Integrative Management Options for Sustainable Agricultural Production and Livelihoods of Smallholders in the Dryland of Southwestern Burkina Faso

Session 2: Systems-based Problem Diagnosis and Improvement

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Grégoire Meylan (USYS TdLab, ETH Zurich)

Quang Bao Le (CRP-DS/ ICARDA)

Boundia Thiombiano (Polytechnic University of Bobo-Dioulasso)

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

RESEARCH PROGRAM ON Dryland Systems

ICARDA Science for Better Livelihoods in Dry Areas

Workshop report

"Integrative Management Options for Sustainable Agricultural Production and Livelihoods of Smallholders in Southwestern Burkina Faso"

Session on "Systems-based Problems Diagnosis and Improvements"

Place and date: Dano/Pontieba, Ioba Province, Burkina Faso, 10-12 October 2016

Project partners: Grégoire Meylan, USYS TdLab, ETH Zurich,

Quang Bao Le, CRP Dryland Systems, ICARDA,

Boundia Thiombiano, Polytechnic University of Bobo-Dioulasso

Abbreviations

CRP-DS:	CGIAR Research Program on Dryland Systems
USYS TdLab:	Transdisciplinarity Lab at the Environmental Sciences Department, ETH Zurich
ICARDA:	International Center for Agricultural Research in Dry Areas
PUBD:	Polytechnic University of Bobo-Dioulasso
UB:	University of Bobo
ALS:	Agricultural Livelihood System

1. Introduction

A 3-day workshop jointly organized by TdLab of ETH Zurich, CRP-DS led by ICARDA and , PUBD to aim at support farmer's self-exploration of sustainable management options for better agricultural livelihood in the dryland of Southwestern Burkina Faso. The village of Pontieba was selected as a case area as the CRP-DS and PUBD have had precedent studies with good quantitative datasets. Day 3 of the Dano workshop (see workshop agenda in Annex 1) was dedicated to let Pontieba farmers jointly

1) express the problem of low crop and animal productivity with food insecurity and poverty as a consequence, and

2) based on this problem expression, define and detail improvements.

Later in the project, such farmer improvements (e.g., construction of small dykes against erosion) will be linked to material flow scenarios (e.g., enhanced soil amendment through increased use of mineral and/or organic fertilizers). The qualitative information gained will complement the material flow systems in order to inform project partners on conceivable action and potential efficiency gains.

2. Participating farmers

All participating farmers are from the village of Pontieba, Ioba Province, Burkina Faso, with five farmers representing each ALS group (see table below) in the workshop. The farmer selection was based on the distance to the gravity centers of ALS groups/clusters (Thiombiano & Le, 2015).

ALS group 1	ALS group 2	ALS group 3
DABIRE Jean	SOME Hubert	SOME Laurentin
SOME Yirzié	HIEN DEKOUOR Jean	DABIRE Johani
SOME Fulbert	DABIRE Martin	SOME Bernard
SOME Etienne	HIEN Baguielkou	DABIRE Raymond

KAMBOULE Martin	SOME Michaël	SOME Jean Daniel

3. Soft systems methodology

The two first steps of the soft systems methodology were applied to yield problems and improvements as seen and detailed by farmers of each agricultural livelihood systems (ALS) (see http://www.naturwissenschaften.ch/topics/co-producing_knowledge/methods/soft_systems_methodology).

1. Expression of problem situation (1h): Collectively, group members create a comprehensive picture of the problem situation through drawing a rich picture. Individual pictures (20 minutes) were combined to one overall rich picture (40 minutes).
   See rich pictures generated by three Agricultural Livelihood System (ALS) Groups in **Annex 2a, b, and c.**

2. Root definition (1h30): Starting from the overall rich picture, possible improvements of the problem situation are brainstormed. The improvements are formulated as root definitions, purposeful systems conceived as relevant to exploring the problem situation. A root definition starts with "A system of activities that … ", followed by the idea, formulated as an input-output purposeful transformation of the problem situation. The root definition specifies what is transformed by whom and for what purpose. It should answer the questions abbreviated by the mnemonic CATWOE:
   "C ('customers'): Who would be victims or beneficiaries of this system were it to exist?
   A ('actors'): Who would carry out the activities of this system?
   T ('transformation process'): What input is transformed into what output by this system?
   W ('Weltanschauung'): What image of the world makes this system meaningful?

As all farmers within an ALS group are assumed to share the same worldview, question W was not posed.

O ('owners'): Who could abolish this system?

E ('environmental constraints'): What external constraints does this system take as given"

See Table 1, 2, and 3 for concrete improvements expected by ALS groups 1, 2, and 3, respectively.

Table 1. Improvements expected by ALS group 1

Purpose	Customers	Actors	Transformation process	Owners	Environmental constraints	Affected flow(s)
Fight erosion and keep nutrients	+ Famer, neighboring farmers (example) - Neighboring farmers (nutrient loss)	Farmer	Construct a low stone wall	Hunters	Labor, hill (source of rocks), cart	F38, P3
Enrich soil	+ Farmer, transport material rental firm, neighboring farmers (nutrient transfer)	Farmer	Transport compost and manure to remote plot	Farmer	Availability of financial resources, roads, labor (if road is to be constructed)	F34
Enrich soil, fight striga	+ Farmer, neighboring farmers (nutrient transfer)	Farmer	Enrich soil	Farmer	Labor availability	F04
Fight striga	+ Farmer	Farmer	Weed after rain	Farmer	Labor availability	F19, F21, F23, F24
Fight striga	+ Farmer	Farmer	Sow early	Animals (eating seeds)	Labor availability	
Keep spread fertilizers on plot, facilitate access	+ Farmer, neighboring farmers (physical benefits) - Neighboring farmers (nutrient loss)	Farmer grouping or farmer (if grouping not possible)	Better maintain little dykes	Fishers (damaging dykes), clogging through weeds	Availability and access to rocks, vehicles, equipment (wheelbarrow, pickaxe, shovel)	F38, P3
Facilitate access to credit for farmers	+ Farmer, neighboring villages (example) - Farmers failing to join grouping (exam), farmers not meeting terms (bitterness)	Core group (several groupings per village are possible), microfinance institutions (support)	Create a grouping warranty fund	Farmers themselves if terms not met	Availability of own resources	

Table 2. Improvements expected by ALS group 2

Purpose	Customers	Actors	Transformation process	Owners	Environmental constraints	Affected flow(s)
Increase soil fertility, fight striga	+ Farmer, family, neighboring farmers (example)	Farmer	Enrich soil	Farmer	Labor availability, information provided by Agriculture Service, equipment (e.g., cart, wheelbarrow, shovel, pickaxe)	F04
Increase production yield	+ Farmer	Agriculture Service, Farmer (responsible for sourcing)	Get better access to improved seeds (linked to previous)	Farmer	Availability of money, trust between Agriculture Service and farmer,	F04
Fight insects	+ farmer, consumers, traders (better products), phytosanitary industry - Neighboring farmers (migration of insects)	Farmer, Technical Service	Get better access to phytosanitary treatment	Famer	Products (chemical and natural), popularization and information, equipment (vaporizer)	F04
Fight flooding	+ Farmer, family, friends (gifts) - Dolo consumers	Farmer, Agriculture Service (responsible for popularization)	Produce strict pluvial rice instead of sorgo	Market (buyers)	Sufficient rain, access to fertilizers, equipment for rice cultivation, labor, access to rice seeds	F04
Improve animal care, reinvest in farm	+ Farmer, consumers (higher product quality)	Farmer	Make livestock farming more profitable	Buyers (market prices)	Corral, feed, veterinary care (3 most important points)	F04 (except corral)
Protect against animals	+ Famer, trader (better products), fence supplier	Farmer and/or farmer grouping	Surround/protect market garden	Farmer	Pike, cement, wheelbarrow, shovel, sand, availability of money and labor	

Table 3. Improvements expected by ALS group 3

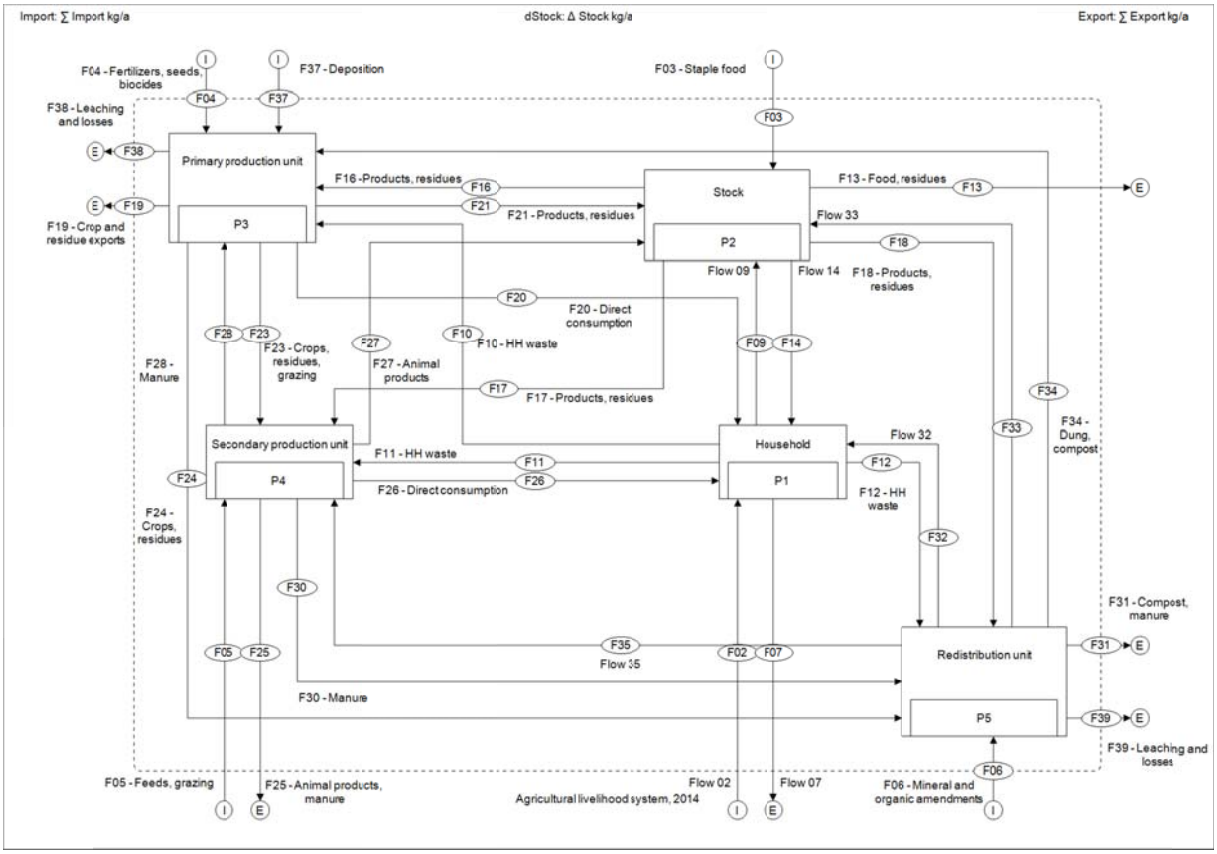
Purpose	Customers	Actors	Transformation process	Owners	Environmental constraints	Affected flow(s)
Keep nutrients on plot, keep soil humidity, fight soil erosion	+ Farmer, neighboring farmers (example)	Farmers (trained by who?)	Reinforce low stone walls	Farmer	Cart, pickaxe (for transport), week water streams	F38, P3
Maintain fertility of remote plot	+ Farmer	State or private project	Be trained in composting and acquire transport equipment	(State or private project is only expected once)	Awareness of state mechanisms	F34
Better distribute rain	+ Farmer, society	Farmer	Reforest	(State encourages action)	Equipment, trees	
Improve livestock health	+ Farmer, consumer	Veterinaries (visits)	Get better access to treatment against livestock diseases	Farmer	Market (non-saturated, i.e., good prices), drug costs (veterinary costs borne by State)	P4
Fight effects of water stagnancy	+ Farmer, traders, consumers	Farmer	Sow earlier	Animals (eating seeds)		
Fight striga, increase soil fertility	+ Farmer, SOFITEX, dolo producers/consumers	Farmer, SOFITEX (providing seeds and mineral fertilizers, purchasing harvest, providing income if surplus)	Rotate cotton and sorgo	SOFITEX (providing mineral fertilizers)	Small plot surface is sufficient	F04
Increase financial possibilities	+ Farmer, bank, friends, parents	Farmer grouping	Group financial capital to provide bank with warranty	Bank (in case of lack of liquidity)	Financial capital	

4. Material flow system

The Figure below depicts the system of nutrient (N,P and K) flows running across components of a smallholder farming system. These componential processes include:

- primary production units (e.g. crop and forage fields),
- secondary production units (e.g. livestock production),
- the stock (for seeds, products, residues and soil reserve, and
- homestead (household), and
- the distribution units.

All processes have a stock (P1, P2, P3, P4, P5) symbolized by a box within the process. This system will be linked to improvements proposed and detailed by the farmers.



5. Discussion

The three ALS groups do not necessarily come up with the same improvements. Improvements regarding animal productivity are not mentioned by ALS group 1, as expected. ALS group 1 possesses no or little livestock. ALS group 2 suggests improvements affecting flow F04 – fertilizers, seeds, biocides to increase efficiency of primary production. Improvements suggested by ALS groups 1 and 3 address various flows or are not related to specific flows (e.g., better access to credit). Depending on the ALS group, improvements do not necessarily have the same environmental constraints. ALS group 1 names "labor" as an environmental constraint to reinforcing/constructing little stone walls to fight erosion. This is not a constraint for ALG group 3.

6. Outlook

The next step will consist in developing material flow scenarios for each ALS group based on the status-quo MFAs of the three farms most representative of the three ALS groups and the improvements suggested by the farmers. Concretely, the MFA scenarios will be implemented by altering in NUTMON (Van den Bosch, De Jager, & Vlaming, 1998) the flows affected by suggested improvements and adapting agricultural production using the empirical production functions of Pontieba (Thiombiano & Le, 2016). For instance, erosion in status-quo MFA of ALS 1 will be reduced in a scenario on fighting erosion by constructing little stone walls around plots and the agricultural production will be adapted according to the relevant (i.e., crop-dependent) production function.

References

Thiombiano, B. A., & Le, Q. B. (2015). Agricultural livelihood systems (ALS) typology for coping with socio-ecological diversity in ALS transition research: A demonstrative case in Pontieba, south-western Burkina Faso. Amman, Jordan: CGIAR Research Program on Dryland Systems.

Thiombiano, B. A., & Le, Q. B. (2016). Integrated production functions for main crop fields in Pontieba, southwestern Burkina Faso: Empirical estimations for efficiency

assessment and further integrated modelling. Amman, Jordan: CGIAR Research Program on Dryland Systems.

Van den Bosch, H., De Jager, A., & Vlaming, J. (1998). Monitoring nutrient flows and economic performance in African farming systems (NUTMON): II. Tool development. *Agriculture, Ecosystems & Environment, 71*(1–3), 49-62. doi:http://dx.doi.org/10.1016/S0167-8809(98)00131-5

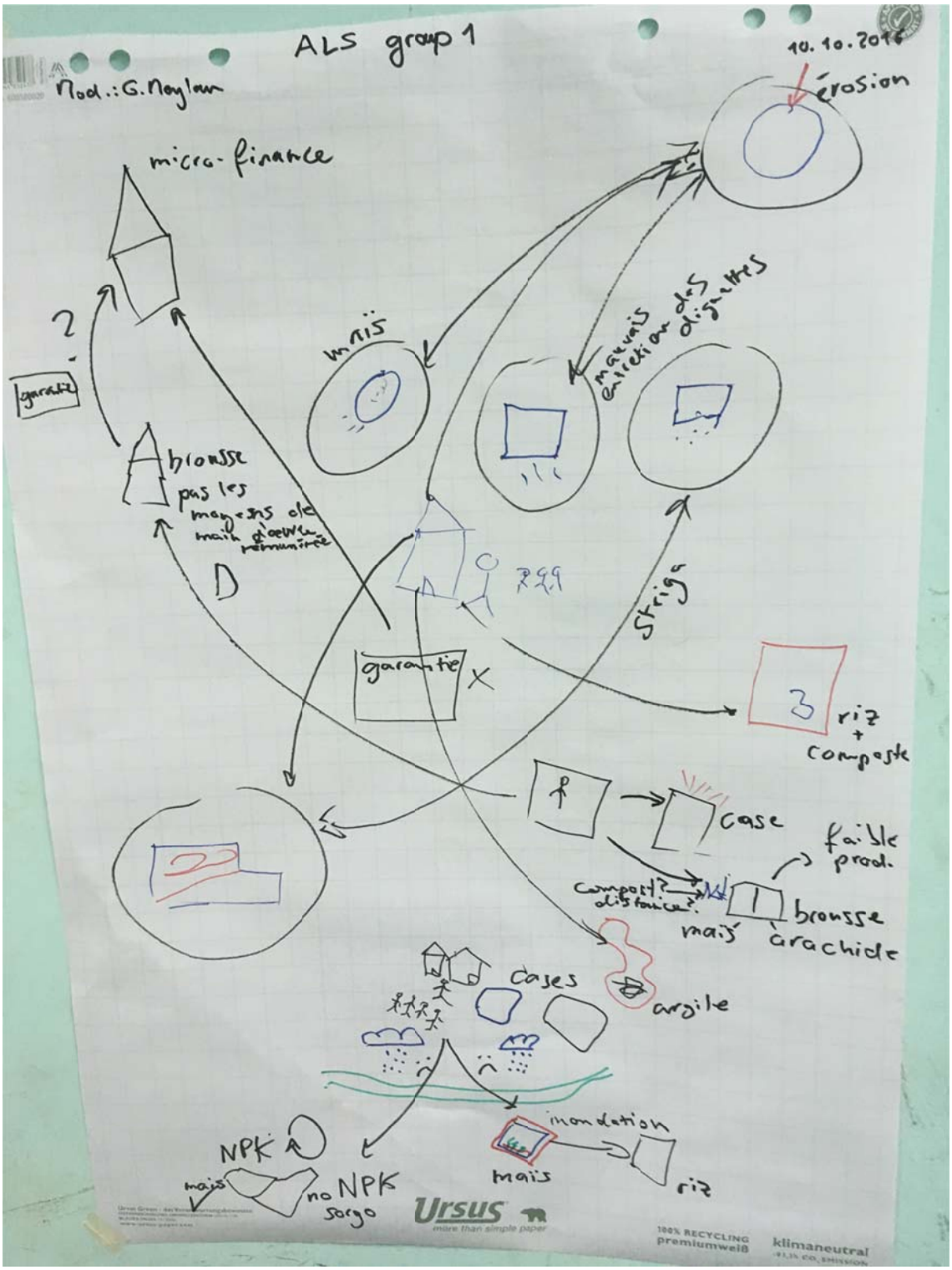
Annex 1. Workshop agenda

Time	Activity
Day 1 (10 October 2016)	
08:00 – 08:30	• Registration (use the Table of Participants)
08:30 – 09:20	• Presentation of previous research results (selected from Thiombiano's dissertation and CRP-DS research report) (Boundia Thiombiano) • Questions and Answers
09:20 – 09:30	• Taking formal workshop photos
09:30 – 10:00	• Coffee/Tea break
10:00 – 12:15	Individual ALS group exercises for weighting significant factors affecting crop choices: 1. Explanation of the exercise (Boundia Thiombiano) (15 min) 2. Weighting factors affecting land use choices: each ALS group works on 3 exercises of 3 crop choices (maize, rice, groundnut) (60 min) 3. Weighting factors affecting nutrient use adoptions: each ALS group works on 3 exercises of 3 nutrient use adoption (mineral fertilizer, organic fertilizer, mineral-organic combined fertilizer) (60 min) (note: background document: Report 2016, Task 2)
12:15 – 13:30	• Lunch break
13:30 – 15:00	Combined, but gender-specific, group exercises for weighting significant factors affecting: 1. Weighting factors affecting land use choices: each gender group works on 3 exercises of 3 crop choices (maize, rice, groundnut) (45 min) 2. Weighting factors affecting nutrient use adoption: each gender group works on 3 exercises of 3 nutrient use adoption (mineral fertilizer, organic fertilizer, mineral-organic combined fertilizer) (45 min)
15:00 – 15:30	• Coffee/Tea break
15:30 – 17:00	Combined group exercises for weighting significant factors affecting: 1. Weighting factors affecting land use choices: the combined group works on 3 exercises of 3 crop choices (maize, rice, groundnut) (45 min) 2. Weighting factors affecting nutrient use adoption: the combined gender group works on 3 exercises of 3 nutrient use adoption (mineral fertilizer, organic fertilizer, mineral-organic combined fertilizer) (45 min)
Day 2 (11 October 2016)	
08:00 – 08:30	• Introduction to Day 2: Future planning by farmers (Boundia)
08:30 – 9:45	Individual ALS group exercises for prioritizing livelihood options among the livelihood portfolio*: • Explanation of the exercise (Boundia Thiombiano) (15 min) • Each ALS group works to <u>imagine</u> their livelihood portfolio in the next 5-10 year (30 min) (* livelihood portfolio = a list of all possible livelihood activities at a particular level of aggregation. E.g.: Maize production + rice production + groundnut production + cotton production + millet/sorghum production + poultry production + cattle production + trading + etc.) • Each ALS group <u>weights</u> livelihood activities in the portfolio in proportion with the degree they would like to invest on (30 min)

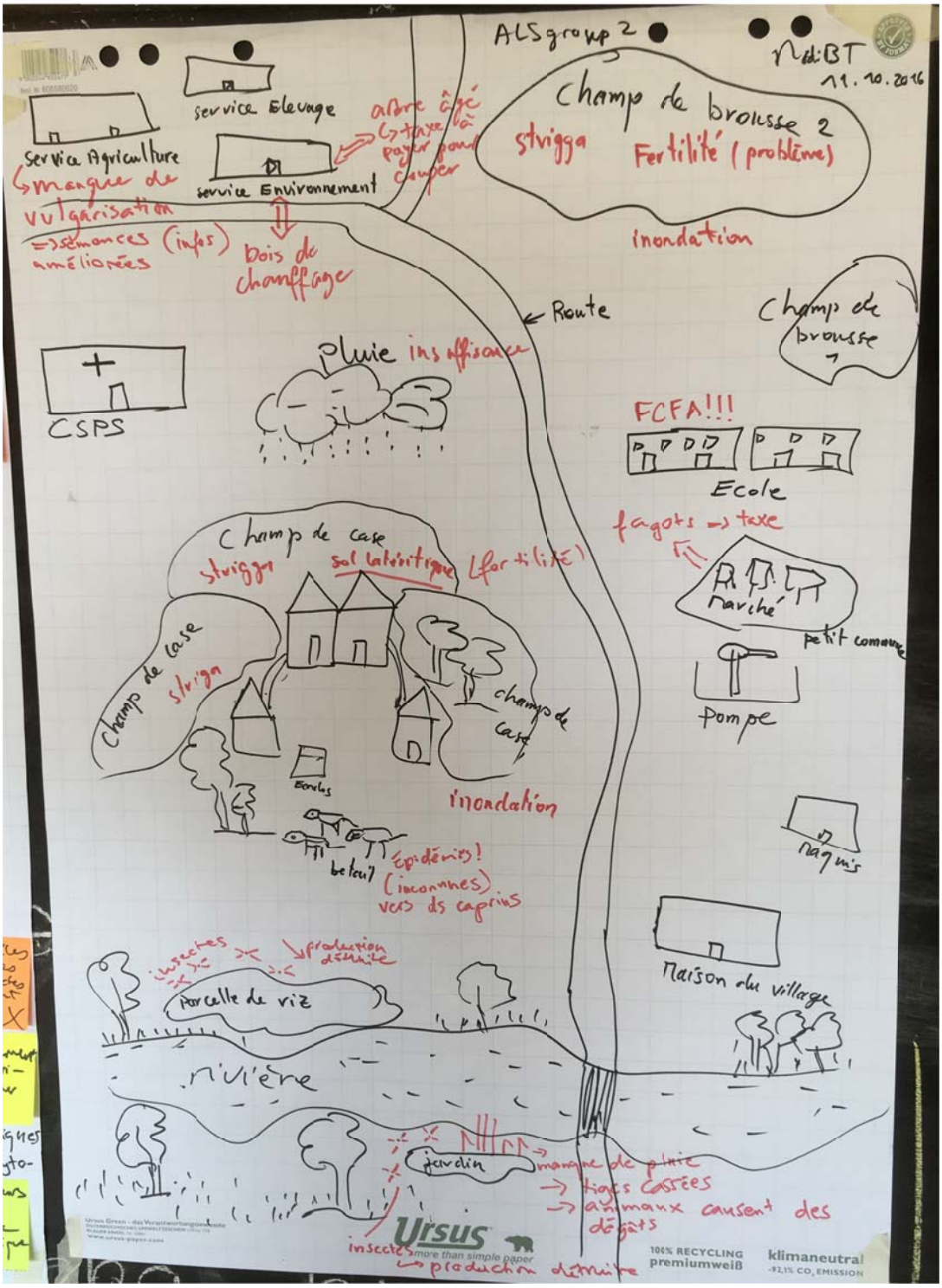
09:45 – 10:15	• Coffee/Tea break
10:15 – 11:15	Individual ALS group exercises for prioritizing livelihood options among the livelihood portfolio (continued): • Each ALS group identified constraints and opportunities for the livelihood activities they like to invest on (30 min) • Each ALS group identified key non-farmer stakeholders and expected roles in each livelihood activities (30 min)
11:15 – 12:15	Combined gender-specific group exercises for prioritizing livelihood options among the livelihood portfolio (continued): • Each gender group weights livelihood activities in the portfolio in proportion with the degree they would like to invest on (20 min) • Each ALS group identified constraints and opportunities (technical, institutional, market) for the livelihood activities they like to invest on (20 min) • Each ALS group identified key non-farmer stakeholders and expected roles in each livelihood activities (20 min)
12:15 – 13:30	• Lunch break
13:30 – 15:00	Individual ALS group exercises for prioritizing management practices needed to be improved for each key livelihood components: • Explanation of the exercise (Boundia Thiombiano) (15 min) • Each ALS group works to identify concrete management practices needing improvement for each livelihood components (Crop: Maize production + rice production + groundnut production + cotton production + millet/sorghum production; Livestock: poultry production + cattle production; Non-farm: trading + etc.) (40 min) • Each ALS group identified technical, institutional and market constraints, key non-farmer stakeholders and expected roles in each management practices targeted (35 min)
15:00 – 15:30	• Coffee/Tea break
15:30 – 16:30:	Combined gender-specific group exercises for prioritizing management practices needed to be improved for each key livelihood components: • Each gender group works to identify concrete management practices needing improvement for each livelihood components (Crop: Maize production + rice production + groundnut production + cotton production + millet/sorghum production; Livestock: poultry production + cattle production; Non-farm: trading + etc.) (30 min) • Each gender group identified technical, institutional and market constraints, key non-farmer stakeholders and expected roles in each management practices targeted (30 min)
Day 3 (12 October 2016)	
09:00 – 09:30	Introduction to Day 3: Problem identification and brainstorming of improvements (Soft Systems Methodology) (Grégoire Meylan)
09:30 – 10:30	Step 1: Expression of problem situation (3 individual ALS groups) • First individual rich picture (20 min) • Overall rich picture as group work (40 min)
10:30 – 11:00	• Coffee/Tea break
11:00 – 12:30	Step 2 (3 individual ALS groups): • Brainstorming of possible improvements (1h30)

12:30 – 13:45	• Lunch break
13:45 – 14:45	Step 1: Expression of problem situation (combined all) • First individual rich picture (20 min) • Overall rich picture as group work (40 min)
14:45 – 15:15	• Coffee/Tea break
15:15 – 16:15	Step 2 (all combined): • Brainstorming of possible improvements (1h)
16:15 – 17:00	Wrap-up and good bye

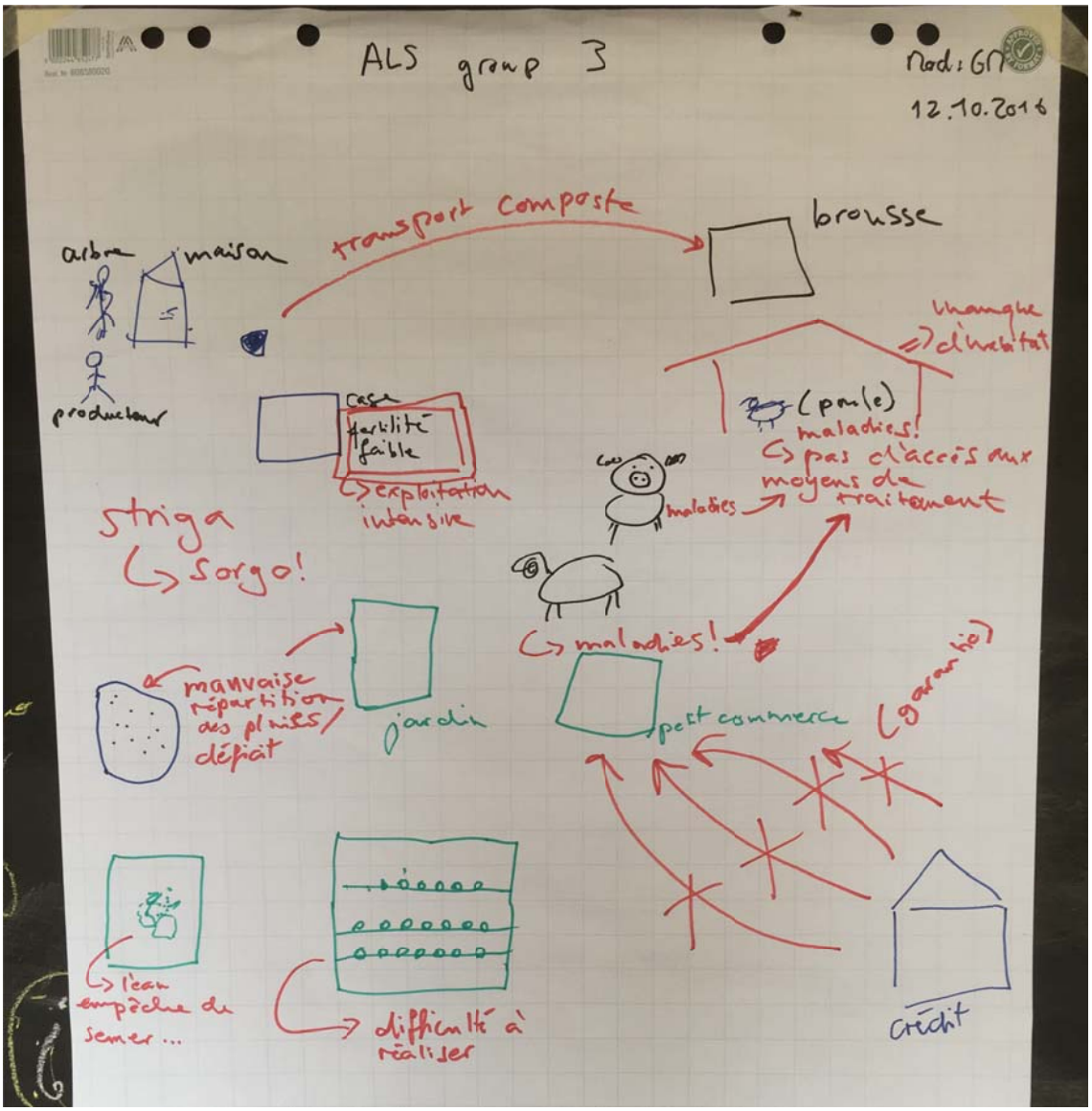
Annex 2a. Rich pictures generated by ALS group 1



Annex 2b. Rich pictures generated by ALS group 2



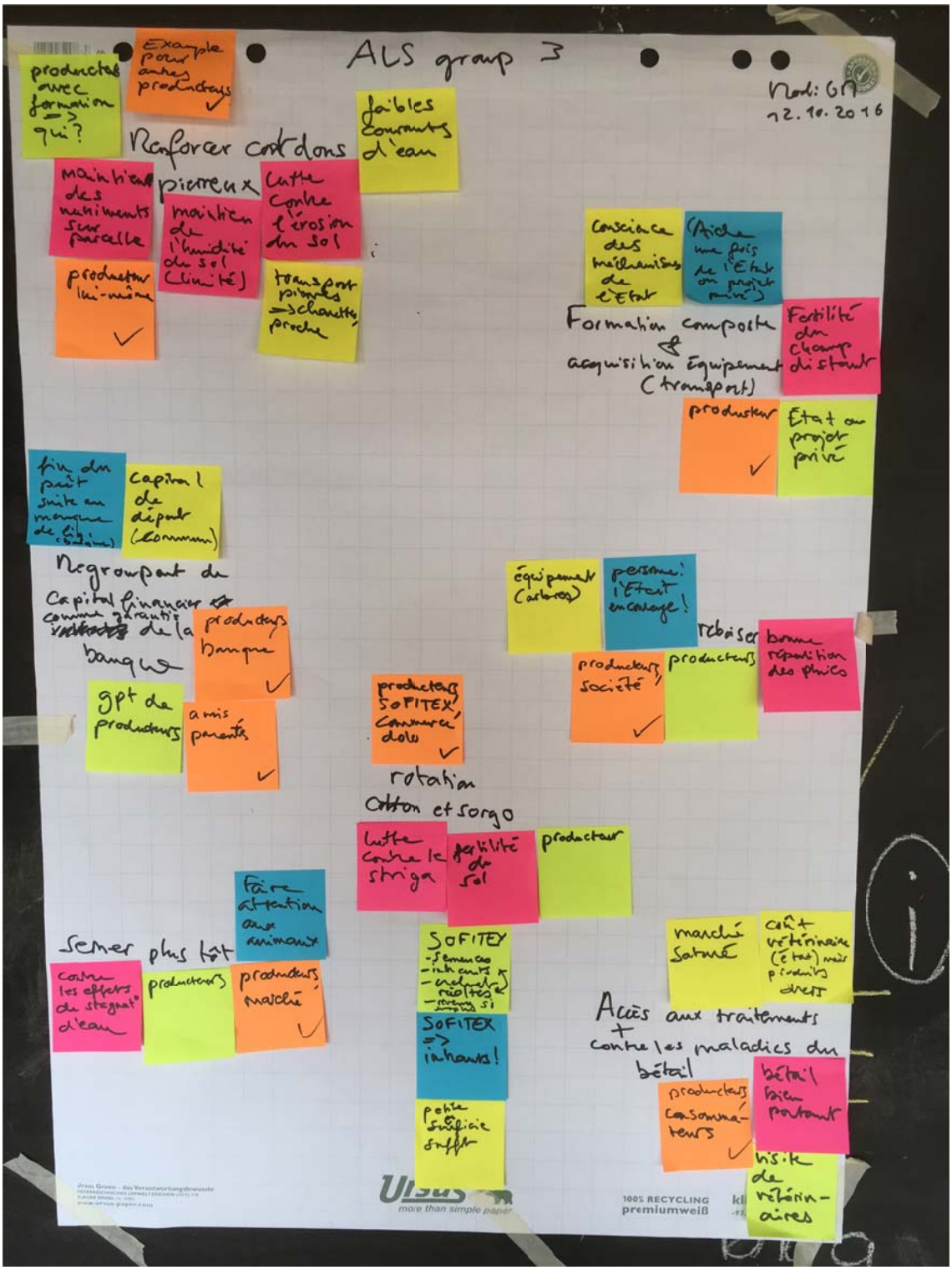
Annex 2c. Rich pictures generated by ALS group 3



Annex 3a. Improvement expected by ALS group 1

Annex 3b. Improvement expected by ALS group 2

Annex 3c. Improvement expected by ALS group 3



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The CGIAR Research Program on Dryland Systems aims to improve the lives of 1.6 billion people and mitigate land and resource degradation in 3 billion hectares covering the world's dry areas.

Dryland Systems engages in integrated agricultural systems research to address key socioeconomic and biophysical constraints that affect food security, equitable and sustainable land and natural resource management, and the livelihoods of poor and marginalized dryland communities. The program unifies eight CGIAR Centers and uses unique partnership platforms to bind together scientific research results with the skills and capacities of national agricultural research systems (NARS), advanced research institutes (ARIs), non-governmental and civil society organizations, the private sector, and other actors to test and develop practical innovative solutions for rural dryland communities.

The program is led by the International Center for Agricultural Research in the Dry Areas (ICARDA), a member of the CGIAR Consortium. CGIAR is a global agriculture research partnership for a food secure future.

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