



Multi-stakeholder Workshop Report

Criteria and Indicators for Sustainability of Agricultural Livelihood Systems: Stakeholders' Perspectives

Cairo, December 2018





RESEARCH
PROGRAM ON
Grain Legumes and
Dryland Cereals

Multi-stakeholder Workshop Report

Criteria and Indicators for Sustainability of Agricultural Livelihood Systems: Stakeholders' Perspectives

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SUMMARY

The workshop was initiated in the frame of the Project GLDC-FP3: Integrated Farm-Household Management under the Activity 3.3.6: Criteria & Indicators of ALS Sustainability. This workshop aimed the farmer's self-exploration of criteria and indicators for sustainability of agricultural livelihood systems. The objectives were specifically for different agricultural livelihoods system types identified in the sub-district of Satiri, in the Houet province, western Burkina Faso to (1) identify key criteria and indicators for the sustainability of agricultural livelihoods system types; and (2) rank by order of importance these criteria and indicators. The workshop was occurred in Ouagadougou in 20 December 2018. There were 31 participants in total, including representative farmers (16) from 4 study villages around Satiri town in Southern Burkina Faso, local extension services, university professors, lecturers and researchers from Institute for Rural Development at University of NAZI BONI (IDR-UNB) and Institut de l'Environnement et de Recherches Agricoles (INERA).

Keywords: Grain legumes, dry cereals, smallholder systems, agricultural livelihood systems, typology, sustainability criteria and indicators, stakeholder perception, Burkina Faso

1. OBJECTIVES

The workshop was initiated in the frame of the Project GLDC-FP3: Integrated Farm-Household Management under the Activity 3.3.6: Criteria & Indicators of ALS Sustainability. This workshop aimed the farmer's self-exploration of criteria and indicators for sustainability of agricultural livelihood systems. The objectives were specifically for different agricultural livelihoods system types identified in the sub-district of Satiri, in the Houet province, western Burkina Faso to:

- (1) Identify key criteria and indicators for the sustainability of agricultural livelihoods system types, and
- (2) Rank by order of importance these criteria and indicators

2. DAY, LOCATION, ORGANIZERS, FACILITATORS, POINT OF CONTACT

Day: 20 December 2018

Location: Centre Cardinal Paul Zoungrana, Ouagadougou, Burkina Faso

Organizers:

- International Center for Agricultural Research in Dry Areas (ICARDA), through the Program Management Unit (PMU) of CGIAR Grain Legumes and Dryland Cereals (CRP-GLDC)
- University Nazi Boni (UNB) (Former Polytechnic University of Bobo-Dioulasso), via Institute of Rural Development (IDR)

Facilitators: Dr. Boundia Alexandre Thiombiano (UNB) and Dr. Quang Bao Le (ICRADA)

Point of contact: Dr. Quang Bao Le (ICRADA) (Q.Le@cgiar.org)

3. WORKSHOP PROGRAM

Table 1: Workshop program, Ouagadougou 20 December 2018

Time	Activity
08:00 – 08:30	<ul style="list-style-type: none"> • Participants registration • Welcoming word by UNB the President of UNB
08:30 – 08:45	<ul style="list-style-type: none"> • Presentation of ICARDA/GLDC
08:45 – 09:45	<ul style="list-style-type: none"> • Presentation of preliminary research results in Satiri sub-district • Questions session
09:45 – 10:00	<ul style="list-style-type: none"> • Taking formal workshop photos
10:00 – 10:15	<ul style="list-style-type: none"> • Coffee/Tea break
10:15 – 12:30	Exercise 1-1: Each agricultural livelihood system (ALS) type identify criteria and indicators of ALS sustainability considering the following aspects: farm-household’s resources, farm-household’s safety/stability, solutions for resource shortage, opportunity to adapt to unwanted events, capacity to adapt to unwanted changes; and conflicting or subsidiary between an intensified crop/livelihood type with others
12:30 – 13:30	<ul style="list-style-type: none"> • Launch break
13:30 – 15:30	Exercise 1-2. Ranking criteria and indicators identified in Exercise 1-1
15:30 – 15:45	<ul style="list-style-type: none"> • Coffee/Tea break
15:45 – 17:00	Exercise 2: Each agricultural livelihood system (ALS) type identify criteria and indicators of ALS sustainability considering the following aspects: Farm productivity, Economic outcome/impact, Human well-being, Environmental outcome/impact, Social outcome/impact
17 :00	Closing the workshop

4. PARTICIPANTS

There were 31 participants in total. The participants includes

- **Farmers (16)** they were selected amongst farmers surveyed during screen study in 4 villages of Satiri sub-district. For each of the four Agricultural Livelihood System types identified by the study, the 4 closest farms to their group centre (Euclidian distance in K-means cluster analysis) were selected. A total of 16 farmers joined the workshop
- **Agricultural researchers (8):** Researchers from Institut de l'Environnement et de Recherches Agricoles (INERA); Lecturers from Institut for Rural Development (IDR) at UNB attended the workshop, and ICARDA scientist.
- **Regional extension service from the Ministry of Agriculture (1)**
- **UNB officials and Students (6):** The President of UNB and the Director of IDR were invited to the workshop as well as a small group of students from IDR.

The full list of participants is attached is Appendix 1.



Picture 1. Family photo of the workshop participants



Picture 2a. The workshop presidium: From left to right: Dr Quang Bao LE, ICARDA Scientist; Prof. Macaire S. OUEDROGO, UNB President; and M. Issa KONATE the deputy director of IDR.



Picture 2b. Plenary session



Picture 3. View of the participants during group exercises



Picture 4. An ALS group assisted by a researcher from INERA during group exercise



Picture 5. An ALS group assisted by a lecturer during group exercise

5. DESCRIPTION OF WORKSHOP ACTIVITIES AND RESULTS

5.1. Workshop activities

After the welcoming words by UNB President, the workshop started with the presentation of ICARDA and CRP-GLDC by Dr Quang Bao Le. Next, Dr Thiombiano presented the key preliminary research results of the study conducted in 4 villages of Satiri sub-district. These villages are: Sissa, Neferelaye, Ramatoulaye and Kadomba. Questions were asked by farmers as well as by stakeholders. The main questions were:

- How did you select farmers attending this workshop? (by Dr Compaore Evelyne from INERA)
- Why is there only one woman attending the workshop? Have accounted for gender? (by Dr Compaore Evelyne from INERA)

- Are you going to set-up on-farm trials? (by farmers)
- Are you going to give us seeds, fertilizers or equipment? (by farmers)
- What will we bring home from this workshop and that make difference from other farmers who also interviewed during surveys? (by farmers).

After the answering of facilitators to the questions asked by participants, Dr Quang Bao Le explained the expected objectives, principles, processes and structures of the group exercises. After clarification in response to questions from participants, the participants were teamed into 4 groups following the 4 agricultural livelihoods system type identified in the study area. Each farmer group were assisted by 2 or 3 scientist/researchers attending the workshop (Lecturers, researchers from INERA, extension agent and workshop facilitators). Students as well as lecturers/Researchers helped translating into native language when necessary. The detailed composition of each group is attached in Appendix 2. The exercises consisted in the identification and ranking by farmers of key criteria and indicators for sustainability of agricultural livelihood systems. Initially planned for one and half day, the workshop was finally held in one day.

5.2 Participatory identification and ranking of key criteria/indicators of agricultural livelihood system sustainability

Concept description

The exercise principles were explained and the criteria/indicators classes were provided by Dr Q. B. Le (Picture 6) as in the Tables 2 and 3. The concept framing the structure of criteria and indicators in Exercise 1 is based on the **System Sustainability Orientations approach (Bossel, 1999; Bossel, 2001)**, which is based on theoretical consideration of socio-ecological system performance that deals with a complex set of interacting and self-organizing natural and human systems and agents, all pursuing their own "interests" while also contributing to the development of the total system. To be viable, a system must devote an essential minimum amount of attention to satisfying the "basic orientors" that respond to the properties of its environment. These basic orientors include: system existence, effectiveness, freedom of action, security, adaptability, co-existence with other systems, and psychological

needs. These basic system performance orientors were used by the core research team before the workshop to define main dimensions under which participants will be asked to (1) think and elaborate specific performance indicators and (2) rank indicators' importance in according to their needs/concerns. Because of its systems-theoretical foundation, this approach avoids the problems of incompleteness and double-counting common in ad hoc methods of indicator selection.

The concept framing the structure of criteria and indicators in Exercise 2 is based on the approach of Smith et al. (2017), which scans and groups indicators over **thematic domains of sustainable intensification**. These thematic domains include productivity, economic sustainability, human well-being, environmental sustainability and social sustainability. The core research team used these thematic domains to ask participants to identify concrete indicators for each domain, and to rank the importance of the indicators.

The idea of deriving stakeholder perceptions on both concepts is NOT to have a comparison for knowing “which concept is better”, but rather maximize benefits can be offered by two concepts. These benefits can be in (1) the complementariness between two approaches that minimizes the missing of important indicators, and (2) the synergy of the concepts that may reveal indicators sharing their importance in both approaches. The shared important indicators, if any, should have a convergent validity that can be used with higher confidence.

Process description

The participatory exercises consisted in asking and facilitating farmers' interactive thinking (within a group of same agricultural likelihood type):

(1) Identify key criteria/indicators of agricultural livelihood sustainability upon a brainstorming session, and

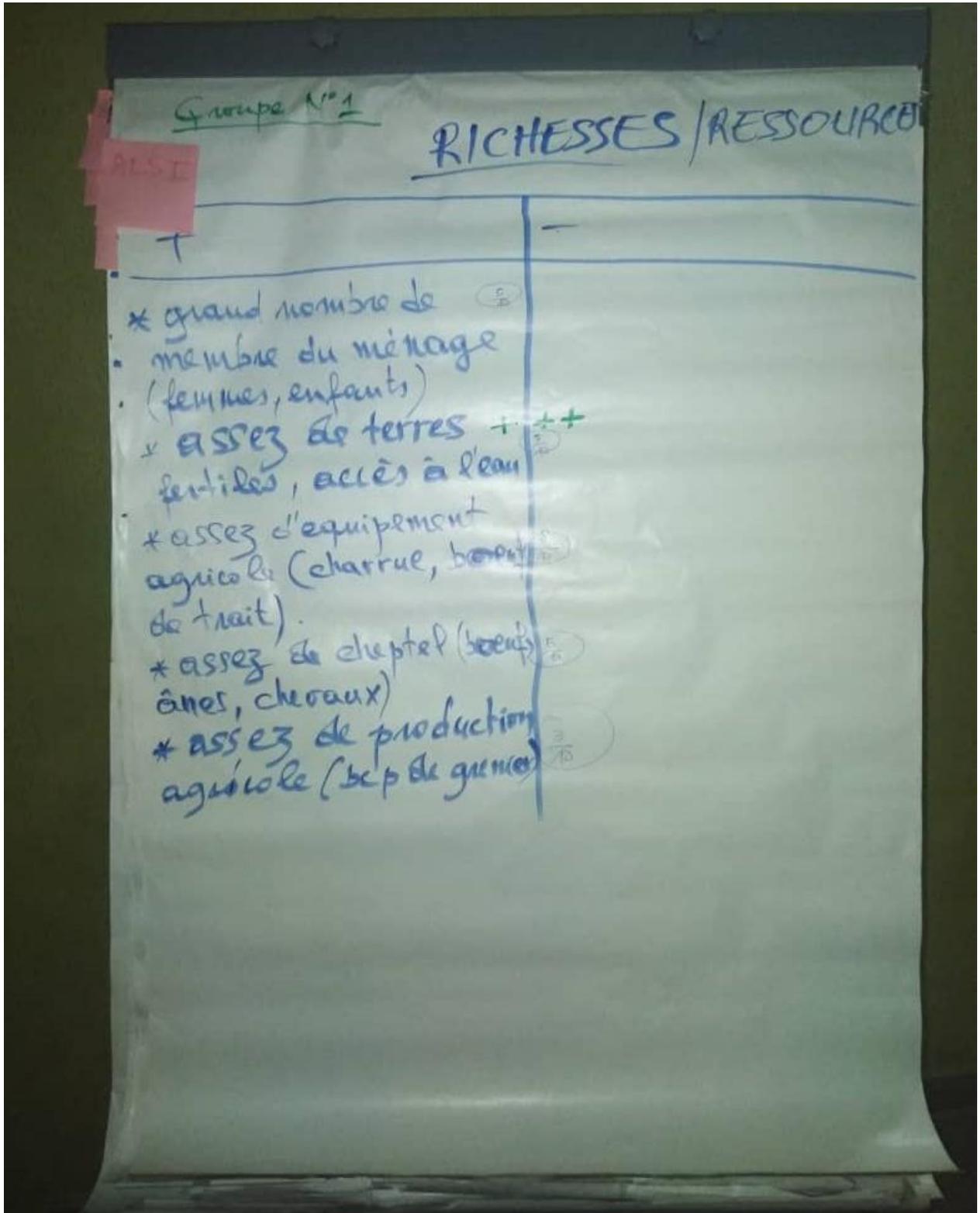
(2) Rank the identified criteria/indicators by weighting them on a scale of 1 to 10. For weighing it was agreed to use 10 grains of groundnuts. The number of grains allocated to a criteria/indicator gives the perceived importance by famers. Responses were written by groups on flipchart as on Pictures 7 and 8.

The main questions asked by participants during group work session are:

- How do we conceptualize and translate well-being into native language? (by Dr Compaore Evelyne from INERA)
- Can you give example of social impact easy to translate into native language? (by M. DAKOUO Benjamin, lecturer at IDR)
- What do you call wealth? (by farmers)
- Can you clarify farm productivity indicator? Farmer usually tend to refer to crop yield (by M. SAWADOGO Souleymane, extension agent)
- Can you explain again well-being (by farmers)
- Can you explain again economic outcome/impact? (by farmers)
- Is there a difference between outcome and impact? by Dr Compaore Evelyne from INERA)
- Can't we just ask farmer to rank criteria/indicators by order of importance (form their perception) without using a weighting scale (use of groundnut for scoring the weight of each indicator) (By SAWADOG Didier, from INERA).



Picture 6. Explaining the expected objectives, principles, processes and structures of the group exercises



Picture 7. Flipchart

Table 2: Criteria/indicators classes for Exercise 1

What indicators (aspect/signs/parameters/...) are important for knowing:	Indicators (aspect/sign/parameters) (max 5 each questions)
Farm-household's resources (both biophysical and socio-economic)?	- -
Farm-household's safety/stability under unwanted changes in climate, disease, pests, market, etc.?	- -
Farm-household's solutions for poor soil, lacking water and labour (resource shortage)?	- -
Farm-household's opportunity to adapt to unwanted changes in climate, disease, pests, market, etc.?	- -
Farm-household's capacity to adapt to unwanted changes in climate, disease, pests, market, etc.?	- -
Conflicting or subsidiary between an intensified crop/livelihood type with others	- -

Table 3: Criteria/indicators classes for Exercise 2

What indicators (aspect/signs/parameters/...) are important for each broad categories:	Indicators (aspect/sign/parameters) (max 5 each questions)
Farm productivity	- -
Economic outcome/impact	- -
Human well-being	- -
Environmental outcome/impact	- -
Social outcome/impact	- -

Results for Exercise 1

Table 4. Ordered key agricultural livelihood sustainability criteria/indicators identified by the ALS types in Satiri sub-district

What indicators (aspect/signs /parameters /...) are important for knowing:	Key Indicators (weight; sign)			
	<i>Livelihood type I. Pro-poor, landless and cereal-based</i>	<i>Livelihood type II: Poor, landless and cereal-based livelihood</i>	<i>Livelihood type III: Medium, land rich, cereal-based livelihood</i>	<i>Livelihood type IV: Better-off, land rich, diversified and livestock-preference livelihood</i>
Farm-household's resources (both biophysical and socio-economic)?	<ol style="list-style-type: none"> 1. Land (8/10; +) 2. Number of animal traction equipment (8/10; +) 3. Labour (5/10; +) 4. Livestock (5/10; +) 	<ol style="list-style-type: none"> 1. land (10/10; +) 2. Livestock (9/10; +) 3. Networking (7/10; +) 	<ol style="list-style-type: none"> 1. Household self-food sufficiency (10/10; +) 2. Number of wives (9/10; +) 3. Labour (8/10; +) 4. Land (7/10; +) 5. Number of animal traction equipment (6/10; +) 	<ol style="list-style-type: none"> 1. Livestock size (10/10; +) 2. Labour availability (09/10; +) 3. Land area (7/10; +) 4. Draught animals and animal traction equipment (6/10; +) 5. Type of house building materials (5/10; +)
Farm-household's safety/stability under unwanted changes in climate, disease, pests, market, etc.?	<ol style="list-style-type: none"> 1. Use of improved seeds (8/10; +) 2. Use of soil and water conservation measures (8/10; +) 3. Planting fruit trees (8/10; +) 	<ol style="list-style-type: none"> 1. Level of good relationship in the community (10/10; +) 2. Having tree plantation (9/10; +) 3. Use of soil and water conservation measures (8/10; +) 4. Practicing crop rotation (7/10; +) 	<ol style="list-style-type: none"> 1. Livestock size (10/10; +) 2. Size of tree (fruit and non-fruit) plantation (09/10; +) 3. Number of family members having permanent non-farm and education-based employment (8/10; +) 	<ol style="list-style-type: none"> 1. Labour quality (10/10; +) 2. Education level (9/10; +) 3. Farm resources management abilities (8/10; +) 4. Livestock capital (7/10; +) 5. Off-farm income (7/10; +)
Farm-household's solutions for poor soil,	<ol style="list-style-type: none"> 1. Use of compost (8/10; +) 2. Water harvesting (5/10; +) 	Learning capacity	<ol style="list-style-type: none"> 1. Use of mineral fertilizers (10/10; +) 	<ol style="list-style-type: none"> 1. Stone bunds (10/10; +) 2. Composting (9/10; +)

lacking water and labour (resource shortage)?	<ol style="list-style-type: none"> Following (5/10; +) Allowing wife to be member of female association to benefit from communal labor (4/10; +) 		<ol style="list-style-type: none"> Use organic fertilizer (9/10; +) Crop rotation (7/10; +) Use of stones bunds (6/10; +) 	<ol style="list-style-type: none"> Use of improved seeds (8/10; +) Tree-crops integration (7/10; +) Reducing land area/intensifying
Farm-household's opportunity to adapt to unwanted changes in climate, disease, pests, market, etc.?	<ol style="list-style-type: none"> Proximity to human and animal health centers (9/10; +) Subsidy programs (seed & fertilizer) (8/10; +) Presence of a dam (8/10; +) Presence of schools and literacy training centers (7/10; +) 	<ol style="list-style-type: none"> Remittance (9/10; +) Access to credit (8/10; +) 	<ol style="list-style-type: none"> Government mineral fertilizer subsidy (10/10; +) Government subsidy for draught animal and animal traction equipment (9/10; +) Presence of a dam (7/10; +) Remittances in cash and kind (5/10; +) 	<ol style="list-style-type: none"> Access to credit (10/10; +) Government subsidy for equipment, improved seeds and fertilizers (10/10; +) Access to water drilling (9/10; +)
Farm-household's capacity to adapt to unwanted changes in climate, disease, pests, market, etc.?	<ol style="list-style-type: none"> Being pro-active, being capable to anticipate (8/10; +) Proximity to water reservoir for livestock watering (8/10; +) High cereals stocks and livestock capital (7/10; +) Proximity to water reservoir for gardening (5/10; +) 	<ol style="list-style-type: none"> Livestock capital (10/10; +) Remittance (9/10; +) Access to credit (8/10; +) 	Access to extension services (10/10; +)	Access to subsidy
Conflicting or subsidiary between an intensified crop/livelihood type with others	<ol style="list-style-type: none"> Negative effects of cotton chemicals on cereals crops as these chemical are often used for cereals crops: absence of cereal-specific chemicals (6/10; +) 	Associating cotton to cereals cropping (negative impact of chemicals on cereals crops: absence of cereal-specific chemicals (10/10; +)	<ol style="list-style-type: none"> Negative effects of cotton chemicals on cereals crops as these chemical are often used for cereals crops: 	<ol style="list-style-type: none"> Non-food cash crops and food crops (10/10; +) Consumption habits with regards to some recommended varieties (9/10; +)

	2. Keeping trees in cereals fields (4/10; +)		absence of legume-specific chemicals (10/10; +) 2. Keeping trees in cereals fields (9/10; +)	
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Results for Exercise 2

Table 5. Classical key agricultural livelihood sustainability criteria/indicators identified by the ALS types in Satiri sub-district

What indicators (aspect/signs/parameters/...) are important for each broad categories:	Key Indicators (sign)			
	<i>Livelihood type I: Pro-poor, landless and cereal-based</i>	<i>Livelihood type II: Poor, landless and cereal-based livelihood</i>	<i>Livelihood type III: Medium, land rich, cereal-based livelihood</i>	<i>Livelihood type IV: Better-off, land rich, diversified and livestock-preference livelihood</i>
Farm productivity	<ol style="list-style-type: none"> 1. Crop yield (+) 2. Livestock productivity: number of birth (+) 3. Rain shortage (-) 	crop yield (+)	<ol style="list-style-type: none"> 1. Return to investment (+) 2. Return to labour (+) 3. Crop yield (+) 	<ol style="list-style-type: none"> 1. Labour productivity: crop yield per worker (+) 2. Self-food sufficiency (+)
Economic outcome/impact	<ol style="list-style-type: none"> 1. Quality of house building material (+) 2. Migration (-) 	Return to investment for hired equipment and land (+)	<ol style="list-style-type: none"> 1. Household income (+) 2. Number of purchased transport equipment :bike, motorbike (+) 	<ol style="list-style-type: none"> 1. Income per invested labour time (+) 2. Return to investment (+)
Human well-being	<ol style="list-style-type: none"> 1. Food security (+) 2. Health status (+) 3. Dressing (+) 4. Income level (+) 	<ol style="list-style-type: none"> 1. Health status (+) 2. Food self-sufficiency (+) 3. Being able to pay kids school fees (+) 	<ol style="list-style-type: none"> 1. Being able to eat desired food (+) 2. Financial wealth (+) 	<ol style="list-style-type: none"> 1. Health status (+) 2. Household equipment (+) 3. Physical appearance (+)
Environmental outcome/impact	<ol style="list-style-type: none"> 1. Bush fires (-) 2. Pollution by pesticides (-) 3. Crop diseases (-) 4. Tree regeneration (+) 	<ol style="list-style-type: none"> 1. Deforestation (-) 2. Loss of fauna biodiversity (-) 	<ol style="list-style-type: none"> 1. Deforestation (-) 2. Water pollution (-) 3. Spread of diseases for human and animals (-) 4. Loss of biodiversity (-) 	<ol style="list-style-type: none"> 1. Land extension (-) 2. Pollution due to pesticides (-) 3. Soil erosion (-)

				4. Deforestation (-)
Social outcome/impact	<ol style="list-style-type: none"> 1. Diversified source of income 2. Being a model in the community 3. Transparency/equity 	<ol style="list-style-type: none"> 1. Solidarity (+) 2. Being respected (+) 	<ol style="list-style-type: none"> 1. Being able to send children to school (+) 2. Solidarity 	<ol style="list-style-type: none"> 1. Solidarity (+) 2. Social events (+)

The way forward

The above results will be considered by the core research team that will aim to assess the complementarity and synergy between the two approaches, which will shape the concrete operational assessments of ALS sustainability in 2019 and onwards.

References

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- Smith, A., Snapp, S., Chikowo, R., Thorne, P., Bekunda, M., Glover, J., 2017. Measuring sustainable intensification in smallholder agroecosystems: A review. *Global Food Security* 12, 127-138.

APPENDICES

Appendix 1. Full list of workshop participants

Ref. no	Full Name	Sex (M/F)	E-mail / phone	Organization/Village
1	DAKOUO Wabè Benjamin	M	dakouo.benjamin@gmail.com /70228229	UNB/IDR
2	SAWADOGO Didier	M	saw.didi@yahoo.fr /70242866	GRNSP/INERA
3	SAWADOGO Souleymane	M	ssawadogo92@yahoo.com /70606266	Ministère de l'agriculture ,ZAT Satiri
4	SAWADOGO/COMPAORE Eveline	F	comepeve@yahoo.fr /78859019	INERA/CMEF/GRNSP
5	COULIDIATY Adeline T. W.	F	70768025	IDR/SER2
6	SOURBIE Zeinabou	F	sourabiezeinabou@gmail.com /74544808	IDR/SER2
7	KOURA Zoumbé	M	kzseraphin@gmail.com	IDR
8	SAVADOGO Ambroise	M	ambroisesvdg@gmail.com /70987733	IDR/Master2
9	DIANDA Saidou	M	diandasaidou@yahoo.fr /76572705	IDR/SER
10	PAGBELGUEM Rahamata	F	52503473	Kadomba
11	SAWADOGO Issoufou	M	79816441	Néfrélaye
12	KAFANDO Karim	M	68234904	Néfrélaye
13	SSAVADOGO Ousséni	M	71526526	Kadomba
14	MILLOGO Karim	M	71538590	Kadomba
15	OUEDRAOGO Abdoul Aziz	M	56751171	Sissa
16	YAMEOGO Théophile	M	73215521	Kadomba
17	DERRA Abdoul-Fatahou (Madi)	M	79020683	Kadomba
18	OUEDRAOGO Daouda	M	71524524	Kadomba
19	MILLOGO Karim	M	71515935	Kadomba
20	mILLOGO Gnampegue Philibert	M	71462062	Kadomba
21	SAWADOGO Abdoulaye	M	71696897	Kadomba
22	TINTO Yssoufou	M	60662618	Kadomba
23	OUEDRAOGO Ali	M	51244570	Ramatoulaye
24	MILLOGO Kresoun Sien Seydou	M	71526897	Kadomba
25	MAIGA Yassia	M	69618311	Sissa

26	KONATE Issa	M	70085859	IDR/UNB
27	OUEDRAOGO S. Macaire	M	70207076	UNB
28	ZOROME Issiaka	M	70312598	UNB
29	THIOMBIANO Boundia	M	boundia@gmail.com/70131245	UNB
30	LE Quang Bao	M	Q.Le@cgiar.org	ICARDA
31	THIOMBIANO Olivier	M	olivierthiombiano@yahoo.fr/71446564	UNB

Appendix 2: Composition of work groups (Dr Quang Bao Le and Dr Boundia Alexandre Thiombiano supervised and moderated all work groups)

Appendix 2.1. Work group 1: Farmers of *Livelihood type I. Pro-poor, landless and cereal-based*

Full name*	Village
YAMEOGO Theophile	Kadomba
MAIGA Yassia	Sissa
OUEDRAOGO Abdoul Aziz	Sissa

Note. Moderators: DAKOUO Benjamin, lecturer at IDR

Moderator assistant: SAWADOGO Didier, researcher at INERA

* the fourth farmer of this group did not attend the workshop

Appendix 2.2. Work group 2: Farmers of *Livelihood type II: Poor, landless and cereal-based livelihood*

Full name	Village
KAFANDO Karim	Néfrélaye
PAGBELEM Rahamata*	Kadomba
SAWADOGO Issoufou	Néfrélaye
SAWADOGO Oussenj	Kadomba

Note. Moderator: Dr COMPAORÉ Evelyne, researcher at INERA

Moderator assistant: Ms. COULDIATY Aline T.W, student at IDR

* is the mother to SANGUIN Madi. She was representing him as he could not come

Appendix 2.3. Work group 3: Farmers of *Livelihood type III: Medium, land rich, cereal-based livelihood*

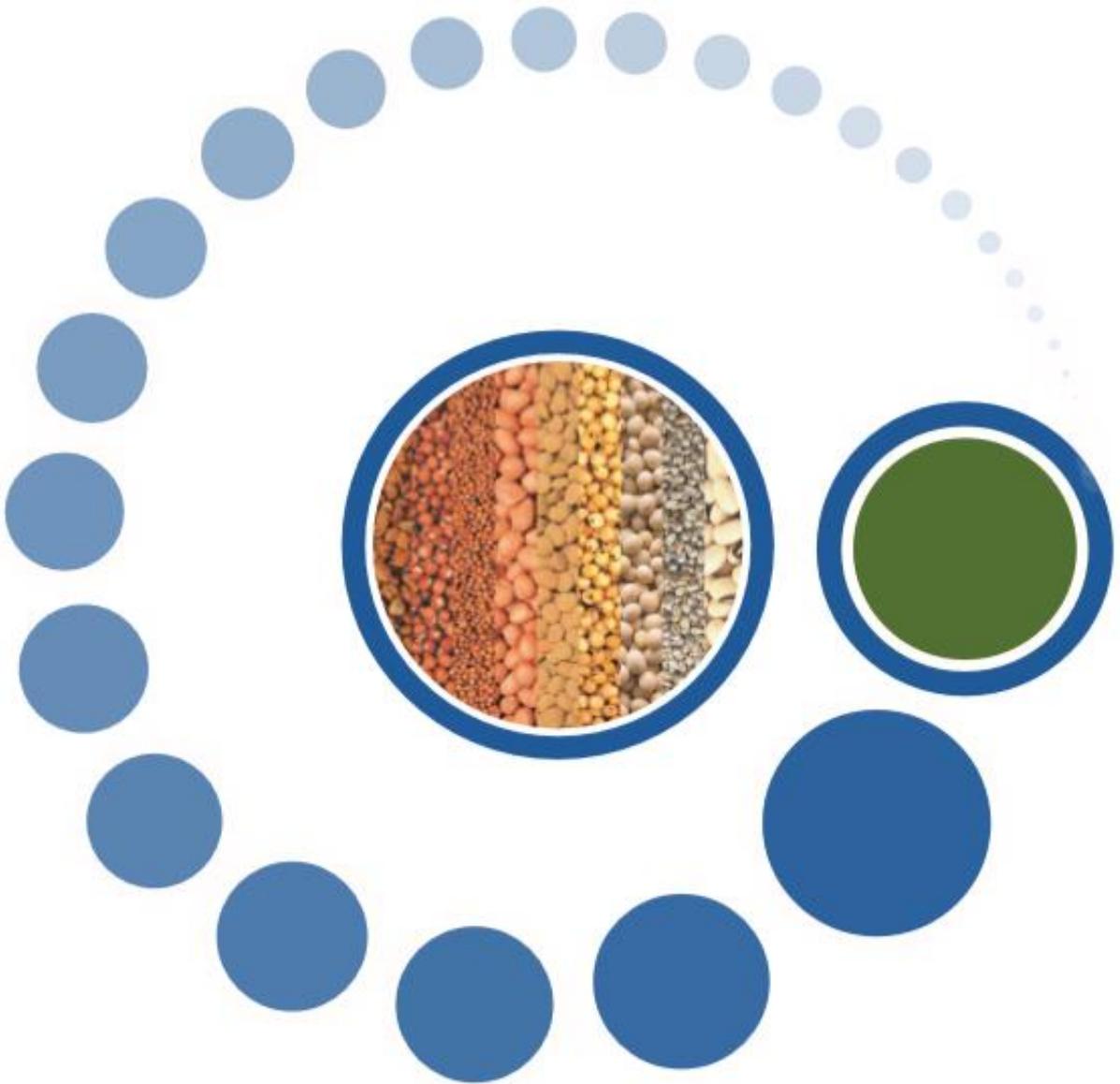
Full name	Village
TINTO Issouf	Kadomba
SAWADOGO Abdoulaye	Kadomba
MILLOGO Seydou Sian	Kadomba
OUEDRAOGO Ali	Ramatoulaye

Note. Moderator: M. SAWADOGO Souleymane, Extension agent, Ministry of Agriculture
Moderator assistant: M. SAVADOGO Ambroise, student at IDR

Appendix 2.4. Work group 4: Farmers of *Livelihood type IV: Better-off, land rich, diversified and livestock-preference livelihood*

Full name	Village
MILLOGO Gnampegue Philibert	Kadomba
DERA Abdoul Fatahou Madi	Kadomba
OUEDRAOGO Daouda	Kadomba
MILLOGO Karim (Wara)	Kadomba

Note. Moderator: M. KOURA Zoumbé, Extension Engineer at IDR
Moderator assistants: M. DIANDA Saidou, student at IDR
Ms. SOURABIE Zeinabou, student at IDR



RESEARCH PROGRAM ON Grain Legumes



IN PARTNERSHIP WITH



and public and private institutes and organizations, governments, and farmers worldwide