How to gain facility in terms of interactions and interdisciplinarity ? Towards a shared and co-built « glossary » for RUBIS

A Common glossary exercise was facilitated to reach crossing visions during RUBIS BI ANNUAL MEETING (June 22, 2021)
The objective was to create a debate to "enrich" our visions and reach "inclusive" and intersecting (interdisciplinary) definitions and visions.

3 key concepts were collectively chosen as being key-concepts for enhancing dialogue and cooperation : RESILIENCE, PARTICIPATORY BREEDING, RUBBER-BASEDAGROFORESTRY

The definitions already available intended to be enriched by the views of the different disciplines. Moreover, an effort has been done to formulate the issues in terms of questions/answers more easily actionable.

As introduction to the discussions and debate, introductory and synthetic presentations was made by specialists either from RUBIS or outside the project (three power points are available)

I- RUBBER-BASED AGROFORESTRY

A presentation was made by Dr Eric Penot

Definition of rubber-based agroforestry and intercropping
The best definition according to Eric Penot is the following from "Laboratoire de Botanique Tropicale" of Montpellier :
"Agroforestry is a land use system, controlled by local population where perennial trees are associated to agriculture and/or stock farming on the same piece of land in such a way that the consequent ecosystem tend to mimic the natural forest ecosystem according to aerial and soil biomass, vegetation structure and specific richness".

Questions/Answers

What's about ?

1. First : It's dynamic !
2. ecologically based, integration of trees on farms, in the agriculture landscape
3. locally, in the same piece of land to mimics the natural ecosystems, to benefit from ecosystemic services
4. temporary agricultural practices
5. specific dedicated cropping system with : 1- generally one big tree, fruit, timber, fire wood other 2- some plants : medicinal, spices, 3- food crops annnual or pluri-annual,
6. Integration of ecosystemic services , positive advantages in terms of sustainability, positive externalities,

remark : some plants are used for ecosystemic services : they are not included in the system but do exist and do have impact

7. either producs with commercial values or self consumption

three aspects : commercial value versus ecosystem services versus self consumption

8. short term versus long term

What's the typology of AF ?

- simple AF system = one or two species, ex rubber/dourian inCambodia,
- complex AF system : multistrata =Agroforest (look like forests, different complex systems,

Does AF go with intercropping ?

Yes , but the intercropping could be temporary , or permanent
There is a complete range of possibilities, many patterns of RAS
AF must be multi strata and mutli species
Classical planting or double spacing,
for which objective , complexe strategies, latex/ timber, market versus self consumption

Are all farmers are always aware if they practice agroforestry (?) May be there are local terms ?. I remember that farmers in one of my research areas didn't think they are practicing agroforestry. This is not a matter of local term, It's more a matter of farmers' understanding and awareness.
yes effectiveley they might put different name for their systems than us , the researchers !!!

Why coffee and erythrina is not agroforestry?
Yes it is "agroforestry" but it is not ' an agroforest" since it's simple, not multistata and not multispecies. There is a difference between agroforst and agroforestry. Agroforest is a more complex system.
It's the reason why in the questionnaire 1 of RUBIS : it's going to be well defined, for the farmers to be sure it's understood
It has to be in the same piece of land
remark : It could be sequencial : we can have a system which is AF for some years and becoming monoculture, if it's double spacing it's permanent

AFS = introduction of trees in a system. AFS = association of rubber trees with other trees only?
No the only condition is that there are at least 2 species

How to differentiate between AF and Integrated farming (IF) ?
Integrated farming = diversified production but not on the same piece of land.
AF = same piece of land. IF== >Diversification at the fram level but not at the plot level (in the same plot).
AF = diversification in the same plot.
Integrated farming means diverse activities and diversification at farm level (no specialisation)

The definitions given are about introduction of trees into cropping systems. In the case of rubber, the trees are the crop ! In this case, is RAS limited to association between rubber trees and other trees?

There are several definitions which are complementary : AFS = Trees+ crops + other plants + livestock ! open, system with a large varieties of plants

Is Intercropping in rubber plantations really an ecological system that "mimic natural forest ecosystem"?

Yes, but only in the case of agroforests (complex agroforests) : typically jungle rubber or multistrata RAS

II- PARTICIPATORY PLANT BREEDING

A presentation was made by Dr Gilles Trouche

"Participatory Plant breeding " **The reasons why it was proposed in the early 90s ?**

- **conventional breeding based on the *green revolution* model, failed to produce improved varieties of food crops well adapted to the farmers' cropping systems and fitting the needs of local processors and consumers**
- **Decreasing support to public agricultural research**
- **Increasing strength & initiatives of local NGOs and Farmer Organizations**
- **Formalized recognition of farmers' knowledge and rights to use agriculture genetic resources**

Questions and answers

What are its main objectives ?

1. **Increase the efficiency of breeding programs** for developing varieties better adapted to small farmers' needs, mainly :
    - higher performance (yield + other adaptive traits) in marginal environments and/or for specific cropping systems
    - accounting for quality traits required by processors and consumers
2. **faster variety dissemination** with **higher levels of adoption**
3. **preservation of local agrobiodiversity** (dynamic conservation)
4. **Strengthening** individual and collective **capacity** of resource-poor farmers

What are the two main strategies used ?

- Participatory Varietal Selection (PVS)

  Farmers mainly involved in <u>evaluation stage</u>

- Participatory Plant Breeding (PPB)

  ==>Farmers involved in all the stages of variety development, including <u>selection in segregating populations</u>

  Long-term results

  Need more training effort and long-term support from breeders

What are the conditions of their application ?

Who are the stakeholders to be involved ? Breeder, Agronomist, Social scientists

Farmers and their organization, Consumers, Traders, Processors , Seed companies, NGOs

Extension services

How to optimize the efficiency of a PPB program?(research questions)

1. Breeding strategy

How to adapt the breeding methods and experimental designs to the constraints of collaborative and decentralized selection and evaluations?

Which stages/generations to manage on-station and on-farm?

2. Level of involvement of farmers and/or other stakeholders

Who to involve at which stages of the program?

What are the roles of each partner and who takes the decisions?

3. Identification and comprehension of the selection criteria for a new variety used by farmers and other stakeholders?
   How to manage it in the program?
4. Organization and sustainability of the program
   How to ensure the commitment of partners, funding and training on the issues of property rights, benefits sharing, social and economic impact …?

Discussion and exchanges

It looks like participatory breeding needs a network of farmers, researchers... this need attention in developping the network. Are we going to develop this network in the framework of Rubis project? Development of this network is essential and takes time; training is a main objective. Developping the capacity of the farmers to conduct activities, discuss and share with scientists
Arini : It re-emphasizes my belief the importance of WP1 doing FGD now, rather than prioritizing the questionnaire. UGM at least has gathered a few local networks, and it's good to start having a conversation with them.

Do you have experience for PB for perennial crops? (Question addressed to Gilles Trouche)

No (Gilles) : no experience on participatory breeding on perenial crops. experience of cotton, quality has to be evaluated by cotton industry. but it could work. cirad has experience on cocoa participatory breeding and citrus and we will get experience from this

Farmers for any crop have always their criteria, it's always interesting to share about the criterai, it's not only yield, quality, could be easiness of plantation,calender of harvers, adpatation to a special use ... always interesting. it is always interesteing to discuss with farmers about their own criteria.

Does IRRI have experience in involving rubber farmers in breeding program?

(Shinta ?) yes we try to involve farmers in activities but for breeding it is difficult. Private and government plantations to conduct LSCT but implementation (specific tapping systm) is difficult

Experience of participatory breeding with perenial crops? feasability?

For Indonesian context, I think Participatory Varietal selection (PVS) is the most logical choice. Farmers cannot wait for the longer process if we use PPB s.s. . Farmers are provided with selected clones and asked to observe by themselves. (Panji)

We need to work on transdisciplinarity through for instance our questionnaires : building the pools. Participatory approach will raise the level of adoption by small holders (Mrs Shinta)

III- Resilience in agriculture and application to rubber-based cropping systems

Please See the presentation "Notes on Resilience Concept" of Dr Arini Wahyu Utami and **the list of references given at the end of this presentation**

"The **ability of a system to buffer changes** or utilize the changes for its advantage" (Ellis 1998:14) and at the same time **to maintain its ability to function** (Traerup 2012) "**without undergoing fundamental changes in its functional characteristics**" (Berkes, Colding, and Folke 2003:14)

According to Berkes, Colding, and Folke (2003): the definition is:

(1) amount of change the system can **buffer** and absorb;

(2) capability for **self-organization**; and

(3) capacity for **learning and adaptation.**

There is 3 components in the concept of resilience

- Ecological resilience: "**a system's ability 'to absorb changes of state variables, driving variables, and parameters, and still persist**' (p. 17)" (Holling, 1973).

- Social-ecological resilience: "**the societies, including their people, economies, and cultures, are an integral part of the biosphere** and crucially dependent on the biosphere's capacity to support human development" (Folke, 2016).

- Economic resilience: "the study of resilience should be restricted to the **analysis of the reaction to and impact of that event itself**, and not extended to refer to the slow incremental process of change and adaptation that normally characterizes an economy in the absence of shocks" (Martin & Sunley, 2015, p. 14).

Discussion and exchanges

Complementary definitions
- First a "traditional" définition of resilience from Holing & Gunderson (2002) (Gunderson 2002).

Resilience determines the level of vulnerability of a system subjected to random (and therefore unexpected) disturbances which may exceed the system's control capacity until failure. It is based on the options of stability, resistance to disturbance and speed of return to equilibrium, to the normal baseline situation. These authors define it as "engineering resilience". Resilience therefore also concerns unexpected shocks or disturbances which may or may not have been foreseen. This is a deterministic and all in all fairly rigid view.

- A second definition is "the ability of a system to experience disturbances while maintaining its vital functions and control capabilities."

In the latter it is therefore the capacity of a system to resist while maintaining the essentials of its structure and its functioning while including the possibility of a change, both in the structure and in the modalities of the functioning of the moment. that it works. It is based on the conditions which maintain an initial but potentially unstable equilibrium which can lead to another equilibrium. It can be measured by the magnitude or level of disturbance that a system can absorb until the system breaks down or changes its structure. These authors define it as an “ecosystem resilience”. This vision seems more pragmatic for living or human systems where the part of determinism is much less predictable.

Sources :
- Gallopin, G. (2002). Resilience: scenarios, surprises and branch ponts. In Panarchy: understanding transformations in human and natural systems. Island press. Press: 21 p.
- Gunderson, L. H. H., CS (2002). Panarchy: understanding transformations in human and natural systems, Island Press.
- Rutten, 1998 .Science and Technology Foresight,

Global information;

- There is a network of researchers who work on the concept of resilience
https://www.resalliance.org/
- A conference was held in Montpellier in 2014 on resilience : https://www.resilience2014.org/
Conf Agropolis int.
- See also Stockholm resilience centre

Questions/answers

Is Resilience usually defined with a shock ? what are the shocks we are talking about?
A shock could be an instant shock (classical definition) or a mid terme or long term schock (more oriented on environment).

Low rubber price/low income for rubber smallholders and climate change/disease outbreack affecting latex productivity
it could be climatic shock, economic shock or simply the fact that RAS appears after the forest : the "shock" is the fact that forest disappears !!!

A drought can be a climatic shock. The outrise of a sudden disease as well.

How do we define resilence of agricultural systems and how do we measure it ?

Economically speaking some indicators are callsicaly used such as:

- **Income stability in the mid term**
- **Factors that might significantly affect one year after a schock income**
- **Evolution of gross/margin ha and return to labor to see impact of potential shocks**

- **Impact of inputs/outputs price evolution (price scissor effect) and bility to integrate cost evolution (linked with income stability)**
- **Risk analysis taking into accound the previous economic calculations as well as indicators such as: i) evolution of debt indicator, return to capital in the mid turn….**
- **E still need to evaluate how to measure environmental factors of resilience (fertility , bio diversity etc …)**

What are the definitions directly applicable to AF? how can we improve the resilience of the AFS ? How can we measure the agricultural system in terms of resilience

Can we say that there is no resilience when the system moves towards another state hindering the ecosystemic services ? or modifying these services?:

- Résilience refers to the magnitude of change or disturbance that a system can experience without shifting into an alternate state that has different structural and functional properties and supplies different bundles of the *ecosystem services* that benefit people
examples of shifts between alternate states include transitions from coral reefs to algae-covered rocks, from grasslands to shrub-dominated landscapes, and from clear to cloudy water in freshwater lakes (source Resalliance.org)

Then it would be called a negative resilience. The system now goes to below its previous trajectory (this term positive and negative come mainly from economist, since they need to quantify things).

we can say that this system goes to another state of resilience. Because any system is not static. Some researchers term this as high or positive resilience

We need to stress out that after a shock, if a system is resilient, its main functions do work normally but may be not in the same "structure" : in other words the farm structure could be changed in order to adapt to new contect.

What is the difference between resilience and adaptation?
We try not to define resilience in linear terms. Adaptation is a linear concept; resilience = how the system will buffer, it's not a linear concept

Adaptation ==> linear process and possibly predictible, while resilience is not predictible, Arini says that her team is struggling to defend a nonlinear concept of resilience. Effectively , we have to be "flexible" on the use of the concept for RAS.

Adaptation is part of resilience, as resilience consists of buffer capacity, self-organization, capacity for learning and adaptation, and timely recovery period. While adaptation is a set of actions intended to cope and go along with a new situation, usually challenging ones, resilience is a state of being. So adaptation is aimed for a system to cope with new or challenging situations, so that the system is able to maintain its function, or to improve it if possible.
For some authors, resilience is one of sustainability science approaches among others which are "adaptive management" , "optimization" and "new models and understanding".