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Sustainable Agricultural Intensification Research and Learning in Africa

Exploring alternatives for livestock production in Bama, Burkina Faso

Playing the transformation game
Report of ResLeSS Workshop 2

February 2018

Prepared by SEI, ILRI and INERA on behalf of SAIRLA

Exploring alternatives for livestock production in Bama, Burkina Faso: Playing the Transformation Game

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SEI Stockholm Environment Institute | ILRI International Livestock Research Institute | ECRC at EDRI | INERA | Sokoine University of Agriculture | ICARDA Science for Better Livelihoods in Dry Areas | CGIAR

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Contents

Acroymns

Acronym	
A1	Agro-pastoral transhumant herd, somewhat improved
ABR	Agro-pastoral transhumant herd, Baseline (current state)
AI	Artificial Insemination
APESS	Association pour le Promotion de l'Elevage au Sahel et en Savane
CFA	Communauté Financière d'Afrique (West African CFA franc, currency in Burkina Faso, code XOF)
CGIAR	Consultative Group on International Agricultural Research
CLEANED	Comprehensive Livestock Environmental Assessment for improved Nutrition, a secured Environment and sustainable Development
D1	Specialised Dairy animals, somewhat improved
D2	Specialised Dairy animals, much improved
DBR	Specialised Dairy animals, Baseline (current state)
DFID	UK Department for International Development
DPAAH	Direction Provinciale De l'Agriculture Et Des Aménagements Hydrauliques (Provincial Department of the Ministry of Agriculture and Water Development)
DPEEVC	Direcion Provinciale de l'Environnement, Economie Verte et Changement Climatique (Provincial Department of the Ministry of Environment, Green Economy and Climate Change)
DPRAH	Direction Provinciale des Ressources Animales et Halieutiques du Burkina Faso (Provincial Department of the Ministry of Animal Resources and Fisheries)
DRAAH	Direction Régionale De l'Agriculture Et Des Aménagements Hydrauliques (Regional Department of the Ministry of Agriculture and Water Development)
DRRAH	Direction Régionale des Ressources Animales et Halieutiques du Burkina Faso (Regional Department of the Ministry of Animal Resources and Fisheries)
ECRC/EDRI	Environment and Climate Research Center (ECRC) at Ethiopian Development Research Institute (EDRI)
F1	Fattening animals, somewhat improved
F2	Fattening animals, much improved
FBR	Fattening animals, Baseline (current state)
FEB	Fédération des Éleveurs de Burkina Faso
GDP	Gross Domestic Product
GHG	Greenhouse Gas
ha	hectares
ICARDA	International Center for Agricultural Research in the Dry Areas
ILRI	International Livestock Research Institute
INERA	Institut de l'Environnement et de la Recherche Agricole
L1	Agro-pastoral dairy herd, somewhat improved

L2	Agro-pastoral dairy herd, much improved
LBR	Agro-pastoral dairy herd, Baseline (current state)
LT	Long transhumance
MRAH	Ministère des Ressources Animales et Halieutiques
NGO	Non-governmental organisation
NRI	Natural Resources Institute
RECOPA	Reseau De Communication Sur Le Pastoralisme
ResLeSS	Research and Learning for Sustainable Intensification of Smallholder Livestock Value Chains
SAI	Sustainable Agricultural Intensification
SAIRLA	Sustainable Agricultural Intensification Research and Learning in Africa
SDG	Sustainable Development Goal
SEI	Stockholm Environment Institute
ST	Short transhumance
SUA	Sokoine University of Agriculture
T1	Draft animals, somewhat improved
TBR	Draft animals, Baseline (current state)
UNDP	United Nations Development Program
UNZ	Université Norbert ZONGO de Koudougou
ZAT	Zone d'Appui Technique

Executive summary

This report presents the design for and preliminary results from the second ResLeSS workshop in Burkina Faso. The workshop is focused around the development of socio-economic indicators that are shared between stakeholders, and a "Transformation Game" that engages stakeholders in scenario development and assessment focused on the CLEANED environmental impact simulation tool. This approach enabled constructive debate between stakeholders who, during the previous workshop, had given voice to their deep conflicts over the future of livestock in Bama. An explicit focus on equity, through the design of the workshops and Game, and the treatment of economic indicators that encompass wider perceptions of value than finance alone, helped ensure that dialogue was able to emerge rooted in an appreciation of the very different perspectives held by stakeholders. The Game opened a space for discussion that has yielded important insights for future development planning and was valued by the workshop participants. Participant feedback makes clear that the workshop developed new knowledge and achieved the objective of creating an opportunity for joint learning - participants welcomed the opportunity to "have acquired knowledge calmly, without fighting and without disruption", and to be able to listen to others' propositions with "mutual respect".

The workshop revealed a shared desire among stakeholders for livestock livelihoods to provide an improved standard of living and wellbeing. However, working in homogenous stakeholder groups, the framing of pastoralism had operated to isolate the pastoralist stakeholders from the wider group. Once the groups became mixed, an appreciation developed for the socio-economic significance of pastoralism, representing an important step forward for shared planning in the area. The provision of rhetorical space through the playing of the game enabled CLEANED to be the focus of a constructive conversation and an effective learning tool.

The results indicate a clear sense that participants are focused on meeting socio-economic goals (expressed for the most part in terms of increased income from livestock) and that this takes priority over environmental concerns. The work done in the mixed groups suggests three central considerations that link environmental, equity and economic priorities in Bama:

1. Any increase in production to meet socio-economic targets will have an associated increase in environmental impacts.
2. Meeting socio-economic targets using the existing pastoralist system, even with slight modifications in feeding, requires higher environmental impacts than the use of improved breeds and management.
3. Improved breeds and management obliges the pastoralist society to commercialize, which is in contrast to their clearly expressed wishes.

These trade-offs reinforce the importance of an integrated approach to planning livestock development trajectories, not least because the constraints imposed by envionrmental impacts may fundamentally limit the socio-economic potential of some storylines for livestock futures.

Land management was raised as both a current problem and as a necessary part of an equitable future. If the transhumant system is to continue alongside sedentary production, interaction between livestock and crop farmers should be coordinated. Access to feed (grazing and crop residues) is essential to support local livestock production, and this means regulating the spread of crop fields, as well as the movement of cattle. This would require agreement between farmers, but also support from commune, provincial and regional administration to enforce agreements.

Finally, the workshop made clear that there is a need for focus on sustainable livestock *transformation*. Transformation opens up the potential to consider alternative strategies or pathways of change for the livestock system, acknowledging that while intensification may indeed be appropriate in some contexts, it should not be assumed to be suitable in all situations. Assessing alternatives to intensification provided important learning opportunities that would not have been possible had the workshop focussed only on intensification. Framing the debate around how to move towards an jointly defined, equitable future is important for enabling progress, while being open to alternative strategies to intensification allows for new and unexpected options to emerge.

1 Introduction

This report summarises the design and initial findings from the second workshop of the Research and Learning for Sustainable Intensification of Smallholder Livestock Value Chains (ResLeSS) project in Bama commune of Houet Province, Burkina Faso, which is part of the Sustainable Agricultural Intensification Research and Learning in Africa (SAIRLA) programme, funded by UK DfID and managed by the Natural Resources Institute (NRI) at the University of Greenwich and WYG. The overall aim of the second workshop is to support participants to undertake a shared evaluation of the social, economic and environmental consequences of plausible livestock futures.

ResLeSS is investigating a process that supports decision-makers in using a rapid ex-ante environmental impact assessment tool (CLEANED[1]) and a participatory economics approach together with input from local stakeholders, to produce decisions that have taken into account three pillars of sustainability – the environment, economics and equity. Using a social learning approach, the project follows a facilitated process of two workshops supported by a reconnaissance tour and ongoing outreach that is designed to enable stakeholders to consolidate their own understanding and priorities before acknowledging the perspective of others.

Workshop 1, conducted in July 2017, gathered data from stakeholders connected to livestock livelihoods in relation to the environment and socio-economics. This work set the stage for the second workshop in two ways. First, the environmental data gathered enabled the parameterisation of the computer-based environmental impact assessment tool (CLEANED), so that it can be used to explore the impacts of alternative livestock futures in the study area in Burkina Faso. Second, engaging with participants around desirable socio-economic futures started a process of capturing an understanding of value that is wider than that offered by a financial assessment alone. Together, these two steps provide the grounding for a process of disciplinary integration and participatory appraisal of potential livestock futures, which we understand to constitute a transdisciplinary research approach.

This transdisciplinary enquiry into livestock futures, via a participatory process that explores the relationship between economics and the environment, is the focus of Workshop 2. The second workshop is a two-day event (balancing the need for sustained interaction with the realities of stakeholder time commitment) that builds on Workshop 1 through:

- Use of CLEANED to generate environmental impact data for different livestock scenarios, parameterised for the case study site in each country using the data gathered in Workshop 1
- The assessment of livelihood impacts of alternative livestock scenarios, using the socio-economic indicators developed during Workshop 1.

Taken together, the two workshops offer a systematic process that works towards the development of more equitable relationships between stakeholders through improved mutual understanding and shared learning.

1.1 Workshop design

To achieve the workshop aims, the design incorporates five central tools and concepts.

First, the workshop makes use of a computer-based environmental simulation tool, called ***CLEANED***. CLEANED calculates environmental impacts (water use, greenhouse gas emission, biodiversity loss and nitrogen balance) for a given area based on the livestock production that is being undertaken in that area. This production is expressed in terms of parameters that can be defined via a user interface (developed during the project). The underlying code consists of 5 modules: livestock productivity, water, greenhouse gas, biodiversity and nitrogen balance.

1 Comprehensive Livestock Environmental Assessment for improved Nutrition, a secured Environment and sustainable Development.

Second, the report refers to ***livestock production practices*** to describe ways of keeping livestock (a combination of livestock species - cows or sheep, traditional or improved breeds - feed requirements, and management). In CLEANED, each livestock production practice is parameterised by approximately 17 parameters (differences in land use for feed production, feed basket, animal productivity, manure management etc.).

Third, a ***vignette*** is a pre-defined narrative description of a particular livestock production practice (e.g. traditional cattle extensively grazed, or improved cattle tethered and fed with locally grown grasses). A combination of vignettes can be used to quickly formulate a plausible livestock future for the landscape – referred to as a ***scenario***. For each vignette all CLEANED parameters are fixed, and by only selecting which vignettes to include and the number of animals assigned to each vignette, the participants can define a scenario (e.g. 5000 animals in vignette A, 500 in B, 7000 in C).

Thus (and fourthly), a ***scenario*** refers to one possible mix of different livestock production practices in a defined landscape. This encompasses the types of livestock production practices assumed to be present and the proportion (or scale) of each practice. For a particular scenario, CLEANED calculates the environmental impact from the mix of livestock production practices in a landscape.

Finally, the workshop culminates in participants playing the ***Transformation Game.*** The Transformation Game enables groups of participants to define a livestock scenario using the vignettes, and then explore the socio-economic consequences of that scenario (via indicators developed in Workshop 1 and refined at the outset of Workshop 2) and environmental consequences (using computers running the CLEANED simulation).

Through discussion of how these results might be interpreted and valued, the Transformation Game enables learning to develop between stakeholders with different viewpoints on livestock livelihoods. Together, the group can then revise their scenario, and test this new scenario using the socio-economic indicators and CLEANED. In this way, the game allows participants to explore livestock futures and develop a better sense of the trade-offs that are embedded in different choices and how these trade-offs are experienced by different stakeholder groups.

1.2 Report structure

The report is organised into three substantive sections, together with this introduction and a conclusion that draws together the main findings. Additionally, there is a companion report that sets out the parameterisation of CLEANED for Burkina Faso. Section 2 describes the design of the Transformation Game, setting out the key features, how it is initialised to provide a representation of plausible livestock futures in Bama, how it is played and how it forms part of the overall participatory workshop design. Section 3 presents the results of the workshop and Game, in terms of the socio-economic indicators jointly agreed between stakeholder groups, the desirable scenarios developed by each stakeholder group, and the discussions and trade-offs that emerged during playing of the Transformation Game in mixed stakeholder groups. Section 4 provide a discussion that reflects on the results in terms of stakeholder priorities, the conditions for learning, trade-offs and synergies, and the wider context that was not embedded into the Game but became an important part of the discussion.

1.3 Participant selection

As far as possible, we invited the same participants that were present in Workshop 1, with some additions based on feedback from facilitators about missing stakeholders in Workshop 1. Throughout we used purposive sampling to select participants, with the primary objective to have representation from each type of stakeholder connected with the value chain, and as a secondary objective, to aim for gender balance. The workshop had 32 participants, representing 5 categories of value chain stakeholders, identified in consultation with local researchers and based on a reconnaissance tour in November 2016: livestock producers; processors; government administration; extension services; and NGOs. For further detail of the composition and selection of selected stakeholders and groups, see Appendix A.

Workshop 1 established that part of the transhumance route is in the southern part of Padema commune, and as such that any discussions involving the future of this transhumance route should include stakeholders from that area. Accordingly, stakeholders from Padema commune were included in Workshop 2.

For the activities, participants were split into four roughly equal-sized groups in Workshop 1, and these groups were maintained for the first section of Workshop 2. These four groups were homogeneous with respect to stakeholder type, so that members within a group were more similar to each other, in terms of experiences and perspective on the value-chain, than to the members of other groups. The 5 stakeholder categories were arranged into 4 groups as follows:

- Transhumants (pastoralists) – this included pastoralist livestock keepers, and the NGO representatives who were all closely involved in pastoral issues and therefore joined this group, and are also pastoralists themselves) (6)
- Other farmers (9) – this included livestock keepers who did not identify themselves as pastoralists
- Processors – this included meat and milk processors as well as 2 producers who do cattle fattening and 2 producers who class themselves as processors as well (8)
- Local administration and experts – this included the Ministry representatives, district administration and extension services, and henceforth referred to as the 'government representatives' (9)

1.4 Sources of data

The material in the report is drawn from documentation recorded and discussions held during and after the workshop:

- flipcharts that recorded intermediate outcomes during the two workshop days;
- six reports written by the workshop facilitators recording their observations and reflections on the proceedings of the workshop;
- reflections by the facilitators and project team collected in de-briefing conversations during and after the workshop;
- pre- and post-questionnaires filled in by the participants; and
- eight individual semi-structured interviews held with selected participants following the workshop (selected because they showed particular interest in the proceedings or were representative of specific groups; representing dairy processing, butchery, fattening, livestock keeper group representatives, pastoralist representatives and the ministry of environment).

2 The Transformation Game in Burkina Faso

The 'Transformation Game' is a novel contribution of the project that allows participants to devise and assess future livestock scenarios. It forms the central focus of Workshop 2.

As noted in section 1, the aim of the workshop is to support participants to undertake a shared evaluation of the social, economic and environmental consequences of plausible livestock futures. Central to this is the use of CLEANED. While the results of CLEANED are relatively straightforward to interpret, developing sufficient understanding of the model and how it can be parameterised is beyond the scope of a multi-stakeholder workshop. The workshop design is therefore driven by two requirements:

- To simplify the use of CLEANED in real-time, so that alternative livestock futures can be assessed without the need to understand, discuss and enter all possible parameters; and
- To simplify the process of making choices between (a potentially huge number of) livestock management options.

The 'Transformation Game' addresses these requirements through the use of vignettes. Each vignette is parameterised prior to the workshop and is available to be called-up via the CLEANED user-interface,

allowing rapid but straightforward user engagement. At the same time, the vignettes define a limited number of livestock management options, reducing the complexity of decision making in the workshop by constraining the number of options available to participants. Together, these factors enable interaction with CLEANED within a manageable time, allowing for relatively quick iterations of scenario development, meaningful discussions of results, and deliberation over potential scenario revisions.

As set out in Section 1.1, vignettes and scenarios are deployed within the Transformation Game to allow iterative assessment of the socio-economic and environmental impacts of scenarios, as illustrated in Figure 1 and explained in Section 2.1.

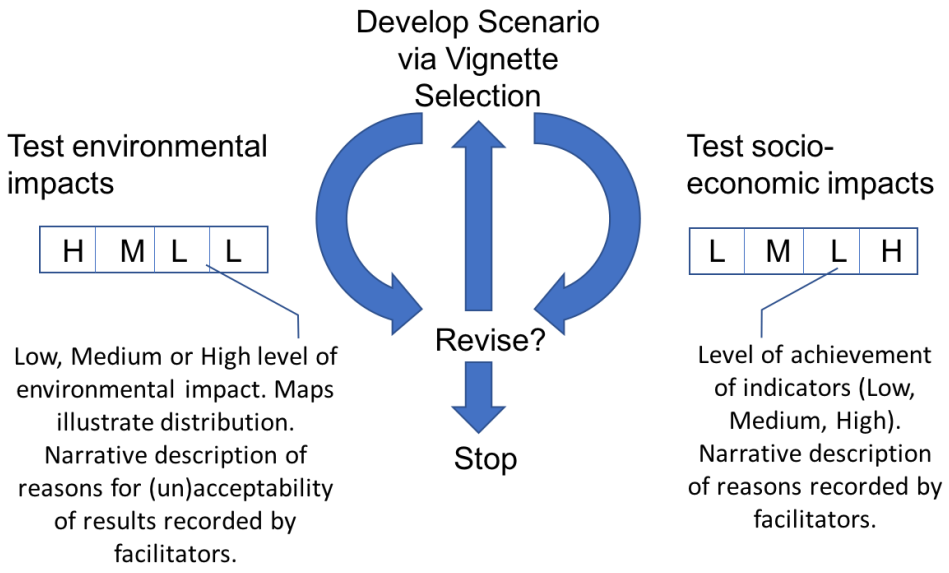

Figure 1 : The Transformation Game. An initial scenario is revised until participants are satisfied with the environmental and socio-economic impacts.

2.1 Playing the transformation game

The Transformation Game comprises five components that are deployed by players in the workshop:

- **Vignette cards:** Central to the game is the vignette, or short description of key elements of a livestock management practice. Each vignette is printed on a card, with an image illustrating the vignette on the front. On the back, an interested participant would find all the associated CLEANED parameters that define the vignette. Figure 2 provides an example from the Burkina Faso game. For each production category (e.g., fattening animals, dairy animals; in the Burkina Faso case there are five, as discussed below) one vignette represents today's practice, and a further one or two vignettes are provided describing possible (and plausible) future changes to animals, feed and/or management for that category (e.g. introduction of high yielding dairy cows). These vignettes are pre-set within the CLEANED tool, so that the non-expert can develop credible scenarios (that is, combinations of vignettes defining the production across the landscape).
- **Game board:** The game board allows participants to select a combination of vignettes. Figure 3 provides an example from Burkina Faso. The bottom row sets out the current scenario – representing what is found in the study area today. This is fixed. The top row is initially blank, allowing participants to choose which vignette card they wish to place in each production category to define their future scenario.
- **Bricks (defining number of animals):** Lego-type bricks are provided to participants, with each brick corresponding to a defined number of animals. The bricks are placed on each vignette card to allow the participants to select the number of animals involved in each vignette across the 'landscape'. Sufficient bricks are provided to represent the total number of animals currently in the

study area, as well as allowing for an increase in animal numbers in future scenarios. Figure 4 illustrates the bricks in use in Burkina Faso.

- **Environmental score cards:** Once a scenario has been selected, participants use CLEANED to produce a set of productivity indicators (recorded in Table 1), and environmental impacts (water, greenhouse gases, and nitrogen balance; Table 2). The results are presented by CLEANED in tables and provide average impact measures for the whole study area for that scenario, as well as a percentage difference in these measures for the scenario from the baseline. Two environmental score cards are provided to allow participants to record the key results given by CLEANED tool for a particular scenario. CLEANED also provides an automatic guide as to whether this change is low, medium or high, relative to the range of possible impacts for the study area (based on plausible scenarios; Appendix B). This assessment allows the participants to gain a sense of the scale of change. The participants then make their own (subjective) evaluation of what this impact means to them, recording their view as to whether the impact is desirable, acceptable or unacceptable and why. This evaluation is captured in the 'Participant Evaluation' column.

Table 1 : Environmental scorecard - productivity indicators

Productivity indicators	% change compared to baseline	CLEANED Generated Score Low/medium/high	Participant Evaluation
Meat produced (tons)			
Milk produced (tons)			
Cropland used (ha)			
Grazing land used (ha)			
Rice area used (ha)			

Table 2 : Environmental scorecard – environmental impact indicators

Other indicators		% change compared to baseline	CLEANED Generated Score Low/medium/high	Participant Evaluation
Water	Total			
	Per animal			
Greenhouse gases	Total			
	Per animal			
Nitrogen				

- **Socio-economic score cards:** Once a scenario has been selected, participants discuss the anticipated socio-economic impacts in relation to each of the indicators agreed during the first day of the workshop (Table 3). The score card encourages the participants to think in terms of the different impacts felt by different groups. Based on these discussions, participants score their assessment of the progress the scenario makes against the indicator as low/ medium/ high.

Table 3 : Socio-economic scorecard

Indicator	What are the benefits?	What are the costs? Why?	Who benefits most and least?	Score
Combined indicator 1 etc.				

Having assessed the environmental and socio-economic consequences of a particular scenario, participants negotiate a revised scenario – using vignette cards and bricks – that they believe will better meet their environmental and socio-economic goals. The revised scenario can then be evaluated and revised in a further iteration of the game.

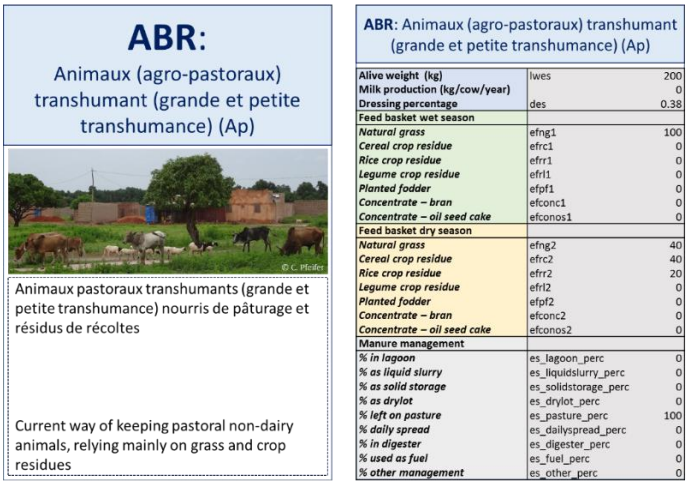

Figure 2 : Example of a vignette card showing the title and illustration on the front (left) and the CLEANED parameters on the reverse side (right).

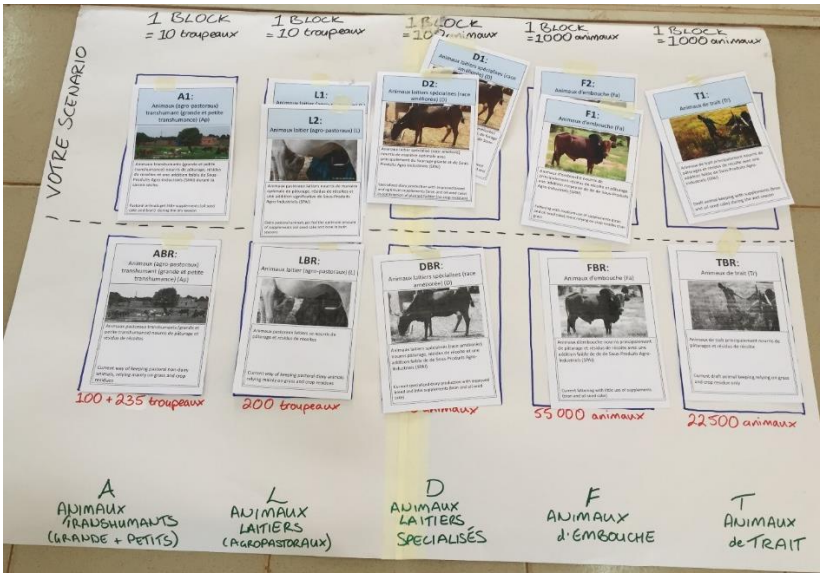

Figure 3 : Game board used in Burkina Faso. Vignette cards can be placed in the top row by participants to select their future scenario.

Figure 4 : The game being played in Burkina Faso. Participants are selecting the number of bricks that they want to assign to each vignette, representing the number of animals.

2.2 Initializing the transformation game for Bama, Burkina Faso

Full details of the parameterisation of CLEANED for the study site can be found in the companion report. Here, we summarise the key points that define how the Transformation Game is played and allow interpretation of the results.

Five livestock production categories were identified during Workshop 1 for Bama, Burkina Faso, comprising dairy, fattening and rearing practices[2] across extensive, semi-intensive and intensive systems. These are:

1. Transhumant herds[3]
    a. Long transhumant herds (LT)
    b. Short transhumant herds (ST)
2. Pastoral dairy herd
3. Specialized dairy animals
4. Fattening animals
5. Draft animals

Table 4 summarises the split between practices and systems. Note in particular the presence of both pastoralist and settled farming in the study area.

Table 4 : Production categories for Cattle production in Bama, Burkina Faso

		System		
		Extensive	Semi intensive	Intensive
Practice	Dairy	Pastoral dairy herd		Specialized dairy animals
	Fattening	Pastoral transhumant herds (LT + ST)	Fattening animals	
	Rearing		Draft animals	

Based on a literature review on livestock productivity and breeds in Burkina Faso, the vignettes were developed in relation to each of the production categories. Each vignette represents a credible combination of feed basket[4] and animal productivity for each animal category. Parameters defining the feed basket required to support a particular combination of meat and milk yield have been derived from the literature and reviewed by a feed and fodder expert. These define vignettes that are credible and based on nutrition available in Bama. Table 5 sets out a total of 13 vignettes; each of these was pre-programmed into CLEANED to allow them to be rapidly accessed during the workshop.

The baseline or current state number of animals in each production category have been defined for Bama as set out in aThe current **version of each production category is comprised of five vignettes; there are a further one or two alternative futures for each category (eight vignettes). Total = 13 vignettes.**

Table 6, along with the number of animals represented by each brick used in the Transformation Game.[5]

2 Rearing is the practice of raising an animal from birth, so all livestock keepers do this. Fattening and Dairy are specialised activities, additional to raising, practiced by a portion of livestock keepers. Fattening is the process of buying adult cattle (often weak or undernourished) and feeding them intensively for a few months to improve their condition, before selling them for a better price. Dairy is the management of the female cows with the objective of selling the milk, which requires a better nutrition strategy to increase milk yields.

3 The long transhumance (LT) refers to animals migrating between Mali and Cote d'Ivoire and Ghana, sometimes over many years, whereas the short transhumance (ST) is more local, in this case only travelling within Bama, the southern portion of Padema and the fringes of neighbouring communes, over the course of the dry season.

4 A 'feed basket' is the type and proportion of feeds used (e.g. 40% grass, 40% crop residues, 5% maize bran etc.)

5 The French for 'herd' is 'troupeaux', however in Burkina Faso there are nuances to the meaning of 'troupeaux', particularly for the pastoralists. While it can mean any group of animals the pastoralists preferentially use it to refer to herds that are more than 70 head.

Table 5 : Vignettes and their descriptions.[a]

	Code	Description
Transhumant herds (A)	ABR: Baseline (current state)	Current way of keeping pastoral non-dairy animals relying mainly on grass and crop residues
	A1: somewhat improved	Pastoral animals get little supplements (oil seed cake and bran) during the dry season
Pastoral dairy herds (L)	LBR: Baseline (current state)	Current way of keeping pastoral dairy animals relying mainly on grass and crop residues
	L1: somewhat improved	Dairy pastoral animals get little supplements (oil seed cake and bran) during the dry season
	L2: much improved	Dairy pastoral animals get fed the optimum amount of supplements (oil seed cake and bran in both seasons
Specialized dairy (improved breeds) (D)	DBR: Baseline (current state)	Current specialized dairy production with improved breed and little supplements (bran and oil seed cake)
	D1: somewhat improved	Specialized dairy production with improved breed and some supplements (bran and oil seed cake) and little use of planted fodder
	D2: much improved	Specialized dairy production with improved breed and optimum supplements (bran and oil seed cake) in combination of planted fodder (no crop residues)
Fattening animals (Fa)	FBR: Baseline (current state)	Current fattening with little use of supplements (bran and oil seed cake)
	F1: somewhat improved	Fattening with medium use of supplements (bran and oil seed cake) more relying on crop residues than grass
	F2: much improved	Fattening with important use of supplements (bran and oil seed cake) more relying on crop resides and planted fodder
Draft animals (Tr)	TBR: Baseline (current state)	Current draft animal keeping relying on grass and crop residue only
	T1: somewhat improved	Draft animal keeping with supplements (bran and oil seed cake) during the wet season

[a]The current version of each production category is comprised of five vignettes; there are a further one or two alternative futures for each category (eight vignettes). Total = 13 vignettes.

Table 6 : Number of animals in the baseline scenario in Bama, Burkina Faso

Category	Baseline CLEANED	Bricks	Single Brick value
Long transhumance herds ('troupeaux')	100 herds LT	10	10 troupeaux[a]
Short transhumance herds ('troupeaux')	238 herds ST	24	10 troupeaux[a]
Pastoral dairy herds ('troupeaux')	200 herds	20	10 troupeaux [b]
Specialized dairy animals	1'400	14	100 animals
Fattening animals	55'000	55	1000 animals
Draft animals	22'500	23	1000 animals
Total animals	123'460		

[a] 120 animals per troupeaux
[b] 20 animals per troupeaux

These vignettes and numbers of animals initialise the Transformation Game on the game board. Important elements of the game board are (Figure 5):

A: the name of each production category – translated into the appropriate language

B: two rows of spaces to place vignettes – the starting situation (B1) and the scenario to be designed (B2)

C: a definition of what 1 brick represents – how many animals or troupeaux (C1) – leading to a corresponding number of bricks in the current scenario (C2).

During the game, vignettes are laid in the squares (along the row B2) and bricks piled on each vignette commensurate with the number of animals to be represented.

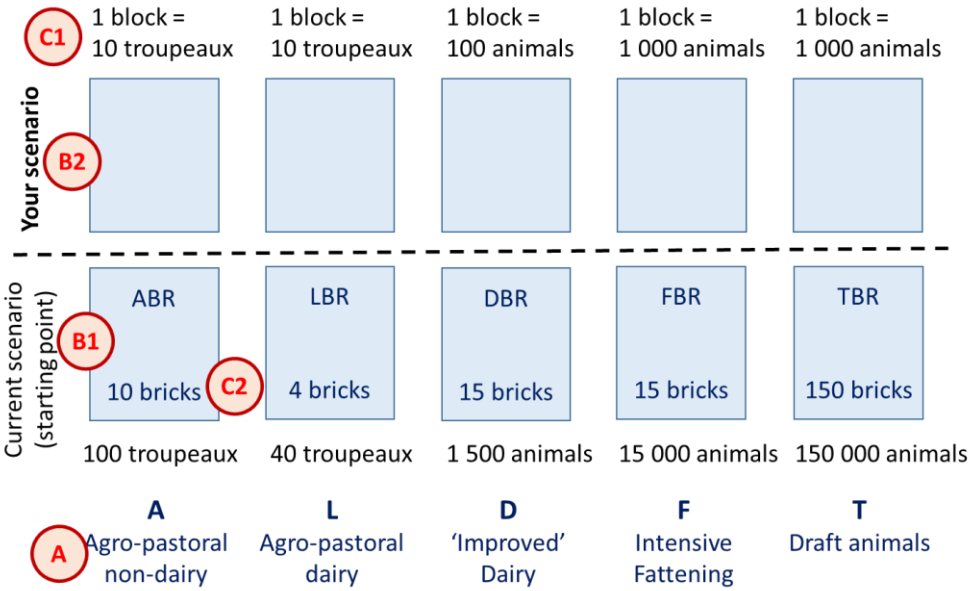

Figure 5 : Game board for selecting vignettes to build a scenario

2.3 Workshop structure

The two day workshop reviews and expands on the findings from Workshop 1, culminating in the participants playing and reflecting on the Transformation Game. The key stages in the workshop are set out below.

2.3.1 Refining the socio-economic performance indicators

Workshop 1 defined and ranked socio-economic indicators for each stakeholder group. Workshop 2 commences with an opportunity to review and refine these indicators (to avoid ambiguity, where similar indicators had a different meaning for different groups, and to ensure each indicator is specific and measurable, allowing for progress to be assessed). In the second workshop session, combined indicators, representing the views of the entire workshop participant group, are discussed.

Refining indicators by group (Day 1, morning)

> **Expected output:** For each homogeneous stakeholder group, a maximum of 5 ranked, specific, measurable indicators including narrative description of low, medium and high progress in the case-study context.

The facilitator presented the 5 top indicators agreed in Workshop 1 to check that everyone still agreed with those indicators, and to introduce the indicators to any newcomers who were not at WS1. The facilitator then led the group in a process of refining each indicator, using a reporting sheet to structure the discussion (Figure 6). The objective was to reach a description that was as specific as possible, with thresholds defined for what constitutes low, medium and high progress towards the overall goal. For qualitative indicators, the groups gave a narrative description of what low, medium and high progress look like.

The indicators were expressed at the level of the commune, not in terms of individuals. Each group was provided with an opportunity to present their detailed indicators to the plenary.

Indicator:		
Description:		
Low:	Medium:	High:

Figure 6 : Reporting sheet for defining Socio-Economic indicators

Combined indicators (Day 1, afternoon)

> **Expected output:** Maximum 5 Key Performance Indicators, agreed by all stakeholder groups as the shared priorities for the workshop. Increase in understanding between those in different stakeholder groups of the differences in socio-economic priorities.

The research team reviewed the detailed indicators and proposed common themes to the plenary. Each group was then provided with time to reflect on the proposal and provide feedback to the questions: Could the group live with the indicator list, even if it is not perfect? If yes, identify one or (max) two key changes that would improve the list. If no, identify key changes that would enable them to live with the indicator list, even if not ideal. From this, the research team developed a final list of indicators for use in the Transformation Game.[6]

2.3.2 Designing and refining scenarios of future livestock production

The second part of the workshop comprised two stages. The first stage, on Day 1, introduced participants to the Transformation Game (the vignettes and the game board) as a way to think about how livestock production in Bama might look in the future – and in terms of how to design a scenario. In their homogenous stakeholder groups, they then discussed and designed an initial scenario from their group's perspective. This was used to inform the starting scenarios for Day 2. In the second stage (Day 2), the

6 The intention had been for this then to initiate several rounds of group discussion and feedback to plenary, allowing gradual refinement of the combined indicators. However, time constraints prevented more than one round of discussion.

CLEANED environmental impact assessment tool was introduced, before splitting participants into two new groups, now with a mix of stakeholders, to evaluate the scenarios using the CLEANED results and the socio-economic indicators. Each group started the Transformation Game with a different initial scenario. The workshop closed with a reflection in each of the two groups about what they liked about the final scenario that they had developed; what challenges they faced in arriving at it; and what they learnt in the process.

Initial scenarios in homogeneous stakeholder groups (Day 1, afternoon)

> **Expected output:** Stakeholders introduced to CLEANED production categories, vignettes and scenarios. Appreciation of how scenarios translate into socio-economic impacts. Development of shared scenario to satisfy economic indicators. Shared understandings developed between stakeholders from different groups.

This session began with introducing the five production categories, explaining these as the research team's interpretation of how participants described livestock management in Bama in Workshop 1. Then, the vignettes were introduced as our interpretation of how the participants see those livestock keeping categories changing in the future – the pathways of transformation. The participants were then introduced to and played the Transformation Game to produce an initial scenario.

Common scenarios in mixed groups (Day 2, morning and afternoon)

> **Expected output:** Each mixed group arrives at their preferred scenario through exploration of trade-offs between environmental and socio-economic impacts – by playing several rounds of the Transformation Game.

Following an introduction to CLEANED, the two mixed stakeholder groups played the Transformation Game. Each group started from a different initial scenario, produced overnight by the research team based on the outputs from Day 1. Two clear trends were observed in the scenarios developed on Day 1: these trends were used as the starting points for Day 2. Facilitation was required to ensure representation and voice for all stakeholders in the mixed group, such that all stakeholders were able to express themselves. The participants first discussed the initial scenario giving their subjective evaluation of the CLEANED environmental impacts, using their knowledge of the local area (for example, thinking of what the impact means in terms of availability and access of resources, and competing users). These discussions were captured in the score card. The participants then evaluated the socio-economic indicators, considering the cost and benefits and their distribution in terms of who the winners and the losers might be. The participants scored the scenario against each of the socio-economic indicators, as low, medium and high.

3 Workshop results

3.1 Socio-economic performance indicators

Each stakeholder group was asked to revisit the socio-economic indicators which they had co-defined in their groups in Workshop 1, which had been developed from the group's "Narrative of success" focused on a day in the life of a fictitious individual ten years in the future (Table 7). These indicators were refined during the opening session of Workshop 2, to make them more specific and measurable, such that they could measure progress towards the achievement of the successful futures envisioned during Workshop 1. Details of the refined group indicators, and the discussion that underpinned their refinement, are provided in Appendix C.

Combined indicators[7] that would represent all participants were developed in a two-step process: first, drawing together similar indicators from the different stakeholder groups and identifying an average or dominant trend in the low/medium/high targets[8]. It was important that, as far as possible, (a) the particular

7 The combined indicators are equivalent to the Key Performance Indicators (KPI) anticipated in the project design. They are evaluated in terms of the scenarios developed for Burkina Faso during the Transformation Game; the Game is a process of evaluating the indicators under emerging scenarios.

8 Time constraints meant that the clustering was undertaken by the project team, with time allowing for only one round of reaction and feedback with the participants. The combined indicators should thus be considered provisional, and ideally would be confirmed by further consultation with the stakeholders, including negotiation over the final meaning associated with indicators that have been clustered due to their similarity.

views of a group were not subsumed within a cluster (i.e., being sure to emphasise subtler differences within each cluster), and (b) that those groups with 'outlier' views (e.g., in a cluster of one) were not ignored or undervalued.

Table 7 : Individual group co-defined indicators, in order of priority

Other farmers	Transhumants	Processors	Government representatives
He reduced the size of his herd from 100 to 50	Pilgrimage to Mecca	Serenity / Having peace of mind	Production of the farm (amount and quality)
He succeeded in intensifying his livestock keeping	Construction of a permanent house	Acquiring a house	The farm
He became rich	Possession of at least 2 troupeaux	Acquiring means of work (processing equipment)	The animals (number and type)
He founded a large family	Coming to the aid of loved ones	Acquiring a means of transport (motorcycle or car)	The farm equipment (biogas digester, housing etc.)
Awa is well-loved and listened to by her husband	Eating tô (staple starch) from millet with milk (every day)	Education of ones children	External investment

Second, this initial set of combined indicators was refined following feedback from each stakeholder group. Feedback was invited per stakeholder group to ensure that each group's consideration of the combined indicators was undertaken with the support of their facilitator, enabling each group to voice its concerns/satisfaction at this stage in a coherent and representative manner. A plenary feedback session may not have achieved this. Once agreed upon, the combined indicators were used in the rest of the workshop to assess the socio-economic impact of different scenarios. The following provides the detail for each finalised combined indicator, along with a summary of the stakeholder group priorities from which it was derived.

Improved infrastructure, processing services, selection and breeds

Description	Progress towards achieving success	
Farmers and value-chain processors have access to and are able to use improved infrastructure, input and processing services, selection and breeds. For example, improved cattle will enable the farm to produce 100l milk/day. *For those who choose to improve*, troupeaux size will reduce to around 50 cattle in well managed herds with carefully selected or improved animals, and will have a barn, water from a pump or borehole and access to vet services.	**Low**:	0-35%
	Medium:	35-65%
	High:	65-100%

This indicator collates the priorities expressed by Government Representatives (the production, animals and equipment on the farm: indicators 1, 3 and 4); 'Other farmers' (the reduction in herd size from 100 to 50, and successful intensification: indicators 1 and 2); and Processors (acquiring equipment and transport: indicators 3 & 4).

Generous and able to offer help

Description	Progress towards achieving success	
Everyone in the zone has the means and desire to be generous and able to offer help to others. This will mean different things to different stakeholders, but the emphasis is on supporting your family and neighbours.	**Low**:	0-30%
	Medium:	30-50%
	High:	50-100%

This indicator collates the priorities expressed by Pastoralists (coming to the aid of friends and family: indicator 4); 'Other farmers' (being generous, as a quality of becoming rich: indicator 3).

Children go to school and no child goes hungry

Description	Progress towards achieving success	
All children in the zone are well educated and no child goes hungry. Some will continue their education through to university level.	**Low**:	0-40%
	Medium:	40-70%
	High:	70-100%

This indicator collates the priorities expressed by Processors (serenity and peace of mind, represented by children being in school and not hungry and educating ones children to university level: indicators 1 and 5); 'Other farmers' (educating ones children, as a quality of becoming rich: indicator 3).

Land rights and housing

Description	Progress towards achieving success	
Land rights secure the area for farming and housing. Houses are permanent and are well built and well equipped (this may mean different things to different stakeholders).	**Low**:	0-20%
	Medium:	20-40%
	High:	50-100%

This indicator collates the priorities expressed by Government representatives (the farm being secured with documentation: indicator 2); Processors (acquiring a house that is secured with documentation: indicator 2): 'Other farmers' (constructed a multi-storey house (to rent out), as a property of becoming rich: indicator 3).

Diversification of livelihoods

Description	Progress towards achieving success	
Farmers have other enterprises or businesses that they invest in and that employ labour. Farmers aim to invest an average of 20% of their annual revenue in these businesses, but only a maximum of 30% will be able to do this each year.	**Low**:	0-45%
	Medium:	45-67%
	High:	68-100%

This indicator[9] collates the priorities expressed by 'Other farmers' (possessing other businesses and employing labour, as a property of becoming rich: indicator 3); Government representatives (having external investments: indicator 5).

Two "troupeaux" at any one time

Description	Progress towards achieving success	
For those with transhumance livelihoods, having two troupeaux at any one time with approximately 70 animals per troupeaux. This provides enough animals to enable valued activities to be achieved, for example, one trip to Mecca and the ability to build a house.	**Low**:	0-20%
	Medium:	20-45%
	High:	45-60%

9 The research team interprets diversification to include expanding a business activities by adding new activities to the existing enterprise. The intention is that farmers' current business activities would provide enough excess to allow them to use, on average, 20% of their annual income for investing in expansion of their business activities.

This indicator collates the priorities expressed by Pastoralists (being or providing the means for 4 of their 5 indicators: indicators 1, 2, 3 and 5). This indicator was included even though it is not a priority for any groups other than the pastoralists, as it has over-riding significance for the achievement of pastoralist interests. Making the Pilgrimage to Mecca, building houses, and eating *tô* from millet all require money, which for pastoralists comes from selling their cows. They estimate that if they have 2 troupeaux this would maintain enough cows to provide the money they need to achieve the other goals. Therefore, this indicator provides the foundation for the other indicators, which are the actual priorities for the pastoralists. Often the pastoralist participants mentioned that money is not important to them – but having cattle is very important, in part as it is the means through which they are able to achieve their goals.

3.1.1 Group reactions and discussion of indicators

The six indicators above incorporate minor changes made following feedback from each stakeholder group. The immediate reaction to the proposed indicators was that each stakeholder group was able to readily accept the first five indicators, with only minor refinements suggested. However, the final indicator (having two troupeaux at any one time) sparked fierce and polarised reactions. The pastoralists (from whom it originated) underlined that it is a minimum to have two troupeaux, but they would like to have more than two. By contrast, all other groups stated that this was the only indicator with which they did not agree and would want to discard. The feeling of the dissenting groups was that it would not be possible to achieve progress against this indicator because there would not be enough grazing land available. The following provides an outline of the perspectives aired in the meeting:

- The government representatives group suggested that this indicator makes no sense.
  - One member was against this indicator, because for him transhumance does not have a place in intensification. He suggested that in view of the problems of grazing, water and crop-livestock conflicts, and with between 50-60 animals per troupeaux, he questioned how they would organise themselves to avoid conflict. For that reason, everyone should move towards intensification. He would agree with the indicator if it was only one troupeaux per livestock keeper – to which others in the group agreed.
  - Another member of the group pointed out that in the villages it is seen as prestigious to have many animals, and so one cannot prevent them from having many animals.
  - A third pointed out that having two troupeaux is a risk management strategy, so that in case of disease the animals are not lost.
  - The final point raised was that crop farmers would never accept two troupeaux per livestock keeper, and if this is a global vision of the future, one should also take the crop farmers into account.
- The 'other farmers' would discard this indicator because it contradicts their first indicator (in which they agreed that it is necessary to reduce the number of animals per troupeaux).[10]
- The processor group rejected this indicator because they believe there is already insufficient space in Bama commune and surrounding area for cropping, livestock grazing and expanding settlements, and they estimate that having two troupeaux of 70 head each would exacerbate the difficulties linked to insufficient space.

These perspectives reflect an underlying conflict between the widespread view that settled farming is the only socially, economically and environmentally sustainable approach to the future of livestock in Burkina Faso, and those (predominantly within the pastoralist community) who want to protect and consolidate livelihoods that are based around transhumance. This conflict had been sharply defined in the first workshop. Here, the pastoralist indicator was ultimately retained due to its fundamental importance to the group, but also in the knowledge that it would surface these tensions in the facilitated mixed groups, thereby exposing the underlying assumptions to scrutiny in a process that involves both sides to the conflict.

Methodologically, securing feedback from each group ensured the pastoralist voice was heard at this stage (despite being a minority view) and enabled a structured discussion (group by group) rather than a potentially more explosive plenary debate. The decision to retain the pastoralist indicator, while ultimately

10 The shared first indicator – rather than that defined by the farmer group alone – defines a reduction in animal numbers for those choosing to improve, so is not inconsistent with the two troupeaux indicator. This exchange is illustrative of a broader antithesis to the interests of the pastoralists in evidence during the early exchanges.

taken by the research team as arbiters of the discussion, was explained in terms of the equity considerations and – to a varying degree – accepted by all participants.

3.2 Stakeholder group scenarios

The combined socio-economic performance indicators were used by each stakeholder group as a basis for a desirable future livestock scenario – that is, one in which the group believes significant progress will be against each socio-economic indicator. The scenarios discussed and agreed by each stakeholder group are listed in Table 8. This details, for each stakeholder group, the vignettes chosen and the number of animals per vignette.

Table 8 reveals two broad storylines for how to increase meat and milk production – one that moves toward intensification with improved livestock management to increase output (represented by a shift to the most improved vignette in each production category), and one that increases animal numbers to increase output (favoured by the pastoralists, with improvement in specialist dairy and draft animals only). Each group that supported the former approach (i.e. other than the pastoralists) expressed an interest in maximising production of meat and milk as a means to satisfying their socio-economic interests (although this was not considered in detail or indicator-by-indicator at this stage, but rather was expressed at the level of a guiding assumption). Key points from the discussions in each group are captured in the sections that follow Table 8.

Pastoralists (Blue group)

The group felt that - given the West African regional policy - there is strong support for the transhumant system, reflected for example through the implementation of protection for transhumance routes, the construction of a market place, and provision of boreholes along the transhumance routes. Therefore, the group felt that the practice will not change but, rather, the numbers of transhumance animals will increase. Also, the pastoral dairy will increase. The feed basket will remain the same because it is very difficult for pastoralists to access agro-industrial by-products (ABR & LBR). The group also decided that specialized dairy will increase while improving the feed basket (D1). For fattening, the participants were convinced that the practices will not change, yet more people will keep animals for fattening (FBR). Draft animals will remain the same number but, because farmers will understand their value, they will improve the feed (T1).

Other farmers (Green group)

This was a diverse group where finding consensus was difficult. For the pastoral dairy, the discussion focussed on the availability of pastures, which led to very different opinions. One participant was in favour of 200 herds; this individual had a pastoralist background and had elected to be in the 'other farmer' group - yet evidently wished to keep traditional transhumant culture. The choice of the vignette L2 (most intensified agro-pastoral dairy vignette, relying heavily on concentrates and planted fodder) was contested on the basis that there are already problems with accessing agro-industrial by-products such as cotton-seed cake, prior to any further increase in demand. For improved specialist dairy, the group discussed the current program for improved dairy breeds that is targeting 3000 dairy cows. The group agreed that more improved animals are needed. The number of fattening animals was to increase and be kept much more intensively, relying heavily on concentrates and planted fodder (vignette F2). Draft animals will remain, because participants do not believe that mechanization will displace all draft animals in 10 years.

Table 8 : Scenarios agreed in stakeholder groups

Category (unit of animals)	Other farmers (Green group)		Processors (Yellow group)		Government representatives (Orange group)		Pastoralists (Blue group)		Baseline (representation of present day)	
	Vignettes chosen	Number	Vignettes chosen	Number	Vignettes chosen	Number	Vignettes chosen	Number	Vignettes chosen	Number
A Transhumant herds* (troupeaux)	A1	50 LT 78 ST	A1	50 LT 100 ST	A1	230 unsplit	ABR	200 LT 300 ST	ABR	100 LT 238 ST
L Dairy herd* (troupeaux)	L2	50-200	L2	100	L2	150	LBR	300	LBR	200
D Specialized dairy (animals)	D2	2'800	D2	1'400	D2	1'800	D1	2'400	DBR	1'400
F Fattening animals (animals)	F2	65'000	F2	110'000	F2	83'000	FBR	110'000	FBR	55'000
T Draft animal (animals)	T1	23'000	T1	12'000	T1	13'000	T1	23'000	TBR	22'500
Total animals		107'160 – 110'160		143'400		128'000		201'400		123'460

* troupeaux = 120 animals in A, and 20 in L; LT = Long transhumance between Mali and Ghana; ST = Small transhumance in Bama, Padema and the edges of neighbouring communes

Meat and milk processors (Yellow group)

For the pastoral transhumant system, the group agreed to intensify to A1 and reduce slightly the number of herds. They believe that there will not be sufficient pastures or crop residue for those livestock keepers who do not own land; the need for transhumance corridors was recognised in the discussion. For the pastoralists' dairy animals, production will be intensified to L2 and the numbers of herds will be reduced because there will not be sufficient pastures. Yet the improvement in the feed through adding agro-industrial by-products was anticipated to increase the amount of milk produced. For the specialized dairy animals, the group decided to keep the same number of animals because there is not sufficient space (for the animals, for feed production and for grazing) for an increase in animal numbers, not least due to increasing land given over to crop production. Yet this improved production (L2) is anticipated to produce a lot more milk and therefore easily pay for the required feed (agro-industrial by-products). The group decided to double the fattening animals and produce in F2, to enable the production of much more meat. However, some in the group would have preferred to choose F1, because it was not obvious that they would get enough income from F2 to justify giving the large amount of concentrates required by F2. It was decided that draft would get improved feed but be reduced in number, as tractors will take over ploughing.

Ministry representatives and district administration (Orange group)

The governmental representatives group decided that in future all animals will be fed better than today, including in the pastoral system (where the A1 vignette was chosen). Also, the trend towards less herds will continue and therefore the number of animals in the pastoral transhumance system was reduced. The same logic was applied to the pastoralist dairy herd which was allocated reduced numbers - but with the more intensive livestock management approach described by L2. This decision was taken after some debate as it is expected to provide benefits to livestock keepers the whole year round. While L1 was discussed, it was anticipated that the benefits would not be high enough to purchase the feed (agro-industrial by-products), and therefore not everyone will have access to them. There was also debate about how many animals the region can support. The initial proposal was to reduce the pastoralist animals by 50%; after discussions it was agreed that given the improvements in the feed basket, there will be option to keep 150 herds (75% of the baseline or current number of animals). For the specialized dairy the group decided to produce following D2, the high productive well-fed cows, and to continue the trend of intensification by increasing the number of animals by 30%. It is assumed that tractors will be used in the production of forage. There was unanimous agreement that meat production will become more important, therefore there will be 50% more fattening animals, and all produced in the most improved F2 approach. Draft animal will get better feed, because the farmer understands their value, and can make more money if they keep them well. Yet, thanks to mechanization the draft animal numbers will be reduced by half.

3.3 Towards a shared vision: mixed stakeholder group scenarios

The two patterns identified in the scenarios developed by the stakeholder groups were used to initialize the Transformation Game at the start of Day 2, with participants split into two mixed stakeholder groups. Each group contained an equal number of participants from each stakeholder group (or as near as was practical).

This is a significant change in workshop dynamics: up to this point, stakeholders had worked together to develop their understanding of their particular needs and interests. The moving to mixed groups ensured that there were least two representatives from each stakeholder group in discussions that were facilitated to build understanding between stakeholders, through the activity of playing the game and negotiating game strategies. Note that steps had been taken throughout the workshop up to this point to start building towards shared understanding, principally through sharing and discussing group interests in plenary sessions.

Group A was provided with a scenario focused on intensification, derived from an average of the livestock numbers found in the 'other farmers', processors and governmental representatives groups. Group B was initialised using the pastoralist scenario. The details are provided in Table 9.

Table 9 : Initial and negotiated vignettes and livestock numbers of the scenarios

	Scenario A				Scenario B				Baseline	
	Initial		Final Negotiated		Initial		Final Negotiated			
	Vignettes chosen	Number	Vignettes chosen	Number	Vignettes chosen	Number	Vignettes chosen	Number	Vignettes chosen	Number
A Transhumant herds* (troupeaux)	A1	85 LT 135 ST	A1	130 LT 310 ST	ABR	200 LT 300 ST	ABR	200 LT 300 ST	ABR	100 LT 238 ST
L Dairy herd* (troupeaux)	L2	125	L2	260	LBR	300	L1	300	LBR	200
D Specialized dairy (animals)	D2	1'600	D2	1'750	D1	2'400	D2	1'400	DBR	1'400
F Fattening animals (animals)	F2	70'000	F2	70'000	FBR	110'000	F1	110'000	FBR	55'000
T Draft animal (animals)	T1	12500	T1	12'500	T1	23'000	T1	17'000	TBR	22'500
Total		113'000		142'250		201'400		194'400		123'460

* troupeaux = 120 animals in A and 20 animals each in L; LT = Long transhumance between Mali and Ghana; ST = Small transhumance in Bama, Padema and the edges of neighbouring communes

Scenario A is characterized by improved livestock management in all categories. There is a slight increase in the numbers of animals in the specialized dairy and fattening compared to the baseline. In all other categories the number of animals are reduced compared to the baseline, meaning that overall there are less animals in the landscape – a strategy built on an assumption of achieving reduced environmental impact and increased productivity through improved herd management. Scenario B is characterized by doubling almost all animals (except for draft animals), and continuing to use current livestock management for the most part. Only specialized dairy and draft animals, that are not part of the pastoralist system, have a slight improvement in livestock management (D1 and T1). In this scenario, the focus is on pastoralist livelihoods and lifestyles, and an assumption that an increase in production, and therefore provision of a better livelihood[11], can best be achieved through increasing livestock numbers.

3.3.1 Group A (Starting scenario: improved management/ reduced animal numbers)

The productivity score card for the initial scenario

Table 10 shows the initial productivity score card for Scenario A. The scenario leads to only a slight increase in meat production (10%) and a 20% *decrease* in the milk production, despite a 40% increase in fattening animals and 14% increase in specialised dairy animals. This low production is a result of the significant decrease in numbers of pastoralist animals. The scenario has overall fewer animals, which are fed on concentrates (agro-industrial by-products), with the consequence that the land required for livestock feed and fodder will reduce by 10% in terms of area used for both crops and for grazing. In each case, the change is 'low' relative to the range of possible impacts for the study area.

Table 10 : The Productivity score card for Group A - initial scenario

	Scenario A	
	% change	score
Meat produced (tons)	+ 10	Low
Milk produced (tons)	- 20	Low
Cropland used (ha)	- 10	Low
Grazing land used (ha)	- 10	Low
Rice area used (ha)	0	Low

The environmental score card for the initial scenario

Table 11 shows the environmental impact from scenario A, in which less water is used, less greenhouse gases are emitted, and the impact per animal is reduced. However, the nitrogen balance also decreases (a negative impact where more nitrogen is being removed from the soil than is being replenished). This negative change is driven by the loss of manure returned to the soil from the decrease in number of grazing animals. In each case, the change is 'low' relative to the range of possible impacts for the study area.

11 One participant explained how pastoralists "do not have money, they have 'richesse' (wealth) which lasts longer than money; money is here today, gone tomorrow but their wealth (the cows) continues".

Table 11 : The Environmental score card for Group A - initial scenario

		Scenario A	
Other indicators		% change	Score
Water	Total	- 10	Low
	Per animal	- 1.2	Low
Greenhouse gases	Total	- 8.6	Low
	Per animal	- 0.4	Low
Nitrogen		- 7	Low

Group discussion about the initial scenario

The group were at first very confused about how these results were produced, and questioned the reliability of the CLEANED model, as they expected that there should be an increase in production both in meat and milk. The participants agreed that a 10 % increase in meat production is a low increase and a reduction of milk produced is not acceptable because there would not be a sufficient change in income to provide for their children. Overall, there was discontent about the productivity, but a neutral feeling about the environmental indicators. There was a short discussion about the water use per cow in improved breeds, questioning why this should reduce. Facilitators explained that improved breeds produce more milk but eat and drink less than local breeds would for the same amount of milk – and that CLEANED shows the implication of replacing local breeds with improved breeds.

The reduced land required by the initial scenario confirmed to the group that 'better' farming methods and improved crop varieties require less land. There was discussion about improved breeds requiring lots of resources, such as more and better feeding and health care (raised by a pastoralist as a constraint). A response was that if you manage the feeding well, if you feed them properly at the end of the harvest then the feed requirements reduce after a while.

In terms of socio-economics, the general feeling was that no progress would be made towards any of the indicators, because the meat and milk production was essentially no different than today, or even worse (Table 12). After initially working in detail through the indicators, the group realised that 'no progress' would apply to all, and that they should move on to discussing a new scenario.

Table 12 : Socio-economic indicator scores for Group A – initial scenario

Scenario A	What are the benefits ?	What are the costs	Who benefits	Score
Improved breeds, infrastructures and services	- the milk will be available the whole year round and not just in the rainy season like right now - the access to the milk will be easy - with the milk income one can buy agro-industrial products - there will be more security for the livestock by keeping them at home (less thefts and death than on transhumance)	- one needs to buy feed the whole year round - one needs to have access to water the whole year round - one needs to grow fodder on cropland	The pastoralists are unhappy as there is neither an increase in milk nor livestock numbers	Low
To be generous and helpful	Given the low meat and milk production gain, there is no gain for this indictor.			Low or not at all
Children go to school without hunger	Some children will go to school but will not reach a high level of education			Low or not at all
Land rights are well defined				Low or not at all
Incomes are diversified				Low or not at all
Pastoralist households own two troupeaux at any time				Low or not at all

Negotiated scenario

In light of shared discontent with the starting scenario, the facilitators proposed a revised scenario that would increase the number of animals. This would aim to serve two purposes – remedy the low productivity, which was assumed to be a result of too drastic a reduction in animals in the starting scenario, and to make some progress towards the indicator of 2 troupeaux, which was excessively penalised in the starting scenario. The agreed revised scenario is presented in Table 13, notably increasing pastoral animals (categories A and L) by 30% from the baseline (the starting scenario imposed a 50% decrease from baseline) and a 25% increase from the baseline of specialised dairy numbers (starting scenario provided a 14% increase). One member wanted to raise the recurring debate about the appropriateness of allowing pastoralists to own 2 troupeaux, but the facilitators highlighted that the intention of the CLEANED tool is to see what impact it would have. It was agreed to suspend the debate until after running the CLEANED tool.

Table 13 : Negotiated scenario for Group A

	Scenario A2			
	Negotiated scenario		Difference vs initial scenario	
	Vignettes	Number	Vignettes	Number
A Transhumant herds* (troupeaux)	A1	130 LT 310 ST	no change	+ 45 LT + 175 ST
L Dairy herd* (troupeaux)	L2	260	no change	+ 135
D Specialized dairy (animals)	D2	1'750	no change	+ 150
F Fattening animals (animals)	F2	70'000	no change	no change
T Draft animal (animals)	T1	12'500	no change	no change

* troupeaux = 120 animals in A and 20 animals each in L; LT = Long transhumance between Mali and Ghana; ST = Small transhumance in Bama, Padema and the edges of neighbouring communes

The results are presented in Table 14 (productivity) and Table 15 (environment). Overall, the results show an increased environmental impact in order to produce more. The scenario relies on more improved breeds, therefore the greenhouse gases per animals are reduced even in an increased meat and milk production scenario. This impact is felt less on water as improved breeds rely more on planted fodder which is more water intensive.

Table 14 : The Productivity score card for Group A - negotiated scenario

	Scenario A2	
	% change	score
Meat produced (tons)	+ 28	High
Milk produced (tons)	+ 28	Low
Cropland used (ha)	+ 12	High
Grazing land used (ha)	+ 17	High
Rice area used (ha)	+ 13	High

Table 15 : The Environmental score card for Group A - negotiated scenario

		Scenario A2	
Other indicators		% change	Score
Water	Total	+14.1	High
	Per animal	- 0.3	Low
Greenhouse gases	Total	+12	High
	Per animal	-2.3	Low
Nitrogen		+ 31.5	Low

Group discussion about the negotiated scenario

The group was happy with the new scenario as the meat and milk production was increased and income should consequently be increased. However, a few members, including one producer, had strong concerns about the increased number of animals in this scenario, saying that there would not be enough grazing land for them. Already today, there are daily conflicts between pastoralists and farmers, and that crossing Bama with lots of animals is already problematic, so increasing the numbers of animals would just create more problems. Although the CLEANED model predicts that this scenario only requires 60% of the available grazing land, and therefore that currently only 50% of grazing land is used, the concerns raised suggest that in reality the 50% 'available' grazing land is not evident and access to grazing land is problematic. The increased number of animals and consequent increased requirement for grazing land also raised the concern that after finishing the crop residues, animals would go into national parks and threaten endangered plant species. Both of these concerns were resolved through agreement that better land and resource management would be necessary if the group were to sanction the increase in land use, and thereby raise the production potential of the study area.

In terms of environmental impacts, participants found that they are acceptable, except that greenhouse gases should be reduced, for example with the use of bio digesters. There were also concerns among participants that there would at times not be sufficient water under this scenario. Overall, this was felt to be a necessary sacrifice to reach the meat and milk production goal.

With this scenario, mainly based on the 28% increase in production, participants were more or less optimistic about making progress against the socio-economic indicators (Table 16, showing number of people ranking progress as 'Medium' or 'High' in brackets). Land rights were felt to be the easiest to achieve, while there was less agreement about progress toward improved management, and being generous. Some participants considered that a greater increase in production of 50-60% would be required to make 'High' progress. In addition, some argued for a 'Medium' rating for 'being generous' because generosity is not (only) a result of increased income from livestock and will not necessarily increase linearly with increasing income. Due to time limitations, the indicator of diversification of income was only partly discussed and having two troupeaux was not discussed. In general, participants made comments relevant to them for each indicator, which did not necessarily fit or cover the questions used in the score-card to guide the conversation (what are the benefits/ costs, who benefits?).

Table 16 : Socio-economic indicators scoring

Scenario A	What are the benefits?	What are the costs	Who benefits	Score
Improved breeds, infrastructures and services	The income gains from the meat and milk production increase would lead to a good increase in infrastructure and material			Medium (9) – High (5)
To be generous and helpful	As production increases people will have more income and can be more generous; but some participants would only rate it high if there were a 60% increase in production. Also, being generous is also linked with a person's character - not everyone will be generous even if they are rich. Similarly, some felt that the increase in production is not important, as long as one can satisfy the needs of one's family.			Medium (9) – High (4)
Children go to school without hunger	In principle, this should be possible with 28% increase, if one economised. Again, some would prefer to see an increase of 50% in order to rate it high.	Some expressed the fear that constructing a new school will be expensive.		Medium (5) - High (7)
Land rights are well defined	This is possible to achieve, and then allows one to secure their land and build their own farm or enclosure. There is a reinforcing cycle – the increased meat and milk production also means more manure, which will allow producers to improve their crops and increase the production of cash crops, which will allow them to achieve this indicator of securing land, and this situation in turn allows for improvement.			Medium (2) – High (10)
Incomes are diversified	(The comment about the multiple uses of manure would apply here too). A pastoralist proposed that with a secured space, pastoralists can have a field, produce crops and forage, no longer require a cowherd and therefore save the wage money.			
Pastoralist households own two troupeaux at any time	*Not discussed*			

3.3.2 Group B (Starting scenario: little change in livestock management/ increased number of animals)

The productivity score card for the initial scenario

Table 17 shows the productivity score card of the initial scenario. The scenario for Group B, with leads to great increase in production both of meat and milk, but also requires more than 50% more grazing land and cropland and starts to make use of rice residues[12].

12 Very little rice is used in the baseline (0.2ha), so a small increase in rice residues (an additional 0.2ha) translates to a doubling (+100%)

Table 17 : The productivity score card for Group B - initial scenario

	Scenario B	
	% change	score
Meat produced (tons)	+ 83	High
Milk produced (tons)	+ 57	High
Cropland used (ha)	+ 57	High
Grazing land used (ha)	+ 56	High
Rice area used (ha)	+ 100	High

The environmental score card for the initial scenario

Table 18 show the environmental impact from the initial scenario. The scenario is broadly opposite to Group A, as 60% more water is used and greenhouse gases emitted. The water use per animal is slightly reduced, but overwhelmed by the overall increase in the number of animals. The increase in grazing animals provides manure for a much improved nutrient balance, with more nitrogen returning to the soil than would be removed.

Table 18 : The Environmental score card for Group B - initial scenario

		Scenario B	
Other indicators		% change	Score
Water	Total	+ 60	High
	Per animal	- 1.4	Low
Greenhouse gases	Total	+ 61	High
	Per animal	+ 0.2	High
Nitrogen		+ 31	High

Group discussion about the initial scenario

Group B started their discussion happy with the meat and milk production output and, although there is negative impact on water and greenhouse gases, they also noted the positive impact on soil. As the discussion moved on, natural resource use was considered and the participants focused on whether there would be sufficient water. Many felt that there will not be water issues because of the upcoming Samandeni dam and the presence of the river Mouhoun and Kou. However, some governmental representatives warned that if rainfall is not sufficient then the dam would not be filled which will lead to water shortage. Also, pastoralists mentioned that in the planning of the dam did not allow for an access point for the animals to drink. The dam does, however, offer opportunities to plant fodder the whole year round. However, increased pesticide use on farms drains into the dam and leads to water pollution potentially reducing the quality of the water in the dam.

Greenhouse gas emissions stimulated significant discussion, including whether reductions could be achieved with technology. However, much of the discussion followed the familiar faultlines of the conflict between the pastoralists and others. A long discussion emerged on whether livestock keeper's bush fires are contributing to greenhouse gas emission or not. To conclude this debate, the facilitator explained that bush fires were considered neutral in the tool as the growth of the biomass would offset the emissions resulting from the fire. There followed a debate about pastoralists cutting branches off trees to feed their animals, and the suggestion that sometimes this went to the extent of felling the tree, which was seen as endangering forests. The pastoralists answered that the crop farmers readily cut down whole trees to be able to use

tractors in the landscape without penalisation. This concluded with a proposal to grow feed and fodder so that the reliance on trees could be reduced. Pastoralists explained, however, that while they have no problem with feed and fodder being planted, because they are mobile they cannot contribute to the practice.

The group scored this scenario in terms of socio- economic indicators (Table 19). The facilitator introduced a voting with thump up and thump down to score the scenario, which allowed rapid identification of differing opinions in the group. This saved a lot of time at a point in the process when discussions had been moving very slowly, and also helped to keep the group active. However, it did not allow in-depth discussions about cost and benefits. Two areas of discussion did emerge. First, there was an in-depth discussion about the different procedures to secure land both in urban and rural area, some saying it was an easy process to obtain the necessary papers, others maintaining that it was difficult. In terms of diversification of income, it was mentioned that this is difficult for pastoralists as they have hardly any other options and by 2030 they could not have the means to invest in something other than livestock, however, other participants suggested that by 2030 other options will be available. For example, they could sell a few animals in order to invest in other activities.

Table 19 : Socio-economic indicator scores for Group B - initial scenario

Scenario B	Score
Improved breeds, infrastructures and services	Low
To be generous and helpful	Medium
Children go to school without hunger	High
Land rights are well defined	High
Incomes are diversified	Medium to high
Pastoralist household own two herds at any time	High

The pastoralist made a claim for their right to maintain their lifestyle, also mentioning that the draft and fattening animals are often animals that are coming from the pastoral herds. Also, World Bank and other actors are investing heavily in infrastructure for the pastoral system. They came up with a proposal:

1. Fattening animals do not use the pastoral zones and rely on planted fodder that farmers grow
2. Dairy farmers get the improved breeds and feed them mainly on planted fodder and agro-industrial by-products
3. The pastoral zones are left for the pastoralists to feed their animals.

This provided a basis on which the group was able to negotiate.

Negotiated scenarios group B

The group had a major discussion about numbers of animals in the pastoral system, where many participants pushed for a decrease, both in the pastoral transhumant and milk herds. However, pastoralists negotiated to keep their animals. In the end, it was agreed that pastoral areas will have to be managed well including the improvement of grazing land in order to be able to carry the transhumant animals. But in exchange for keeping their numbers, it was agreed to slightly intensify the transhumant dairy, i.e. produce following the vignette L1. L2 was felt to require too much agro-industrial by-products that pastoralists felt are and would be difficult to access. The group agreed to reduce the number of specialized dairy as it would also intensify to D2, despite some participants suggesting that the agreed number (1,400) was too low, as already today there is an artificial insemination program targeting 3000 animals a year. The rational was that the same income can be made from less animals. There was little drive to reduce the fattening animals, but it was agreed to intensify its livestock management. Notably, some mentioned that improved productivity was not per se synonymous with improved income as one would need to buy agro-industrial by products.

The agreed revised scenario is presented in Table 20. Overall, more intensified vignettes have been chosen, except for the agro-pastoral transhumant and draught animals where there is little incentive to provide costly improved feeds as there is no continuous harvest as in dairy and fattening to justify the increased

cost. Only a few animals have been reduced, from specialised dairy (42% cut from the initial scenario, back to the baseline number of animals) and draught animals (25% cut from both initial and baseline).

Table 20 : Negotiated scenario – Group B

	Scenario B2			
	Negotiated scenario		Difference vs. initial scenario	
	Vignettes	Number	Vignettes	Number
A Transhumant herds* (troupeaux)	ABR	200 LT 300 ST	no change	no change no change
L Dairy herd* (troupeaux)	L1	300	LBR --> L1	no change
D Specialized dairy (animals)	D2	1'400	D1 --> D2	- 1000
F Fattening animals (animals)	F1	110'000	FBR --> F1	no change
T Draft animal (animals)	T1	17'000	no change	-5000

* troupeaux = 120 animals in A and 20 animals in L; LT = Long transhumance between Mali and Ghana; ST = Small transhumance in Bama, Padema and the edges of neighbouring communes

The scores of this negotiated scenario are presented in Table 21 for productivity and Table 22 for the environment. Overall, Group B slightly reduced the environmental impacts at the cost of more limited milk production, requiring 6-7% less land, 8% less water and emitting 3.5% less greenhouse gases. Nonetheless, the environmental impact remains significantly higher than the baseline.

In general, participants remained happy with the socio-economic ranking of this scenario (Table 23), particularly that they managed to make more progress to improved livestock management (breeds, infrastructure, services) than in the initial scenario.

Table 21 : The productivity score card for the negotiated scenario group b

	Scenario B2	
	% change	score
Meat produced (tons)	+ 83	High
Milk produced (tons)	+ 31.6	Low
Cropland used (ha)	+ 51	High
Grazing land used (ha)	+ 49	High
Rice area used (ha)	+ 100	High

Table 22 : The Environmental score card for the negotiated scenario group B

		Scenario B2	
Other indicators		% change	Score
Water	Total	+ 52	High
	Per animal	- 1.7	Low
Greenhouse gases	Total	+ 57.5	High
	Per animal	+ 1.5	Low
Nitrogen		+ 27	High

Table 23 : Socio-economic indicator scores for Group B - negotiated scenario

Scenario B	Score
Improved breeds, infrastructures and services	High
To be generous and helpful	Medium
Children go to school without hunger	High
Land rights are well defined	Medium to high
Incomes are diversified	High
Pastoralist household own two herds at any time	Medium

4 Discussion

4.1 Stakeholder groups: shared and contrasting priorities

The progress indicators selected by the 'other farmers' and government representatives groups describe progress towards intensification (greater output achieved through more organised nutrition and herd structure management[13] and the equipment and infrastructure to support it), and what the additional income provided by that progress would be spent on (in less and more detail respectively). Similarly, the processors group focus on improving their practice and access to the necessary equipment to do so. In addition, they define their priorities outside of livestock – to provide well for their family, to bring peace of mind, and to educate their children. The pastoralist group view improvement very differently. They identify priorities for their wellbeing outside of livestock rearing (pilgrimage to Mecca, building a house, aiding family and friends, and eating *tô* from millet), while defining the level of traditional livestock rearing that would supply the resources to achieve those priorities (having at least 2 troupeaux). This difference in perspective was pervasive in discussions throughout the workshop.

The socio-economic priorities of stakeholder groups are centred around what could be framed as "basic needs", for example being able to provide for one's children (education and eradication of hunger), and having services for a good standard of living (e.g. electrification of houses, water supply in houses). The representatives present at the workshop felt that these basic needs had not yet been achieved to a reasonable level. Until they do so, increasing income, which they see as directly related to an increase in meat and milk production, will likely take priority over concern for environmental impacts. This has indeed proved to be the case, as we discuss below. Group B's initial scenario in the second half of the workshop showed that achieving high enough meat and milk production to achieve the socio-economic indicators from a livestock-based livelihood alone will incur environmental impacts that impose constraints that cannot be ignored. This reinforces the importance of an integrated approach to planning livestock development trajectories, which considers both environmental and socio-economic priorities.

When the stakeholder groups moved on to discussion of scenarios, the differing visions of the stakeholder groups became more visible. The 'other farmers' group chose to improve livestock management across all categories, and doubled the number of animals in specialized dairy production. This was informed by an expectation that a government dairy program will be successful. It also reflects the group's ambitious socio-economic narrative, which aims for all livestock farmers to achieve intensification, and the expected prosperity that intensification would bring. In their narrative of success (Workshop 1) this represents a good future for everyone, and thus the group believe this should be the ambition of everyone. As a result, their scenario would see the area specializing in dairy production. A reliance on draft animals suggests that the group do not anticipate the feed and fodder production to be achieved with mechanisation. The processors' group also see improved management across all production categories. This scenario is characterized by

13 Planning, using right food mix to give the right nutrients according to life stage of the cows, and herd management that maintains genetic quality by keeping a selected breeding herd with the best bulls and dairy cows, and managing the time of calving to even out milk supply over the year.

doubling numbers of improved fattening animals while in all other production categories animal numbers were reduced – suggesting an area specialising in meat production. This also reflects, perhaps, the interests of a (male) butcher representative who was particularly dominant in the group.[14] It is notable that the difference between the milk or meat specialisation scenarios goes deeper the adoption of improved animals, implicating, for example, the business models, market relationships and infrastructure required in the area.

The scenario developed by the government representative group shows similar patterns, yet the changes compared to the baseline are less dramatic. This scenario is close to an average of the three non-pastoralist group scenarios, reflecting the group's role that provides them with a view of the different interests across the socio-economic and political landscape. It is also consistent with the rationale behind the thresholds they defined to measure progress in their socio-economic indicators. They would indeed like all livestock keepers to move towards intensification, but (unlike the processors and other famers) acknowledge that not everyone will be intensified by 2030. The pastoralists, however, come to scenario building from a different starting position. Livestock management improvement is only proposed in those categories that are not traditional pastoralist activities, e.g. draft animals and specialised dairy. This seems to demonstrate that this group does not believe in the intensification of their system, and want to keep their traditional extensive lifestyle – a conclusion that is underpinned by the pastoralists' explicit claim that their mobile systems do not allow for any intensification.

The non-pastoralist scenarios were combined for use by Group A in the second part of the workshop. These were recognisable intensification scenarios, where the aim is to increase meat and milk output, and therefore income, by moving to more productive animals with better-managed and higher quality feed baskets. The improved feed and fodder, however, requires accessing expensive agro-industrial by-products (cotton-seed cake, other oil-seed cakes, commercial feed mixes with maize and rice bran etc.), and shifting cropland from cereal, which contributes to food security, to planting fodder which only supports food security indirectly through the production of meat and milk (and does so significantly less efficiently in terms of resource use). A shift towards a market based economic model is implicitly anticipated, where livestock keepers need to sell livestock products, e.g. meat and milk, so that they can buy the feed and fodder, and use surplus income to provide food for their families. Despite this conventional narrative of progress (i.e., reliance on technical improvement and trade-based food security) it is notable that the 'other famers' group were reluctant to reduce the number of draft animals, possibly due to the fact that they do not believe that mechanisation will be significant in the next 10 years. In contrast, the processors and governmental representatives described scenarios that halved the number of draft animals.

The pastoralist scenario was adopted as Scenario B in the second part of the workshop. This scenario represents traditional livestock production based on the current logic of food security for sedentary farmers and risk management through the pastoralist system. To achieve gains in income, they increased the number of animals in the pastoral categories: 100% more long transhumance, 26% more short transhumance, and 50% more pastoralist dairy. In the subsequent negotiated scenario, the pastoralist members managed to maintain these numbers. Overall, this suggests that the pastoralists are not ready to change their lifestyles away from traditional practices and risk management approaches in order to produce in a more commercially-focused manner. Yet, they seem to understand that specialization and intensification is possible in the more sedentary lifestyles, reflected in their selection of more intensive management and reduced animal numbers in the specialized dairy and draft animals categories.

4.2 Mixed groups: starting scenarios matter for learning

Group A started off with a highly intensified scenario, but with 8.5% fewer animals over the landscape than the baseline. The pastoralists in the group were surprised by the reduction in transhumant animals and immediately started proposing changes, before seeing the results of running the scenario. The output of meat and milk is similar to current production: the gains offered by intensification were offset by too large a reduction in animal numbers. In terms of the environment, this scenario was good: all environmental

14 Moreover, is unclear if the processors' scenario is entirely coherent, as nothing has been said about where the source of additional animals for the fattening animals come fromprocess. In the baseline, there is a correlation between the number of transhumant animals and the number of fattening animals, as the fattening animals are bought from the local pastoralist system. Increasing the former fattening animals while decreasing the lattertranshumant animals either means suggests that the group intends the fattening animals to come from elsewhere (perhaps an increase in sedentary farmers rearing cattle for fattening, or from outside Bama), or that the link between the pastoral system and the fattening system was not explicit and discussed.

indicators improved relative to the baseline. Yet all stakeholders were (very) unhappy about the scenario, as it did not offer a promise of a better life in the future. The discussion around environmental impact was brief at this point, with comments only offered about water consumption and land required. The negotiated scenario increased the number of pastoralist animals – remedying the 'mistake' in the initial scenario of over-reducing animal numbers – and, as expected, meat and milk output increased (around 28%). At first the group was very happy with this, but as the discussion about progress towards socio-economic indicators went on, some stakeholders expressed the wish to have even higher increases in meat and milk production (50-60%), to ensure their socio-economic progress. Although the government representative members raised concerns about the 12% increase in environmental impacts associated with the 28% increase in meat and milk production, there was not much group discussion, suggesting that even with the visibility provided by CLEANED, environmental impact takes second priority to income potential for stakeholders in Bama. Facilitation in future workshops may need to take note of this, providing more time and space to work through the wellbeing and livelihood consequences of environmental change.

Group B started off with a scenario that significantly increases the number of animals, and keeps the management of them almost as today. This was a significant disappointment to non-pastoralist group members, who had hoped for improved management across all categories and felt that the number of animals on the game board was too great. All stakeholders, however, were happy with the meat and milk output as it would - in their understanding - bring the financial benefits that they were looking for in the socio-economic indicators. Yet, this scenario comes with quite significant environmental impacts. Stakeholders tried to come up with a common position on whether those impacts are acceptable or not. This led to a detailed discussion about water usage and greenhouse gas emission and, to a lesser extent, soil health. The environmental debate was mainly started with accusations about which stakeholder group uses which resource the most and who pollutes the most. Ultimately, this discussion showed participants that each stakeholder group makes use of natural resources and all groups contribute to the environmental impact. From this acknowledgement, the discussion continued about the carrying capacity of the area. Although there was no agreement on how the different interventions currently in development, such the construction of a large dam, will influence the carrying capacity, every participant in the group learned something from the others about the possible impact that livestock production has on the natural resources, and that these impacts are shared between the stakeholder groups.

These contrasting group experiences suggest that the starting scenario exerts an influence over nature of the group discussion and the potential for learning. In Group B the pastoralist scenario proved to be positive for all stakeholders: in itself a surprise to participants, many of whom came to the workshop with a shared narrative around the unsustainability of pastoralism. Framing – that is, the shared assumptions that shape how actors interpret a situation (Leach et al., 2010) – is significant here. To this point the framing of pastoralism had operated to isolate the pastoralist stakeholders from the wider group. The initial assessment of the Group B starting scenario (which replicated the scenario developed by the pastoralist group) changed this situation, with subsequent debate focused on how to reduce the environmental impacts rather than moving significantly from the pastoralist scenario. This is not to say that there was now wide agreement around responsibility for environmental impact – in fact the opposite was the case. Rather, a shared assessment of the pastoralist scenario had revealed significant potential shared benefits and, ultimately, provided a basis for discussion. The notion that profitable and sustainable livestock futures are incompatible with pastoralist interests – a central tenet of the framing held by the majority of stakeholders – was absent in the negotiated scenario that emerged from Group B. Moreover, the shared desire to find a way to exploit the socio-economic benefits of the starting scenario provided a foundation from which an acknowledgement of mutual responsibility for environmental harm emerged, and learning from each other became possible. In contrast, in Group A, the space for joint learning on the environment was crowded out by the need to focus on fundamental socio-economic considerations. Yet here, too, the conventional framing of pastoralism was ultimately challenged: in this case, as the group recognised the necessity of pastoralist livestock to future prosperity. However, a failure to produce unequivocal socio-economic gains in the revised scenario proved a barrier to meaningful environmental discussion. Not surprisingly, participants prioritised their basic needs.

As this discussion suggests, the group scenarios converged significantly after one round of negotiation in terms of numbers of animals and choice of vignette (Table 26)[15], as did their production and environmental

15 Draft and fattening animals generally are sourced in the long transhumance herds. From the baseline, we know that there is a relationship of roughly 1 fattening animal to at least 5 transhumance animals. This condition is fulfilled in both scenarios.

impact (Table 24 and Table 25). Yet despite the convergence, the scenarios remain different. Group A developed a scenario that has a focus on specialized dairy whereas Group B's negotiated scenario represents a scenario that focuses more on fattening. As shown in Table 24 this is also what the productivity reflects, as Group B's scenario produces much more meat. However, unexpectedly, this scenario also produces more milk than Group A (despite the focus of the latter on milk production). This is because Group B prioritised more pastoral dairy animals.

Table 24 : Comparison of the Productivity score cards

	Scenario A1	Scenario B1	Difference	Scenario A2	Scenario B2	Difference
	% change from baseline	% change from baseline	% (B1-A1)	% change from baseline	% change from baseline	% (B2-A2)
Meat produced (tons)	+ 10	+ 83	**73**	+ 28	+ 83	**55**
Milk produced (tons)	- 20	+ 57	**37**	+ 28	+ 32	**4**
Cropland used (ha)	- 10	+ 57	**67**	+ 12	+ 51	**39**
Grazing land used (ha)	- 10	+ 56	**66**	+ 17	+ 49	**32**
Rice area used (ha)	0	+ 100	**100**	+ 13	+ 100	**87**

Table 25 : Comparison of the Environmental score cards

		Scenario A1	Scenario B1	Difference	Scenario A2	Scenario B2	Difference
Other indicators		% change from baseline	% change from baseline	% (B1-A1)	% change from baseline	% change from baseline	% (B2-A2)
Water	Total	- 10	+ 60	70	+14.1	+ 52	37.5
	Per animal	- 1.2	- 1.4	0.2	- 0.3	- 1.7	1.4
Greenhouse gases	Total	- 8.6	+ 61	69.6	+12	+ 57.5	45.5
	Per animal	- 0.4	+ 0.2	0.6	-2.3	+ 1.5	3.8
Nitrogen		- 7	+ 31	38	+ 31.5	+ 27	4.5

The same patterns can be observed in Table 25 on the environmental impact, where despite convergence Group B's scenario still performs less well in terms of environmental impact.[16]

Two observations that have significance for future work emerge from these reflections. First, in the Transformation Game (and, more generally, where simulation tools are relied upon) it appears that the starting scenario frames the subsequent conversation, opening up or closing down the potential for learning, but does so in complex and potentially unexpected ways. In each Group there was a shift in understanding of pastoralism. The overt challenging of the perspective of the majority in the opening scenario was effective in the case of Group B, but further research would be required to establish the particular conditions that led to this effect (for example, disposition of stakeholders, skill of facilitators, social and cultural context). Second, the experiences in Burkina Faso suggest that the utility of a simulation device such as CLEANED requires rhetorical space – that is, the opportunity to be the focus of a constructive conversation – to be an effective learning tool.

16 In terms of productivity per animal, water productivity in scenario B is better, because in scenario A, more water per cow is used to produce planted fodder.

Table 26 : Comparison of Initial and Negotiated scenarios

	Initial Scenario				Difference (initial)		Negotiated Scenario				Difference (negotiated)	
	Scenario A1		Scenario B1		A1-B1		Scenario A2		Scenario B2		A2-B2	
	Vignette	Number	Vignette	Number	Vignettes	Number	Vignette	Number	Vignette	Number	Vignettes	Number
A Transhumant herds* (troupeaux)	A1	85 LT 135 ST	ABR	200 LT 300 ST	+	**-115 LT** **-65 ST**	A1	130 LT 310 ST	ABR	200 LT 300 ST	+	**-70 LT** **+10 ST**
L Dairy herd* (troupeaux)	L2	125	LBR	300	++	**-175**	L2	260	L1	300	+	**-40**
D Specialized dairy (animals)	D2	1'600	D1	2'400	+	**-1'800**	D2	1'750	D2	1'400	**no difference**	**+350**
F Fattening animals (animals)	F2	70'000	FBR	110'000	++	**-40'000**	F2	70'000	F1	110'000	+	**-40'000**
T Draft animal (animals)	T1	12500	T1	23'000	**no difference**	**-10'500**	T1	12'500	T1	17'000	**no difference**	**-4500**

* troupeaux = 120 animals in A and 20 animals in L; LT = Long transhumance between Mali and Ghana; ST = Small transhumance in Bama, Padema and the edges of neighbouring communes

4.3 Trade-offs and synergies

The comparison between the two negotiated scenarios suggests that stakeholders are ready to increase the environmental impact in order to reach their meat and milk production – and hence socio-economic - objectives. However, there is some complexity to this picture, which was evident in discussions within the stakeholders groups throughout the playing of the Transformation Game.

In the negotiated scenario, Group A increased the total number of cattle by 26% from their initial scenario[17], leading to a gain of 28% in meat and milk production. In the improved system the animals have become somewhat more efficient, and the change in environmental impacts – while increasing – are (in percentage terms) lower than the change in number of animals. In this scenario, both meat and milk production increase equally. Yet, this scenario favours the sedentary farmers, as it assumes that across all production categories livestock keepers produce in a mode that depends on inputs, meaning that the pastoralist production system is required to rely on purchasing feed from the market rather than on their traditional risk management strategy of sending parts of the herd away to find feed (grazing)[18]. On the other hand, all socio-economic indicators that ranked low in the initial scenario now ranked as medium to high as the meat and milk production has increased. However, the group did not discuss the cost of purchasing inputs and the extent to which this would erode any financial gains made (and therefore erode anticipated socio-economic advantages).

In the initial scenario, Group B increased the number of cattle in the area by 63%, achieving gains in meat of 83% and milk of 57% over the baseline. After much negotiation on how to reduce environmental impacts, Group B reduced animal numbers by 6% for their negotiated scenario, by reducing the number of specialised dairy animals and draft animals. The pastoral livestock management remained the same as the baseline (that is, unimproved), but as a compromise the group accepted to slightly improve the productivity of the pastoral dairy and fattening production categories. This resulted in a slight reduction in environmental impacts, and maintaining the same meat production, but induced a significant reduction in milk production relative to the initial scenario (yielding an overall increase of only 32% over the baseline). The outcome was seen as a success and worth trading in 25% increase of milk production relative to the baseline, although the meat and milk production gains are still largely made at the cost of environmental impact. When evaluating the socio-economic indicators, the group agreed that the negotiated scenario would allow progress against the indicator of improved production by allowing an increased number of improved animals, and that it would allow incomes to be diversified (although there was no detailed discussion on this point). However, contrary to the initial scenario, it was felt that the negotiated scenario reduced the likelihood of the pastoralists meeting their target of having two troupeaux at all times.

Based on the discussions leading to the negotiated scenarios, the following trade-offs can therefore be identified in relation to the production targets expressed by the two groups:

1. Any increase in production will have an associated increase in environmental impacts.
2. Meeting production targets using the existing pastoralist system, even with slight modifications in feeding (the ABR, A1, LBR, L1 vignettes), requires higher environmental impacts than by using improved breeds and management (the L2 & F2 vignettes).
3. Improved breeds and management obliges the pastoral society to commercialize.

These trade-offs suggest that a scenario that seeks to meet all stakeholders' targets is one that allows for co-habitation between intensive and extensive livestock management. For sedentary production categories, this would imply improved animals for specialized dairy production and fattening that are fed in a highly commercial mode, relying on agro-industrial by-products and planted fodder instead of natural grass. These animals are very productive and therefore have a reduced impact on most environmental measures (except for water as fodder plantation requires more water than crop residues). The reduced impact of more intensive practices is also partly because agro-industrial by-products (an important part of the intensified feed basket) are accounted for as waste products, with environmental impacts that are external to the

17 15% more than the present day cattle population (the baseline).

18 Which also serves as an insurance against losing the herd to disease.

livestock system[19]. As natural grass is not used by the sedentary animals, that grass is made available to the pastoral production categories, helping to offset the increase in environmental impact that results from an increased number of pastoralist animals.

The financial cost of buying inputs was only briefly discussed by participants, but the sentiment from various group discussions and post-workshop interviews was that the cost of agro-industrial by-products is increasing, such that participants were not certain that the improved production in intensification of fattening would be enough to cover the cost of the feed basket required by that intensification. There was more confidence (in Group B) that specialised dairy would provide more than enough income to cover the increased cost. More research is required to clarify this point and better quantify the trade-off between input costs and productivity. However, even the brief discussion had an impact on a few participants who had not before considered this aspect of intensification, and appreciated the significance of considering profitability in future livestock strategies.

The results also indicate a clear sense that participants are focused on meeting socio-economic goals (expressed for the most part in terms of increased income from livestock) and that this takes priority over environmental concerns. While there is a need for a more detailed discussion with stakeholders focused on the livelihood impacts of less environmentally sustainable choices, Trade-offs 1 and 2 indicate that increased environmental impacts are likely in the future – and most likely will remain so until a satisfactory level of socio-economic progress is achieved.

Sustainable Development Goal 2 (SDG 2, zero hunger) calls for doubled agricultural productivity by small-scale food producers including pastoralists[20]. Given Trade-Offs 2 and 3, and the significance placed on transhumance by pastoralists, this prompts the question: should pastoralists be required to double their productivity? And if so, how can pastoralists increase productivity while maintaining their culture, lifestyle and ethos of risk management, which came out as a non-negotiable for them in the discussions? This illustrates how working to achieve fundamental needs can require compromises in terms of environment and natural resource management – each of which are expressed within the SDGs (Nilsson et al. 2016). A better understanding of these trade-offs, located in particular socio-ecological contexts is essential if the SDGs are to be coherently deployed.

4.4 Putting scenarios in context

The CLEANED tool, with a landscape focus, only captures the outcome of those aspects of the more detailed dynamics of livestock ownership and feed access within Bama that have been modelled and that produce a certain mix of livestock production categories. However, bringing the CLEANED tool together with the socio-economic indicators in the Transformation Game provides the opportunity for stakeholders to bring their knowledge of these dynamics into the discussions to design credible and meaningful scenarios and to make an evaluation of the results that is grounded in the local context. There is evidence that that occurred in the workshop.

In both building and evaluating scenarios, some participants resisted the choice of the most improved version of production categories (vignettes L2, D2, F2) as they rely largely on buying concentrates, comprising agro-industrial by-products such as cotton-seed cake. Participants argued that it is too expensive to buy these inputs and despite improved productivity, it would not be profitable. Participants also argued for reduced animal numbers saying that land for grazing is already constrained, and that an increase in land (to feed a larger herd) would not be feasible; that there are already daily conflicts over land access for grazing, and that in the future there would be more competition for land for housing and for cropping. All are aware that land resources are diminishing, they can see the encroachment of buildings and cropland for themselves – one participant said "it is not cattle spreading everywhere, it is cropland". Yet, if one was to take CLEANED calculations alone to guide scenario building, it would show that biophysical potential for grass production is far higher than the demand from Bama's baseline livestock herd, and that doubling the

19 Similarly, if improvements involved using commercial livestock feed mixes that are bought from outside the study area (which is not the case in Bama), the impact would not be assigned in the study area and therefore not be counted in the CLEANED assessment for the study area.

20 'By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment' (UNDP, n.d.)

number of animals would not yet reach the limit of what Bama could provide. Key informant interviews during the reconnaissance tour explain the mismatch: Bama is a fodder exporting area. Natural grass, crop residues and planted fodder are sold to neighbouring communes, mainly Bobo-Dioulasso. In addition, most of the high-quality cotton seed cake from Bama is sold in Mali, where it fetches a much better price than in Bama. As a result, feed is more difficult (and more expensive) to access for those within Bama.

The second implication of the CLEANED tool being at landscape level, which was not well addressed in the workshop, is the ownership of animals in the different categories. The CLEANED tool only needs overall numbers of animals in each category – it does not matter how those animals are arranged among the population of Bama. However, different distributions would have very different socio-economic impacts on the population, and affect who could achieve their socio-economic goals and to what extent. This could have been discussed in the design of the scenarios – for example, whether the trend is towards homogenisation or towards specialisation. Homogenisation would see everyone having some extensive animals and some specialised animals, to spread risk, which may distribute benefits more evenly across the population, but also may mean that the extent of improvement of the specialised categories would be limited. Specialisation would see the specialised dairy and fattening concentrating in a few farms with larger herds of improved animals, and the economy of scale would allow them to intensify further than if the specialised animals were distributed over all the population of Bama. The benefits of specialisation would then only accrue to a much smaller section of Bama's population. Future workshops will need to raise these debates; more time for facilitated evaluation of the socio-economic implications of the scenarios would allow the question of distribution of benefits to be addressed. Had there been further iterations of the Game, these dynamics may have been raised in deciding how to change the choice of vignettes and distribution of animals to achieve better production outcomes.

These insights from the participants, raised in the context of the Game, show the significance of taking a participatory approach, and the constraints and potential pitfalls of using a simulation tool in isolation. However, it is also difficult to explore the complexity of these issues in a short amount of time, with a group who have a wide range of ways of understanding topics around natural resource use. The use of the Game simplified this task – and made it fun, which according to the participants also allowed them to have a "high level of the debate and the justification of positions for a better future . . . as we were responsible adults and able to listen and share our different experiences". At the same time, the use of the CLEANED tool provided a source of neutral information (numbers indicating the implications of the scenarios) that participants deferred to, keeping the hot debate in Group B civilised. Designing and evaluating scenarios using the socio-economic indicators alone would not have provided this same neutral voice around which to debate, or the opportunity to see that outcomes may not be as expected.

5 Conclusion

This report has presented the design for and preliminary results from the second ResLeSS workshop in Burkina Faso. More detailed analysis of the results of the workshop will follow later in the project, focused around contributions to the academic literature. However, at this stage a number of observations can be made. Overall, the blending of the CLEANED simulation tool with scenario development via the Transformation Game enabled constructive debate between stakeholders who, during Workshop 1, had given voice to their deep conflicts over the future of livestock in Bama. An explicit focus on equity, through the design of the workshops and Game, and the treatment of economic indicators that encompass wider perceptions of value than finance alone, helped ensure that dialogue was able to emerge rooted in an appreciation of the very different perspectives help by stakeholders. Central to this was participatory development of scenarios via vignettes, and their testing using CLEANED and socio-economic indicators, which together opened a space of discussion that has yielded important insights for future development planning and was valued by the workshop participants. Participant feedback makes clear that the workshop did provide new knowledge – learning emerged around the value of thinking ahead to plan for the future; the potential for higher productivity from new breeds and the trade-off against profitability; and that cows produce greenhouse gases. Importantly, the workshop achieved the objective of creating an opportunity for joint learning - participants welcomed the opportunity to "have acquired knowledge calmly, without fighting

and without disruption", and to be able to listen others' propositions with "mutual respect", as "responsible adults" (see more detail in Appendix D).

The workshop revealed a shared desire among stakeholders for livestock livelihoods to provide an improved standard of living and wellbeing. There were, however, deeply contrasting perspectives on how this should be achieved. One storyline favoured building up the capacity of livestock production or processing to improve productivity in order to achieve higher incomes, while a second (pastoralist) storyline focused on building up the size of the livestock herds (troupeaux) in order to provide the capacity to sell more animals when needed. These different framings of the problem were significant for how learning emerged in the participatory exercises, defining the assumptions shared by different stakeholder groups that shape how they interpret and react to scenarios. While working in homogenous stakeholder groups, the framing of pastoralism had operated to isolate the pastoralist stakeholders from the wider group. Once the groups became mixed, an appreciation developed for the socio-economic significance of pastoralism, representing an important step forward for shared planning in the area.

In particular, there was evidence of acknowledgement of pastoralists' claim to their livelihood, while recognising that change would have to come from both sides. For example, there was recognition that everyone uses natural resources (not only the pastoralists), while the processors group acknowledged the importance of opening transhumance corridors. The government representatives were significant in coming to recognise that pastoralists have different priorities which should be respected (as do crop farmers), including that cattle reflect prestige and that transhumance is a risk management strategy. In their opening scenario, the government representatives attempted to provide better livelihoods *for* pastoral livestock keepers, but did so without understanding the pastoralists' interests. The pastoralists acknowledged that in order to survive in the future they will need to adapt, but see this in terms of the organisation of grazing land and services to better manage the conflict between crop and livestock farmers, rather than a change in the way they keep livestock per se.

The mixed groups also revealed how the starting "scenario" of an alternative livestock future frames the subsequent conversation, opening up or closing down the potential for learning. There is need for more research here, as the outcome from each group may well depend as much on the skill of facilitators as it does on the extent to which scenarios challenged pre-conceived notion of environmental sustainability and economic benefit. The results also suggest that the utility of a simulation device such as CLEANED requires rhetorical space – that is, the opportunity to be the focus of a constructive conversation – to be an effective learning tool. Mixed groups were clearly essential to allow learning from each other to develop. However, it was equally crucial that stakeholders were in homogenous groups for the first part of the workshop, in order to consolidate their views as a group and allow stakeholder representatives to build on this foundation during the mixed group discussions.

The results indicate a clear sense that participants are focused on meeting socio-economic goals (expressed for the most part in terms of increased income from livestock) and that this takes priority over environmental concerns. However, based on participants' knowledge of the input and output market in Bama, the option of using the most improved form of livestock production is seen as undesirable because of the increased cost of inputs. While there is a need for a more detailed discussion with stakeholders focused on the livelihood impacts of less environmentally sustainable choices, it is likely that increased environmental impacts will be experienced in the future – and most likely will remain so until a satisfactory level of socio-economic progress is achieved. The work done in the mixed groups suggests three central considerations that link environmental, equity and economic priorities in Bama:

4. Any increase in production to meet socio-economic targets will have an associated increase in environmental impacts.
5. Meeting socio-economic targets using the existing pastoralist system, even with slight modifications in feeding, requires higher environmental impacts than the use of improved breeds and management.
6. Improved breeds and management obliges the pastoralist society to commercialize, which is in contrast to their clearly expressed wishes.

These trade-offs reinforce the importance of an integrated approach to planning livestock development trajectories, which considers both environmental impacts and socio-economic priorities. This is not least because the constraints imposed by envionrmental impacts may fundamentally limit the socio-economic

potential of some storylines for livestock futures (as was discovered by Group B). It is also important to note that different distributions of livestock across the landscape would have very different socio-economic impacts on the population, and affect who could achieve their socio-economic goals and to what extent. Given more time, it would be desirable to discuss this trade-off during the design of the scenarios.

The outcome of the workshop is not a full design for livestock futures in Bama but, rather, a better understanding among and between stakeholders, and for the research team. This includes understanding of the key trade-offs and the socio-economic context within which those trade-offs need to be negotiated. The experience of the workshop showed that to adequately explore issues requires allowing time to let the participants immerse themselves in the discussion – to get used to the Transformation Game and understand the dynamics of the scenarios and the accompanying results, in order to engage with and respond to the results. Further iterations of the Transformation Game may have allowed participants to unpack the trade-offs in more detail. However, land management was raised by both mixed groups as both a current problem (ongoing land use conflicts) and as a necessary part of an equitable future. If the transhumant system is to continue alongside sedentary production, interaction between livestock and crop farmers should be coordinated, not just within one commune but across a region in order to make a difference. Access to feed (grazing and crop residues) is essential to support local livestock production, and this means regulating the spread of crop fields, as well as the movement of cattle. This would require agreement between farmers, but also support from commune, provincial and regional administration to enforce agreements[21].

Finally, the workshop made clear that there is a need for focus on sustainable livestock *transformation,* and not limit our research to sustainable livestock *intensification*. Transformation opens up the potential to consider alternative strategies or pathways of change for the livestock system, acknowledging that while intensification may indeed be appropriate in some contexts, it should not be assumed to be suitable in all situations. Including 'sustainable' in the definition requires consideration of market linkages, economic futures and political economy, all contextualised by existing understandings of wellbeing, values and the social networks that shape the food system. As the preliminary outputs and discussions of the Transformation Game show, assessing alternatives to intensification provided important learning opportunities that would not have been possible had the workshop focussed only on intensification (an approach that would also have alienated the pastoralist stakeholders). Framing the debate around how to move towards an equitable, jointly defined future is important for enabling progress, while being open to alternative strategies to intensification allows for new and unexpected options.

6 References

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7 APPENDIX A – Workshop participants

Table 27 describes the 5 categories of stakeholders identified as important in the cattle value chain in Bama, Burkina Faso.

21 In discussions after the workshop, the facilitators who are local researchers, also mentioned coordination between ministries of agriculture and livestock to provide balanced support when there is a conflict. At present, technicians from the ministry of agriculture or livestock are expected to support 'their side', rather than being neutral arbiters, so if only one technician is present, the outcome is expected to be in favour of that ministry.

Table 27: Workshop 2 Stakeholder groups, Bama, Burkina Faso

Stakeholder group	Total number	New since Workshop 1
Livestock producers which can be divided further: producers of moving livestock (transhumants), producers of stationary livestock (other farmers), and producers who fatten cattle	15	7
Processors, which can be divided further: Butcher, restaurant owner Small dairy processor	 3 1	 2 0
Provincial and regional government representatives involved with managing animal and environment resources, from Ministries of: - Animal Resources and Fisheries (DPRAH, DRRAH) - Environment, Green Economy and Climate Change (DPEEVC) - Agriculture and Water Development (DRAAH, DPAAH)	6	2
Local administration and agricultural extension agents (Chef-ZAT)	4	2
NGOs involved with livestock production (RECOPA, APESS, FEB)	3	0

8 APPENDIX B – Defining CLEANED-generated scores

In order to support stakeholder discussion, the research team proposed that scenario scores be represented in terms of a low, medium or high change from the baseline. To achieve this, four explorative scenarios were developed. The different explorative scenarios have been developed to represent the range of plausible change in the landscape, and therefore the range of likely calculated environmental impacts. This range for each impact indicator was cut into 3 equal intervals defining the low, medium and high impact.

8.1.1 The exploratory scenarios

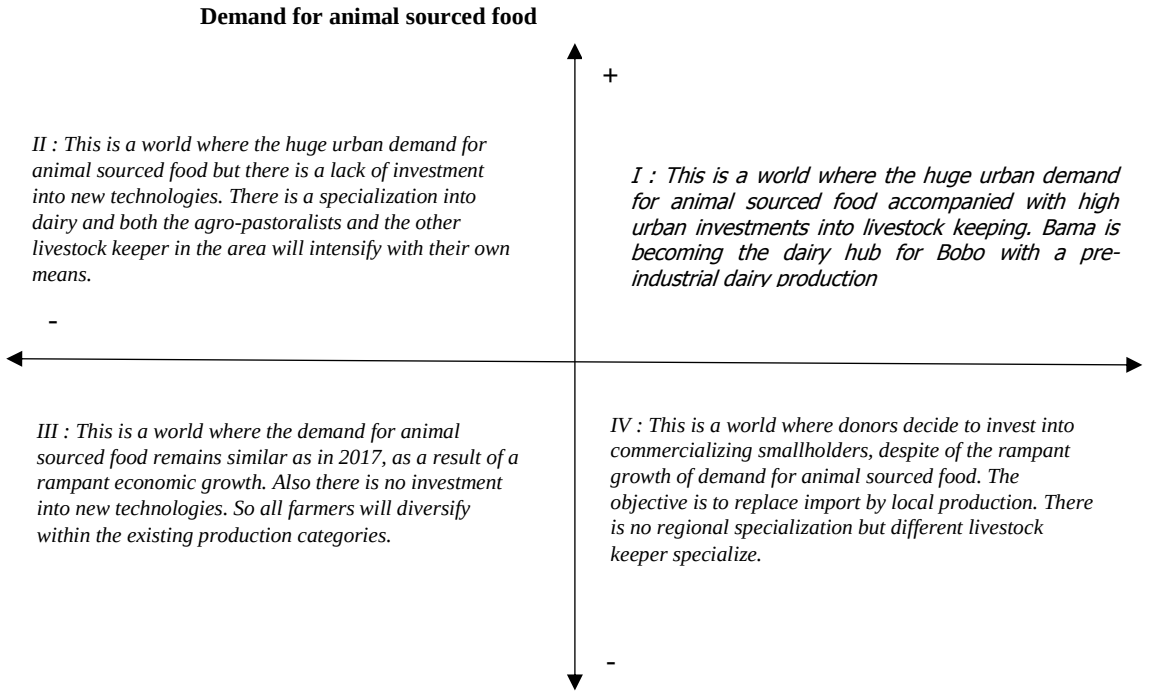
The exploratory scenario describes events and trends as they could evolve based on alternative assumptions on how these events and trends may influence the future. They provide several plausible futures that include external factors (the ones we do not have any influence on) and internal factors (elements it is possible to affect). The setup of such scenarios is usually base on two major uncertainties that cannot be influenced by the stakeholders but that will shape the outcomes.

For Bama, two uncertainties have been identified:

1. The demand of animal sourced food, which generally correlates with economic development. The emerging middle class demands from more animal sourced food. Yet, Burkina Faso remain one of the least developed countries, and the civil unrest of the last years have always correlated with a reduction in GDP. Clearly the emergence of that middle class will depend on the economic growth that will only come with political stability.
2. Level of investment into the agricultural sector and with a particular focus in livestock production. In developing countries, there are various options of investment, agriculture is one among many and competing with the energy sector, real-estate, industrial production. The technologies available in the agricultural sectors will heavily depend on how much funds are made available for the sector.

Working with these two uncertainties leads to the four following scenarios:

1. Scenario I : The dairy hub Bama
2. Scenario II : The smallholder revolution works
3. Scenario III : Mission " surviving"
4. Scenario IV : the donor driven intensification



Scenario I : the dairy hub Bama

This is a world where the huge urban demand for animal sourced food is accompanied by high urban investments into livestock keeping. Bama is becoming the dairy hub for Bobo with a pre-industrial dairy production, with milking machines. This specialization take place thanks to new technologies. Improved efficient breeds are brought in, accompanied with a good veterinary and breeding services. Also fodder production is improved, thanks to better seeds sorts and more fertilizer use. Also because of the specialization, there is a move away from crops to planted fodder. Thanks to these improvement is no encroachment onto the savannah for new cropland. Draft animals will almost disappear as tractors are taking over.

The overall growth of the whole industry offers many new opportunities to young people who now find jobs on the intensive farms and the processing plants that provide the dairy products demanded by the urban population of Bobo-Dioulassou. Because of these new opportunities, young people from agro-pastoral families, tend to settle and take jobs. Nonetheless, agro-pastoral families will keep their lifestyle as a sort of insurance, but the amount of animals will reduce because there is a lack of young people willing to open the transhumance route. This implies that each family that had troupeaux in 2017 will still have a maximum of one troupeau with about 75 animals.

CLEANED pre-set scenario I

Category	Chosen vignette	Livestock number
Agro-pastoralist transhumant	A1	Troupeau : - 20% with 100 animals
Agro-pastoralist dairy	L1	Troupeau : 0% with 25 animals
Dairy	D2	100 farms with 50 animals
Fattening	F1	0 %
Draft	TBR	-90%
Crop	C1	
Land use	LUC0	

Scenario II : the smallholder revolution works

This is a world where the huge urban demand for animal sourced food but there is a lack of investment into new technologies. There is a light specialization into dairy and both the agro-pastoralists and the other livestock keeper in the area will intensify with their own means.

Agro-pastoral communities will try to increase their amount of lactating cow, increase the animals for fattening and keep the other troupeau a bit smaller. There is an emergence of commercial dairy and fattening farms. They make use of improved breeds, but not the highest performing one, as there is not sufficient feed and fodder in the area, that kept cropping as in 2017, i.e. a strong orientation for staple crop, and no investment into planted fodder. Therefore, there is a massive increase of cropland encroached on the savannah.

Because in this scenario there is large economic growth, we will also assume that policies that allow the co-existence of the different production systems, and therefore the pastoral routes and zones could be enforced.

CLEANED pre-set scenario II

Category	Chosen preset	Livestock number
Agro-pastoralist transhumant	A1	Troupeau : 0% with 100 animals
Agro-pastoralist dairy	L1	Troupeau : 20% with 25 animals
Dairy	D1	+ 100%
Fattening	F1	+ 0%
Draft	TBR	0 %
Crop	CBR	
Land use	LUC4	

Scenario III : mission "surviving"

This is a world where the demand for animal sourced food remains similar as in 2017, as a result of a rampant economic growth. Also, there is no investment into new technologies. There is little incentives to improve the production. Yet, all livestock keeper's major objective will be to insure their livelihood. Because there are not many other opportunities, young people stay in rural area. As a result, there are more households keeping similar amounts of animals in similar way than today. However, all livestock keepers start diversifying the keeping strategy, so pastoral household will keep some improved dairy cow and

fattening animals, whereas other livestock keeper will start having animals that move, in order to cope with the risk in this business resulting from climate change. Also, crop will be produced in a similar way but because of the population pressure there is an increase of cropland of 20%. Also, because to the stagnant growth, the pastoral routes and zones could not be enforced.

CLEANED pre-set scenario III

Category	Chosen vignette	Livestock number
Agro-pastoralist transhumant	ABR	+23%
Agro-pastoralist dairy	LBR	+23%
Dairy	DBR	+23%
Fattening	FBR	+23%
Draft	TBR	+23%
Crop	CBR	
Land use	LUC2	

+23% is the expected growth of rural population in Burkina Faso by World Bank.

Scenario IV : the donor driven intensification

This is a world where donors decide to invest into commercializing smallholders, despite of the rampant growth of demand for animal sourced food. The objective is to replace import by local production. There is no regional specialization but different livestock keepers specialize and improve productivity in each production category. The same assumption on population growth than in scenario III. Because of the high population pressure, there will be a 20% increase in cropland. But donors will force the implementation of the agreement around pastoral zones and route.

CLEANED pre-set scenario III

Category	Chosen preset	Livestock number
Agro-pastoralist transhumant	A1	+23%
Agro-pastoralist dairy	L1	+23%
Dairy	D1	+23%
Fattening	F1	+23%
Draft	T1	+23%
Crop	C1	
Land use	LUC3	

+23% is the expected growth of rural population in Burkina Faso by World Bank.

8.1.2 Assigning scores

The environmental indicators are computed for each scenario. The difference to the base run was computed in absolute values. The maximum of this absolute value provides the credible range for the scenarios. This range value divided by three is the threshold value that has been used, as shown in Table 28 below, where X is the absolute value of the difference between a scenario and the base run. Note that this places the base run at having an impact of 0, which means that the current level of impact is not evaluated to avoid making a value judgement by outsiders that will be based on incomplete information about the magnitude of the

impact in a particular context. Therefore the tool only provides an evaluation of the magnitude of **change in impact** due to a scenario, and not an evaluation of the absolute impact. Participants (or tool users) are then invited to consider what that change in impact might mean for them, given their knowledge of current levels of impact.

Table 28: Assigning an automatic score to changes in environmental impact

Condition	Score
X < threshold	Low
Threshold < X < 2*threshold	Medium
X > 2*threshold	High

This rule has been applied to each environmental indicators. The threshold has been computed based on these computations:

	output from the scenairo					difference				difference in absolute value					
productivity	base run	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	max	treshold
meat	9683	10339	9683	11885	11885	6.8	0.0	22.7	22.7	6.8	0.0	22.7	22.7	23	7.7
milk	3800	7400	6400	4674	4674	94.7	68.4	23.0	23.0	94.7	68.4	23.0	23.0	95	31.7
croparea	556	556	833	833	667	0.0	49.8	49.8	20.0	0.0	49.8	49.8	20.0	50	16.7
grazarea	830	830	833	552	719	0.0	0.4	-33.5	-13.4	0.0	0.4	33.5	13.4	34	11.3
ricearea	104	104	104	104	104	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0
ar_rc	3	3	3	4	4	-9.1	3.0	24.2	24.2	9.1	3.0	24.2	24.2	25	8.3
ar_g	449	415	469	551	551	-7.6	4.4	22.7	22.7	7.6	4.4	22.7	22.7	23	7.7
ar_rr	0	0	0	0	0	0.0	50.0	50.0	50.0	0.0	50.0	50.0	50.0	50	16.7
import_c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
import_g	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
import_rr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
numcow	117460	108250	120860	1444172	1444172	-7.8	2.9	1129.5	1129.5	7.8	2.9	1129.5	1129.5	1130	376.7
numcow_tt	12000	14400	12000	14760	14760	20.0	0.0	23.0	23.0	20.0	0.0	23.0	23.0	23	7.7
numcow_tpt	28560	34800	12000	34800	34800	21.8	-58.0	21.8	21.8	21.8	58.0	21.8	21.8	58	19.3
numcow_tl	4000	4000	6000	4920	4920	0.0	50.0	23.0	23.0	0.0	50.0	23.0	23.0	50	16.7
numcow_d	1400	5000	2800	1722	1722	257.1	100.0	23.0	23.0	257.1	100.0	23.0	23.0	258	86.0
numcow_f	55000	55000	55000	67650	67650	0.0	0.0	23.0	23.0	0.0	0.0	23.0	23.0	23	7.7
numcow_da	22500	2250	22500	27700	27700	-90.0	0.0	23.1	23.1	90.0	0.0	23.1	23.1	90	30.0
water										0.0	0.0	0.0	0.0	0	0.0
wr_sum	138638099	127492339	146930835	130374908	98961822	-8.0	6.0	-6.0	-28.6	8.0	6.0	6.0	28.6	29	9.7
wdiff	1715601	1726747	1707308	1723864	1755277	0.6	-0.5	0.5	2.3	0.6	0.5	0.5	2.3	3	1.0
wu_animal	1180	1178	1216	904	686	-0.2	3.1	-23.4	-41.9	0.2	3.1	23.4	41.9	42	14.0
wu_milk	36484	17229	22958	27894	21173	-52.8	-37.1	-23.5	-42.0	52.8	37.1	23.5	42.0	53	17.7
wu_meat	14318	12331	15175	10970	8327	-13.9	6.0	-23.4	-41.8	13.9	6.0	23.4	41.8	42	14.0
wui_avg	0	0	0	0	0	-8.0	5.3	-6.7	-29.3	8.0	5.3	6.7	29.3	30	10.0
green house gaz										0.0	0.0	0.0	0.0	0	0.0
COe_l	231102447	190129690	246554707	296079143	288747780	-17.7	6.7	28.1	24.9	17.7	6.7	28.1	24.9	29	9.7
co2e_manure_l	86378279	60272253	96377351	118153793	110966149	-30.2	11.6	36.8	28.5	30.2	11.6	36.8	28.5	37	12.3
rum_co2e_yearto	144807210	129940479	150060304	177767624	177767624	-10.3	3.6	22.8	22.8	10.3	3.6	22.8	22.8	23	7.7
co2cow	1967	1756	2040	2054	2003	-10.7	3.7	4.4	1.8	10.7	3.7	4.4	1.8	11	3.7
co2milk	60816	25693	38524	63346	61777	-57.8	-36.7	4.2	1.6	57.8	36.7	4.2	1.6	58	19.3
co2meat	23868	18389	25464	24913	24296	-23.0	6.7	4.4	1.8	23.0	6.7	4.4	1.8	23	7.7
bio										0.0	0.0	0.0	0.0	0	0.0
bio_index_avg	0.15	0.15	0.12	0.12	0.14	0.0	-20.0	-20.0	-6.7	0.0	20.0	20.0	6.7	20	6.7
esp_sc_max	0	0	3	3	3										1.0
soil										0.0	0.0	0.0	0.0	0	0.0
SB_l	-12144199	-11607154	-10518943	-11406001	-12781717	-4.4	-13.4	-6.1	5.2	4.4	13.4	6.1	5.2	14	4.7
Ni_l	73821	57458	81642	98199		-22.2	10.6	33.0	-100.0	22.2	10.6	33.0	100.0	100	33.3
Ni_cow	1	1	1	0.68	0.65	-15.4	7.6	8.4	3.5	15.4	7.6	8.4	3.5	16	5.3

9 APPENDIX C – Stakeholder group socio-economic performance indicators

The following sections detail the target and associated indicators decided by each stakeholder group. Any additional discussion in reaching the final decision is also reported, together with any facilitator reflections.

Note that these results constitute the "co-defined indicators" anticipated in the project proposal. Prioritisation of these indicators is provided by the ranking, with indicator 1 being the highest priority.

9.1 Other farmers

1. Reducing herd from 100 to 50

Description	Progress towards achieving success	
Percentage of livestock keepers in Bama who have reduced the average size of their troupeaux from 100 head of cattle to 50 head of cattle.	**Low**:	0-40%
	Medium:	45-60%
	High:	80+%

The group felt that this is the most important indicator because of the reduction in grazing area, lack of water, lack of labour and improvement of feeding/nutrition.

2. Successfully intensifying livestock management

Description	Progress towards achieving success	
The proportion of livestock keepers in Bama who have: - Constructed a barn - Ensured the health of their animals with monitoring - Have water available from a pump or bore hole - Have constructed a fodder store - A well-managed herd (structure – only one bull selected; new bulls sold; a few selected milk cows serviced by bull). - Using Artificial Insemination (AI) - Introduced better species	**Low**:	0-15%
	Medium:	30-70%
	High:	70-100%

3. Becoming rich

Description	Progress towards achieving success	
The proportion of livestock keepers in Bama who have: - Constructed a multi-storey house (to rent out) - Bought a house for their wife - Have married several wives - Have educated all their children - Employed several workers - Are generous - Possess other businesses	**Low**:	10-40%
	Medium:	50-67%
	High:	68-100%

Although it was not subsequently taken up, after lunch the group also discussed a fourth indicator of "wife being respected by the village". This was considered to be a function of being rich: because he is rich he has become prestigious, and she is well respected as a consequence.

9.2 Pastoralists

1. Pilgrimage to Mecca

Description	Progress towards achieving success	
Proportion of all livestock keepers who have made the pilgrimage to Mecca at least once.	**Low**:	50 %
	Medium:	60 %
	High:	90 %

For a pastoralist to have succeeded in life, he must have made the pilgrimage to Mecca at least once in his life. In order to have the means to achieve this goal, the group estimated that one would need to have 4 troupeaux (with approximately 70 animals per troupeaux) in order to provide 7 good quality bulls to sell to make the pilgrimage. Having the 4 troupeaux also means that when they return from the pilgrimage they still have animals to carry on with and pick up the same rhythm/ standard of living as before.

One person suggested that you also need good health, but the others all rejected this idea, saying that one's health is in God's hands, and so this consideration should not be taken into account. The one who suggested it did not continue discussing it and accepted the statements of the others.

For evaluating the indicator, they felt that 50% is acceptable for the 'low' threshold, as the majority of pilgrims are the livestock keepers. Therefore, it would be normal that in a better future for livestock keepers, the number who accomplish the pilgrimage would increase.

There was a total divergence in the group about how many animals would be required to sell in order to make the pilgrimage, until they made the calculations. The group calculated that, at today's prices, about 7 good bulls would give enough money (2.2 million CFA) to buy the air tickets and subsistence for one person to go to Mecca. To support these arguments on the necessity of having lots of animals, one member showed the picture of the bulls that his father recently sold so that he could take his wife and go to Mecca.

Another facilitator commented that the measurement should qualify that it should be proportion of all Muslim livestock keepers – but acknowledged that almost all livestock keepers are Muslim. As it was not the group that said this, that edit was not made. In writing up the report, we double-checked with the facilitators of this group, and they confirmed that the group talked of all livestock keepers, any person related to the raising of cattle. We decided to leave it as the group wrote it here, but make our interpretation of it that practically it should be 'of all pastoralists' because non-pastoralists tend not to be Muslim.

2. Building a house

Description	Progress towards achieving success	
Proportion of pastoralists who have constructed a permanent house (in cement).	**Low**:	20-25%
	Medium:	30-40%
	High:	>50%

Several houses need to be constructed, to live in and to rent out. In order to achieve that, at least 30-40 cows would be needed, according to the type of house.

There was some debate about how many cows would be needed to sell to build a double-storey house. Given that the price of materials and land vary over time, and with location of the land, the group estimated the overall cost and members suggested that this could equate to 30, 35 or 40 cows, hence the interval of 30-40 animals was kept to cover all suggestions and the variability in costs.

For measurement of the indicator, some suggested that 20-30% should be the target for High, rather than Low, but the argument for Low was stronger, that these days even the Peulh who live in the bush are more and more building permanent houses. After that, there was unanimous agreement on the evaluation of low, medium and high.

3. Having at least 2 troupeaux

Description	Progress towards achieving success	
Proportion of pastoralists who possess at least 2 troupeaux.	**Low**:	20%
	Medium:	40%
	High:	50-60%

The wish of the livestock keepers is to have some troupeaux. In the future, it would be desirable for each livestock keeper to possess 2 troupeaux, where a troupeau is composed of 70 head of cattle. The group highlighted the nuance in the meaning of 'troupeaux' - that livestock technicians have a different definition of 'troupeau' to the Peulhs, that according to technicians, even a herd size of only 15 cattle is considered a troupeau.

4. Coming to the aid of friends and family

Description	Progress towards achieving success	
Proportion of pastoralists who have managed to help their family and friends by: - Sending at least 1 or 2 of their relative to Mecca each year - Giving Zakat each year - Employing ones relatives - Entrusting ones cattle to ones relatives, so that they can benefit from the manure, milk and draft power - Organise, or help to organise, marriages of ones relatives - Helping relatives with their medical needs	**Low**:	15-20%
	Medium:	30-40%
	High:	50-60%

5. Being able to eat *tô* from millet with milk

Description	Progress towards achieving success	
The frequency with which pastoralists are able to eat tô from millet with milk.	**Low**:	Once per week
	Medium:	4 days per week
	High:	7 days a week

Tô from millet with milk is a cultural food and a staple food for the Peulhs. It is also a good quality food. Millet is a versatile food, prepared in many ways (with milk, porridge, *gapal* - like dumplings had with sauce or yoghurt or honey), *sôbal*, couscous). Milk is equally transformable (cream, butter, soap). It is important to note that pastoralists eat 4 times per day:

- Very early in the morning, 05:00 – 06:00: milk and coffee
- At 09:00 – 10:00, *tô* and milk
- Lunch from 13:00 – 14:00, sôbal, gapal and tea
- Dinner, 19:00 – 20:00, *tô* and milk

The group found this to be a difficult indicator to discuss, because at first the group said that achieving this indicator would be impossible, and therefore could not see the reason to elaborate on it. After a lot of discussion, also with the session facilitator, all agreed that it was very important to them, and as such, it is even more important that they should define this indicator, because it is something to strive for.

The reason that the group believe this indicator to be impossible, is because *tô* from millet is expensive, albeit still being a staple food. Millet costs CFA 25'000 whereas rice costs CFA 15'000, so it just costs too much to eat millet. *Tô* from maize is also cheaper than millet, and more commonly found. They also find that millet is not easily available to buy, even if they wanted to. In Bama, very little land is used for millet; millet is from further north, in Sahel where it is drier. Bama is too wet for millet. Also, it is mainly only grown by the pastoralists, as other crop farmers do not eat millet so would not grow it (perhaps a reason why it is so expensive).

9.3 Meat and milk processors

1. Serenity and peace of mind

Description	Progress towards achieving success	
The proportion of all children in Bama who are in school and not hungry. This was agreed as a proxy for no longer having worries, and therefore having peace of mind	**Low**:	<10% of children in Bama are hungry & >80% of children are in school.
	Medium:	Almost all children have enough to eat and all children are in school.
	High:	All children have enough to eat and all children are in school.

The group found this indicator very difficult to make measurable, and spent an hour discussing it. Various ideas were put forward, for what relieves ones worries and offers serenity:

- When you have the benefits from work (wealth, prosperity);
- When your work has been successful and you have an income (are able to sell);
- When there is stability in the country; and
- When you have good health and money.

In essence, when you have the means to provide your family with food, education and good health, then you will worry less. Children going hungry was agreed to be the main cause of worry, and therefore became the proxy indicator. The starting point for the thresholds was that the participants agreed that, currently, 80% of all children in Bama are in school.

Several other suggestions put forward for evaluating the indicator (the different levels) were:

- serenity is not necessarily linked to wealth
- moral satisfaction, for example the fact of having lots of animals
- improvement of the living environment of the population
- an individual's appearance

2. Acquiring a house

Description	Progress towards achieving success	
Proportion of the population of Bama who have acquired a cement house. The house should: - have four rooms, running water and electricity; - be furnished and equipped (furniture, TV, gas equipment in the kitchen inside the house, air conditioning/ fan) - be secured with administrative documents (land and building rights/ Urban permission to inhabit)	**Low**:	30%
	Medium:	50%
	High:	70%

There were no debates about this indicator, only complementary discussions to add details to the description – the equipment and the residence documents.

3. Acquiring the means to work

Description	Progress towards achieving success	
Proportion of actors (butchers, dairy processors, fatteners, restaurant owners) who have access to the equipment and material required to carry out their work. The equipment required includes: - Acquiring a pump so that animals have access to water - Having infrastructure for keeping animals (fodder, concentrates, crop residues), for transformation (a dairy, a butchery) and for raising animals (a stable/ barn) - Having a multi-purpose shredder mill to grind feeds (fodder, crop residues) - Dairy equipment (gourdes/ bottles, pasteuriser, filling machine, mixer/ agitator, cooler, churns, cream separator, fridge, freezer, ice box/ cooler. - Butchery and grillhouse equipment (grill, knives, tables, chairs, coats, plates, basins, boots, helmets, manger, drinking trough, apparatus for processing the animals). - Having a book to keep accounts. - Having a car to transport animals, feed and produce (meat, milk, etc.).	**Low**:	30 %
	Medium:	60 %
	High:	80 %

There were no debates about the indicator description, but plenty discussion about the thresholds to evaluate it, particularly the value of 'High'. According to the activities represented by the group members, the following suggestions for the value of 'High' were made:

- The butchers (2) estimated that, by 2030, 100% of butchers should have the equipment described in the box
- The dairy processors (3) estimated that, by 2030, 80% of milk processors should have their equipment
- The one livestock keeper estimated that, by 2030, 90% of livestock keepers would have their equipment
- The one fattener estimated that, by 2030, 60% of fatteners would have their equipment
- The one restaurant owner estimated that, by 2030, 60% of restaurant owners would have their equipment

The agreement was to take a rough average of these thresholds and apply it to all tradesmen, but within trades, so one would measure for each trade how far they had progressed to acquiring their respective equipment.

The path to achieving this indicator would be by gradually building up savings from profit in order to invest in equipment.

4. Acquiring a means of transport

Description	Progress towards achieving success	
Proportion of actors who have acquired a car and a motorbike.	**Low**:	20%
	Medium:	40%
	High:	70%

Everyone was in agreement about how to measure this indicator, that one needs to have both a car and a motorbike at the same time.

5. Educating ones children

Description	Progress towards achieving success	
Proportion of the educated children in Bama who have reached university level.	**Low**:	30%
	Medium:	70%
	High:	90%

All participants agreed that the reason to educate ones children is so that they can acquire the knowledge to better manage the activities that they will take up. And that for this, the children will need to reach university level.

9.4 Ministry representatives and district administration

A feature of this group's discussions about the indicators was a constant referral back to the narrative of success developed in workshop 1 (for the fictitious Mr Zanga), which is indeed where the indicators originate. Where there were several suggestions raised about a point, or some concern by one or two participants about the ambition of a point, the debate was usually settled by referring back to Mr Zanga, and imagining what the case would be in a world where Mr Zanga represented someone who has been successful.

1. Production of animal-sourced products by the Farm

Description	Progress towards achieving success	
Proportion of all livestock keepers in Bama who have a farm that produces: - 100 litres of milk per day - 1000-1500 eggs per day and has 40-50 small ruminants on the farm.	**Low**:	5%
	Medium:	10%
	High:	30%

An initial proposition was to specify the number of animals of each type on the farm, but participants agreed that daily meat and milk production was a better measure, because there is a minimum output that is required for the farm to be viable, to recoup investments and not make a loss. Of course, output depends on how many animals there are, and how much has been spent on investing in the animals. One member was concerned with also representing those who are just beginning to intensify, but the rest of group maintained that because these indicators are inspired by and centred around the farm of Mr Zanga, who has the means to invest well in livestock – and acknowledged that this does not represent everyone, but is a goal to work towards. Suggestions for milk production ranged from 30-200 litres per day. One member doubted whether the local breeds could achieve more than 3 litres per day each, but the rest reminded him that these are dairy breeds which can together produce up to 100 litres per day. There was little discussion about egg

production, other than that the views were split as to whether production should be 1000 or 1500 eggs per day, therefore the range was kept. Small ruminants were agreed to be like a savings and not a priority, and therefore daily production indicator made little sense, and the more important detail is that there should be always 40-50 small ruminants on the farm. After a reminder that the indicators are global, i.e. not at an individual level, because Mr Zanga is a model for everyone, it was easily agreed that the measure should be the proportion of producers having attained the level of production of Mr Zanga. There was some debate about what target to set: 2-10-15% for low-medium-high was felt to be too low, for what could be achieved over 30 years. On the other hand, expecting half of the population of producers to have intensified in 30 years raised a concern that there would be no more land for cultivation, should this happen (because Mr Zanga owns 5 – 10 hectares of land). As such, it was agreed that the target should be 30% of producers in Bama because in 30 years land would be a concern.

2. The farm

Description	Progress towards achieving success	
Proportion of all livestock keepers in Bama who have a farm of 5-10 hectares that is secured with title deeds and permission for agricultural use.	**Low**:	15%
	Medium:	25%
	High:	50%

It was agreed that buildings and equipment all fall into another indicator and do not need to be included here. Therefore this indicator is about the size and security of the land for the farm.

Note, after some debate, the % thresholds for achieving this indicator were set higher than the rest of the indicators. The argument for aiming for up to 50% of producers with secure land is that currently many producers already have the land, it is just not secured, and so in 30 years it should be possible to secure it. Countering this, the concern was raised that in 30 years it would be difficult for 30% of producers to get land rights because of conflict with crop farmers and because outsiders could come in and take the land. However, the defense that it is the current tendency for producers to secure their land convinced the others, and the original proposal was kept. The threshold for Low is also higher than for the other indicators, because there are already several farmers with secured land, and therefore the baseline is higher than for the other indicators, justifying a higher minimum threshold of progress.

3. The animals

Description	Progress towards achieving success	
Proportion of all livestock keepers in Bama who have on their farm: 20 improved dairy cows 1500 laying chickens 50 small ruminants	**Low**:	5%
	Medium:	10%
	High:	30%

It was agreed that detailing the breeds was unnecessarily complicated, but sufficient to say whether the breeds are local or improved – and everyone underlined that all breeds on the farm should be improved breeds. Before agreeing on 20 dairy cows, it was clarified for one member who asked whether the target is for Mr Zanga or for everyone, that they expect that Mr Zanga would be typical of the zone in 30 years time, so potentially anyone could attain the same level as Mr Zanga. The initial suggestions about the number of chickens and small ruminants was accepted by all. The group agreed to use the same measurement as for the first indicator (low=5%, med=10%, high=30%) – in fact the same logic was used for all indicators except for indicator 2.

4. The equipment and infrastructure on the farm

Description	Progress towards achieving success	
Proportion of all livestock keepers in Bama who have on their farm: - Wheeled machinery (e.g. tractor, vehicles, other wheeled equipment) - Biodigester - Buildings (for livestock, living and feed storage) - Water tower	**Low**:	5%
	Medium:	10%
	High:	30%

There was some debate about whether having a water tower would be possible in 30 years until remembering that this is the ideal situation to be attained, and a suggestion to at least have a borehole. Vehicles/ wheeled machinery were added as essential equipment to move/ sell farm produce, and tractors were included into this category. Similarly, solar equipment and electricity installations were incorporated into the larger category of buildings. The measurement thresholds are the same as those agreed in Indicator 1.

5. External investments

Description	Progress towards achieving success	
Proportion of all livestock keepers in Bama who spend, on average, 20% of their annual on other investments (either in assets or in other enterprises).	**Low**:	5%
	Medium:	10%
	High:	30%

This indicator prompted the most different positions among the group. For this indicator, all agreed easily on putting aside 15-20, even 40% of annual revenue from the farm to invest or spend on things or activities outside of livestock. They settled on 20%, on average, to allow for variation from one producer to another, and from one year to the next.

However, when defining the purpose of that investment, members of the group had two distinct suggestions for what the indicator is referring to, and kept both because the group felt strongly about both:

i. investing in other income-generating activities, such as a mini-dairy, or feed mill
ii. investing in one's family so to say, for example by buying a car for your wife, or buying property.

One member highlighted the value of external investments, for example in property, because if the producers just save money, they can try to/ be tempted to remove the money for expenses.

One member hesitated to use the same measurement thresholds as for indicator 1 (5% - 10% - 30%), on the basis that they should be lower because some are reticent about investing. However, the group argued that each have their own way of investing – but everyone will invest somehow (e.g. motorbike for the children, or the factory, etc.), particularly as Mr Zanga is a visionary, so he will invest.

10 APPENDIX D - Participant feedback

At the end of the workshop, participants were invited to fill in an evaluation form, including two free text questions:

i) Did you change your point of view about something following the discussions in the workshop? If so, what changed, and what prompted the change of view?
ii) Did anything surprise you in the workshop? If so, what was it?

The most common feedback, both in terms of changing their opinion and being surprised, was to learn knowledge to help them improve their production or processing methods, or that there are improved breeds and improved methods that can lead to high production of meat and milk. Participants said their change of view was that:

"Yes, I am convinced that I can produce more meat and more milk"

"I leave with plenty of knowledge that I will put into practice to improve my livestock keeping"

"Yes, the need to improve techniques of livestock keeping to expand the production of milk and meat"

Participants were surprised:

[about] "The existence of high-performing, improved breeds"

[that] "I did not know that I could acquire through this workshop the knowledge that can yield something, to advance my practice of livestock keeping"

Related to gaining knowledge about improved livestock management, a couple participants had a change of view in realising that changing their practices could improve their profitability. Another was surprised to learn that more intensive production could be more economical than current practices.

"I thought before that I had a good knowledge of livestock keeping. Following the workshop, I have seen that what I have been doing doesn't allow me to get enough earnings. I have learned that the higher number of troupeaux is not synonmous with profitability. I have learnt that one should reduce the number to be able to look after the animals"

"Yes, I had new ideas which will allow me to change our way of managing our processing activities . . . for profitability."

The second most common feedback was surprise at learning that livestock has an impact on greenhouse gases:

"Yes! The point about greenhouse gases. Now I understand that the digestion of the animals has an impact on the environment"

Several participants were surprised about the quality of the debates that they had in the workshop, allowing them to exchange ideas calmly, with everyone listening, writing that what surprised them was:

"we have learned that livestock keeping can bring us good yield to allow us to resolve our problems. We have acquired knowledge calmly, without fighting and without disruption. This suits us well and we thank you for that."

"the mutual respect of everyone in listening and taking into account the propositions"

"the high level of the debate and the justification of positions for a better future; understanding the spirit of fair play, as we were responsible adults and able to listen and share our different experiences"

A couple of participants were surprised at the negative view of pastoralism from the other participants:

"Yes. Plenty of participants think that pastoral livestock keeping will not exist after some time."

"People view pastoralism in a bad light"

And finally, a more philosophical reflection from one participant:

“Yes, I changed my point of view, because the knowledge that I have acquired here showed us that it is in changing in the right direction that one can get results and not in changing without knowing where one is going”