseignements et une libre circulation des étudiants. Donc, les modules validés dans un pays le seront dans tous les pays. Le système universitaire laotiens et le système thailandais auront non seulement la même vision mais seront compatibles.
Pour la recherche, le 'potentiel' des deux pays est effectivement très différent. Réduire le différentiel et permettre une meilleure intégration est un des objectifs de ce projet.

Note de l'évaluateur 2 : A avec un rapport très positif
Je partage complètement la position de l'évaluateur qui considère la lettre de la responsable très percutante qui donne une bonne impression sur sa capacité à diriger le projet (c'est une physiologiste et biologiste des organismes).

L'unique faiblesse est émise sur les échantillonnages qui ne sont pas clairement définis.

Je suggère de demander cette petite précision en chrono-séquences au porteur de projet

Des informations supplémentaires ont été fournies et se trouvent dans les différents paragraphes qui décrivent les protocoles ainsi que dans le budget.

Le projet Eco-Rubber

« Soil functioning changes under tree cultivation: the case of rubber tree in North-East Thailand and Laos"

a pour objectif d'étudier l'impact de l'hévéa sur le fonctionnement biologique des sols et les services écosystémiques dans le Nord-est de la Thaïlande et au Laos. Il s'inscrit dans une thématique importante liée à l'utilisation du sol, sa conservation et le maintiende sa fertilité. Ce projet est en rapport avec l'augmentation considérable de la production de gomme et caoutchouc en Thaïlande. Il est proposé pour un meilleur contrôle de l'impact des écosystèmes de services sur la qualité et changement du sol (biodiversité et propriétés physico-chimiques).

Ce projet réunit les chercheurs de l'université **Khon Kaen** (KKU) et du Land Department Development (LDD) (Thaïlande), de l'université Nationale du Laos (NUOL, Laos) de l'IRD (et du CIRAD) (dont beaucoup sont déjà en place). De ce point de vue l'équipe réunie plusieurs structures universitaires sur 2 pays et avec une possibilité (à terme) d'impact au niveau régional (**Réseau** ASEAN, SE Asian Nations).
L'équipe souhaite en ***outcomes*** devenir un centre d'excellence (pour obtenir plus de fonds et d'équipements) et faire du Knowledge Transfer (stakeholders, farmers…).

- Très bonne **insertion** dans le milieu scientifique et au niveau **régional.**
- Une très bonne association avec les chercheurs de l'IRD qui dénote d'une très bonne capacité d'encadrement des jeunes et de réalisations des programmes envisagés
- Très bonne insertion dans le milieu scientifique et au niveau **international.**
- **Très bonne capacité de formation de doctorants et au niveau du Mastère intégrant les jeunes futurs PhD actuellement en fin de thèse (comme lecturers). Page 44 (bourse BEST d'etudiants LLD en stage à Montpellier.**

Les chercheurs IRD, du CIRAD et les chercheurs de Montpellier vont assurer les formations et co-encadrements

En ce qui concerne les équipes :
Le porteur du projet, Dr Kiriya SUNGTHONGWISES, est très motivée et apporte beaucoup d'éléments montrant que la démarche et les zones d'études (plantation d'hévéa) sont bien choisies pour étudier les changements dans le sol (spectre de l'écosystème naturel lié à la monoculture).
On peut souligner qu'il s'agit d'équipe jeunes avec un bon nombre de publication et dynamiques ayant déjà eu des relations de coopération internationales (avec des avec le Japon et la France) avec notamment des agronomes notamment spécialistes du sol et des socio-économistes pour le développement des services environnementaux.

En ce qui concerne la qualité du projet :
Il est très bien rédigé avec une très bonne clarté et cohérence du programme scientifique proposé. J'ai moi aussi vraiment apprécié les photos, figures et diagrammes qui donnent une bonne visualisation du projet. Les équipes privilégient les échanges interdisciplinaires dans les deux sens et la communication.

En ce qui concerne le budget :
Proposition d'un cofinancement égal (50 000 euros) de la part de l'Université KKU (point FORT) en plus des autres projets complémentaires qui consolident les équipes et la faisabilité du projet. Notamment 25 kEur sont prévus pour du séquençage de génomes bactériens et des analyses de sols et organismes (point FORT).

Impact sensiblement certain dans le cadre d'ASEAN (association of South-East Asia Nations). Le budget va couvrir les déplacements et travaux sur terrains ainsi que les missions et stages, WS…

Rapport 2 :

L'objectif de ce projet est de construire un centre d'expertise en agroécologie tropicale réunissant des chercheurs/enseignants chercheurs de l'université Khon Kaen (KKU) et du Land Department Development (LDD) (Thaïlande), de l'université Nationale du Laos (NUOL, Laos) de l'IRD (et du CIRAD). La plupart des chercheurs IRD (& CIRAD) sont déjà en place, soit en Thaïlande (KKU), soit au Laos (NUOL) où ils ont mis en place des programmes de recherche et où ils ont tissé des liens avec les chercheurs Thaïs et Laotiens porteurs de la demande, ainsi qu'avec la hiérarchie des institutions de rattachements qui appuient la demande et qui sont prêtes (KKU) à apporter un cofinancement et à mettre à disposition des infrastructures en cas d'acceptation du projet par l'AIRD.

Le projet est rédigé avec clarté et expose les différents objectifs de la future équipe, qu'il s'agisse des objectifs scientifiques, institutionnels que d'enseignement. Le projet de recherche, en phase avec les recherches menées par l'IRD localement, est réfléchi et bien structuré et apparait parfaitement réalisable. L'implication des chercheurs IRD apparait élevée et inclut un volet significatif de formations théoriques à différentes approches en écologie et agronomie.

Cependant, deux difficultés potentielles qui devraient faire l'objet de toute l'attention des porteurs du projet.

Le premier est que les porteurs devront mettre en place un mode de fonctionnement "fluide" qui tout en impliquant et en "mettant en valeur" les différentes institutions locales impliquées ne conduit pas à un blocage du projet par l'une ou plusieurs de ces mêmes institutions. Il s'agira notamment de clairement définir la répartition des budgets et les prérogatives des entités gestionnaires de ceux-ci.

Le risque de blocage est très faible pour plusieurs raisons :

1. Les dix pays de l'ASEAN ont décidé d'intégrer leurs pays au sein d'une communauté assurant la libre circulation des biens et des personnes (à l'image de la communauté européenne), et en particulier la circulation des étudiants avec un système d'équivalence des 'crédits' ou 'unités de valeurs' pour les examens universitaires ; ils ont également décidé de favoriser la coopération dans le domaine scientifique comme le montrent les deux documents ci-dessous.

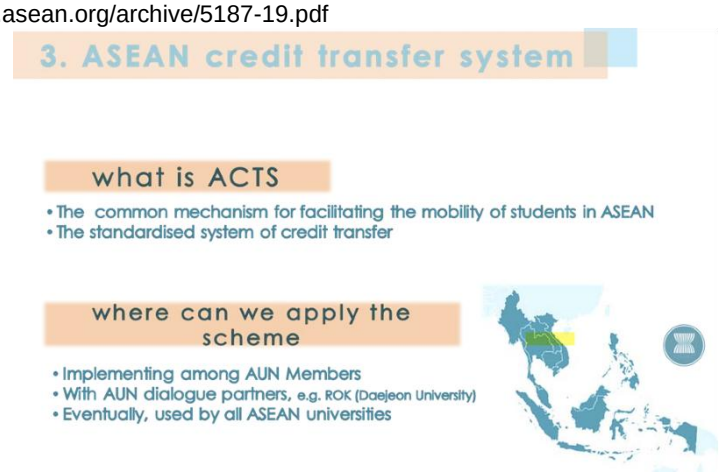
A.5. Facilitating access to applied Science and Technology (S&T)

15. ***Strategic objective:*** Develop policies and mechanisms to support active cooperation in research, science and technology development, technology transfers and commercialisation and establishment of strong networks of scientific and technological institutions with the active participation of private sector and other relevant organisations.

Actions:

i. Establish a network of S&T centres of excellence to promote cooperation, sharing of research facilities, technology transfer and commercialisation, and joint research and technology development by 2011;
ii. Strengthen collaborative research and development in applied S&T to enhance community well-being;
iii. Facilitate the exchange and mobility of scientists and researchers from both public S&T institutions and private sector according to the respective laws, rules, regulation, and national policies;

http://www.asean.org/archive/5187-19.pdf



(http://www.asem-education-secretariat.org/imperia/md/content/asem2/events/2010berlin/gajaseni.pdf)

De plus, il existe déjà des coopérations internationales entre les 2 universités et entre les 2 instituts techniques, et dans chaque pays il existe une coopération entre l'université et l'institut technique.

Suite aux réunions de montage de ce projet JEAI, 4 étudiants thaïlandais de KKU (niveau bachelor) sont en train de réaliser leur stage (3 mois) pour moitié à NUOL et pour moitié au DALAM. Ces stages sont entièrement pris en charge par KKU.

Il existe donc déjà une coopération sur des bases harmonieuses entre les différentes institutions.

Quant au budget, il sera délégué à la porteuse de projet, maître de conférence à KKU. Nous avons vérifié que ce budget peut être utilisé en dehors du territoire thaïlandais. Le budget a été défini en commun entre les participants de la JEAI ; il est prévu que les 2/3 du budget versé par l'IRD sera attribué aux recherches effectuées au Laos ; 1/3 + le complément de KKU sera versé pour les actions menées en Thaïlande (au sein de KKU et du LDD). Il s'agit là d'un engagement moral pour lequel nous sommes parfaitement confiants.

Le second concerne le fait que le projet inclut un double objectif en termes de formation. D'une part le lancement d'initiatives de formations au sein des 2 universités impliquées au niveau Master, mais d'autre part, aussi (et surtout) une formation des membres mêmes de l'équipe de recherche. Pour ce dernier volet, il faudra être attentif à ce que les partenaires de la NUOL puissent s'inscrire très rapidement au sein d'une formation doctorale et puissent acquérir une formation à la recherche par la recherche effective, malgré sans doute les charges d'enseignement qu'ils devront continuer à assumer et l'interaction forte avec l'université Thaïlandaise KKU qu'ils devront mettre en place.

Dans le projet soumis en 2013, l'équipe avait oublié de mentionner que les 'lecturers' de NUOL qui demandent à l'université une disponibilité de 3 ans pour préparer leur thèse, continuent de toucher 90 % de leur salaire et sont entièrement déchargés d'enseignement.

Les employés du DALAM qui prépareront une thèse, continueront de toucher leur salaire, mais le travail de recherche doit correspondre aux besoins du DALAM, ce qui est le cas de la problématique développée dans 'Eco-Rubber'.

2 – Evolutions du projet depuis 2013

- intégration du DALAM (Department of Agricultural Land Management, LaoPDR). Les discussions et les réunions organisées depuis la dernière soumission ont convaincu le DALAM de s'impliquer fortement, ce qui nous permettra de former deux de leurs chercheurs.

- évolution du protocole : si nous conservons l'étude de chronoséquences comme la base de notre travail, nous avons suggéré à la jeune équipe de renforcer le volet expérimental, car l'expérimentation est essentielle à la démarche de recherche proposée. Cette partie du travail permettra aussi de mettre en place un observatoire pour évaluer les changements à long terme.

- diminution de la contribution de KKU qui oblige à réduire certaines actions qui va inciter l'équipe à trouver plus de financements extérieurs.

_____

APPENDIX 2

Presentation of the main

KEY PERFORMANCE INDEX (KPI)

already used at KKU.

Key Performance Indicators of Research Group in Khon Kaen University
July 2012
Research and Technology Transfer Affairs, Khon Kaen University

	Key Performance Indicators	Weight
1.	Research publication in journal	
1.1	Articles published in academic journals which is international indexed in Scopus or ISI or ISSI and have Impact factor in JCR	1.00
1.2	Sum of impact factor in JCR of article published in 1.1 (per impact factor 1)	0.10
1.3	Articles published in academic journals which is international indexed in Scopus or ISI or ISSI but no Impact factor in JCR	0.50
1.4	Articles published in TRF/Office of Higher Education Commission database	0.15
1.5	Articles published in TCI (Thai Citation Index) database	0.10
2.	Other publications	
2.1	Book or chapter publication, synthesized from research work (English, Thai)	0.4,0.2 2,1
2.2	Research report (Monograph) evaluated by qualified peers, published in book format (English, Thai)	0.5,0.25
2.3	Book, Pocket book, VDO (English, Thai)	0.1,0.05
2.4	Strategic suggestions for solving community and social problems which have been cited/used in national and local levels	1,0.50
3.	Presentation of research work	
3.1	Presentation as a Keynote Speaker or Invited Speaker in international level (per time)	0.30, 0.20
3.2	Presentation as keynote Speaker or Invited Speaker in national level (per time)	0.15,0.10
3.3	Presentation in international conference and published abstract, full manuscript in proceedings	0.10,0.20
3.4	Presentation in national conference and published abstract, full manuscript in proceedings	0.05,0.10
4.	Intellectual property	
4.1	Registration for Patents/ Plant Registration /Petty Patent	0.50
4.2	Registration for Patents in terms of Product Design	0.50
4.3	Got Patents/Plant registration	1.00
4.4	Got Petty Patent	0.50
4.5	Got Copyright	0.20
4.6	Income from commercialization (per 100,000 baht)	0.10