

Participatory assessment of vulnerability and planning of adaptation to climate change in the Yatenga, Burkina Faso

Working Paper N. 64

CGIAR Challenge Program on Climate Change, Agriculture and Food Security (CCAFS)

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RESEARCH PROGRAM ON
Climate Change,
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ABBREVIATIONS AND ACRONYMS

ADEFAD	: Aide aux Enfants et Familles Démunies
CCAFS	: Climate Change, Agriculture and Food Security
CGIAR	: Consultative Group on International Agricultural Research
CIAT	: Centre International pour l'Agriculture Tropicale
CRiSTAL	: Community-based Risk Screening tool-Adaptation and Livelihoods
DADI	: Direction de l'Aménagement et du Développement de l'Irrigation
DRS/WSC	: Defence and land restoration /conservation of water and soil
FAO	: Food and Agriculture Organization of the United Nations
ICRISAT	: International Crops Research Institute for the Semi-Arid Tropics
INERA	: Institut de l'Environnement et de Recherches Agricoles
INSS	: Institut des Sciences des sociétés
IPCC	: Intergovernmental Panel on Climate Change
MAH RH	: Ministry of Agriculture, Water and Fisheries
NGO	: Non Governmental Organisation
NAPA	: National Adaptation Plan of Actions
SPAI	: Sous-produits Agro-industriels/agro industrial by-products
TOP-MECAC	: Toolkit for planning, monitoring and evaluation of climate change adaptive capacities
UFROAT	: Union des Femmes Rurales de l'Afrique de l'Ouest et du Tchad
IUCN	: International Union for Conservation of Nature
VAP	: Vision, Action, Partnership

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EXECUTIVE SUMMARY

The impacts of climate change on food security are a thorny issue, especially in countries with marginal and volatile weather conditions. Burkina Faso is one of those countries where agriculture, mainly rain-fed type, is highly dependent on agro-climatic parameters such as rainfall, temperature, sunshine, wind, etc. In Yatenga province, located in the northern region of Burkina Faso, the agro climatic parameters are undergoing major changes over the years. The autonomous adaptation to climate change and climate variability has been implemented by the people through the diversification of their activities, irrigation, water management, risk management and disaster insurance.

Since the development of national adaptation program of action, significant efforts have been made to promote the planned adaptation. Despite these efforts, the food security situation remains critical for the rural population. One reason for this is that the approaches and planning tools used are varied and variously promote the participation of local populations. Indeed, the level of participation of rural people in the planning, monitoring and evaluation of adaptive capacity is often not complete and adequate. This participation is limited to either (1) the vulnerability analysis, leaving the choice for technicians to plan the adaptation actions that will be implemented by the rural populations, or (2) to the choice of tasks by communities, technicians having already investigated the communities' vulnerability. Consequently, the coherence between the vulnerability, adaptation actions and the current capacity of the population is very low.

Under such conditions of the application of planned adaptation, it is difficult or impossible to implement the monitoring-evaluation system that will inform on adaptive capacities. Most of the current monitoring-evaluation systems are focused on the changes of state of natural resources and population. Yet, in the context of climate change more than in any other context, the change of resources and / or populations states will not be enough to adapt, if individuals, institutions and groups do not change their behaviour. Two questions then arise: (1) can the involvement of stakeholders in the use of tools for planning, monitoring and evaluation foster changes in behaviour, relationships and actions to adapt to change climate? (2) How rural actors make use of these tools?

To answer these questions, the approach of sustainable livelihoods was used. This approach puts people affected by the effects of climate change at the centre of a network of interrelated influences that have an impact on how they create livelihoods for themselves and their households. Several participatory tools have been applied to highlight the networks of influence in which the livelihood resources of the rural population are. These are tools for vulnerability analysis (mapping of resources and climatic or not hazards, vulnerability matrix, CRiSTAL, participatory analysis of vulnerability factors), and tools for planning adaptive capacity (Vision action-partnership, outcomes challenges).

The tools for vulnerability analysis and the vision-action-partnership were initially applied in a community in the Climate Change, Agriculture and Food Security (CCAFS) block of Tougou (Tibtenga). The results were submitted to representatives of four othercommunities (Pabio, Ramdola, Lemnogo-Mossi and Koubi-Thiou) and development partners in theYatenga. During this workshop, all the tools for vulnerability analysis and adaptive capacity planning wereapplied to participants for augmenting the information collected in Tibtenga with those from the othercommunities, validating the vision, actions and partnerships and defining outcome challenges as changesin behaviour for each partner,including the communities themselves. Finally, the tools have been appliedseparately for men and women groups to understand the differences related to gender and to avoid gender-based discrimination in adaptation planning.

The results show that there are differences and similarities between women and men in the analysis of vulnerability to climate hazards and adaptation strategies. These differences lie in the perception of the level of access to the main livelihood resources by each group. For example, in the category of natural resources, fuel wood was identified as an important resource for women who are responsible for providing energy in rural households, while pastoral lands was listed as important by men who generally manage the household's livestock. At the level of the three main climate hazards, the women did not mention flooding probably because the resources they have access to are not affected by floods, as opposed to men group who listed flood among the three major climate hazards they face. Yet, these differences in interests do not mean that resources are *sensus stricto* separate between men and women, nor lack of awareness on hazards not listed by any of the gender-based group.

Adaptation strategies implemented and / or identified by each group also differ slightly. But a strategy appeared common to both genders. This is the development of agricultural land associated with the assisted natural regeneration that would fight against drought and strong winds (identified by both genders) and floods (identified by men). Based on their level of access to livelihood resources, women and men showed a relative difference in the analysis of the importance of resources for the implementation of adaptation strategies. Thus, in general, men give more importance to natural and physical resources, while for women, social and human resources are the most important. This difference is probably related to the fact that men have always received more training and information than women.

Despite this relative difference in perceived vulnerability to the impacts of climate hazards, the elements of vision for the future (5-10 years) developed by men and women are either similar or complementary. Both genders aspire to a healthy, educated and skilled society capable to restore natural ecosystems in their territories and to ensure food security for people and livestock. Actions identified in the context of climate change, agriculture and food security program are consistent with this vision. However, other actions not related to the program must be implemented by others to achieve the vision. Partners and communities together have defined the outcomes challenges defined as behavioural changes required to move towards the vision.

Ultimately, the five rural communities in Yatenga have developed autonomous adaptation against the effects of the climate hazards they face. They have also the ability to analyze and develop planned adaptation actions. In this process of planning adaptation, one must ensure that the identified strategies contribute to a broader vision of sustainable development and identify what to monitor and evaluate to make sure that adaptation is taking place. The participatory action research while supporting the implementation of identified actions should encourage changes in behaviour that actors have defined.

Keywords: Vulnerability, climate hazards, adaptive capacity, planning, monitoring and evaluation, Yatenga, Burkina Faso.

RESUME EXECUTIF

D'après le 4^{ème} rapport IPCC, 2007, les scénarii futurs du changement climatique pour l'Afrique de l'Ouest indiquent que la variabilité climatique actuellement vécue risque d'augmenter et de s'intensifier. Les impacts du changement climatique sur la sécurité alimentaire constituent une question épineuse, notamment dans les pays du Sahel à conditions climatiques marginales et volatiles. Le Burkina Faso fait partie de ces pays où l'agriculture, principalement de type pluviale, est fortement tributaire des paramètres agro-climatiques tels que la pluviométrie, la température, l'ensoleillement, le vent, etc (source, voir communication du Burkina Faso). Dans la province du Yatenga située dans la partie Nord du Burkina, ces paramètres agro climatiques connaissent d'importantes variations au fil des années. L'adaptation autonome au changement et à la variabilité climatique a toujours été mise en œuvre par les populations à travers la diversification de leurs activités, l'irrigation, la gestion de l'eau, la gestion des risques de catastrophes, etc.

Depuis l'élaboration par le Burkina Faso du programme d'action national d'adaptation (PANA) en 2007, d'importants efforts ont été fournis pour promouvoir l'adaptation planifiée. Malgré ces efforts, la situation de la sécurité alimentaire reste toujours précaire, voire critique pour les populations rurales. Une des raisons à cette situation est que les approches et outils de planification utilisés sont variés et favorisent diversement la participation des populations locales à l'évaluation de leur propre capacité d'adaptation au changement climatique. En effet, le niveau de participation des populations rurales au processus de planification et de suivi-évaluation des capacités d'adaptation n'est pas souvent complet et adéquate. Cette participation se limite soit à (1) l'analyse de la vulnérabilité, laissant le choix aux techniciens de définir et de planifier les actions d'adaptation, (2) soit au choix des tâches à conduire par les communautés, les techniciens ayant déjà enquêté sur la vulnérabilité. Conséquence, la cohérence entre la situation de vulnérabilité, les actions d'adaptation et les capacités actuelles des populations est très faible.

Dans de telles conditions d'application de l'adaptation planifiée, il est difficile voire impossible de mettre en place un dispositif de suivi-évaluation qui renseigne sur les capacités d'adaptation, la plupart des dispositifs actuels étant focalisé sur les changements d'état des ressources naturelles et de la population. Pourtant, dans le contexte de changement climatique plus que dans tout autre contexte, le changement d'état de ressources et/ou des populations ne saurait suffire à s'adapter, si les individus, les institutions et les groupes ne changent pas de comportement. Deux questions alors se posent : (1) l'implication des acteurs dans l'utilisation des outils de planification et de suivi-évaluation peut-elle stimuler les changements de comportements, de relations et d'actions en vue de s'adapter au changement climatique ? (2) comment les acteurs ruraux les utilisent-ils ?

Pour répondre à ses questions, l'approche des moyens d'existence durable a été utilisée. Cette approche met en effet les personnes affectées par les effets du changement climatique au centre d'un réseau d'influences interdépendantes qui ont un impact sur la façon dont elles créent des moyens d'existence pour eux et leurs ménages. Plusieurs outils participatifs mettant en évidence les réseaux d'influence dans lesquels se trouvent les moyens d'existence des populations rurales ont été appliqués. Il s'agit d'outils d'analyse de la vulnérabilité (cartographie des ressources et des aléas climatiques, matrice de vulnérabilité, CRiSTAL, analyse des facteurs de vulnérabilité), et d'outils de planification des capacités d'adaptation (Vision-action-partenariat et défis de changements).

Dans le cadre du programme CCAFS, les outils d'analyse de la vulnérabilité et de planification des capacités d'adaptation ont été appliqués dans un premier au sein d'une communauté dans le bloc CCAFS de Tougou (Tibtenga) au Burkina Faso. Les résultats obtenus ont été soumis aux représentants de quatre autres communautés (Pabio, Ramdola, Lemnogo-Mossi, Koubi-Thiou) et des partenaires au

développement dans la province du Yatenga. Au cours de cet atelier, tous les outils d'analyse de la vulnérabilité et de planification des capacités d'adaptation ont été appliqués aux participants pour élargir les bases de la fiabilité des informations collectées à Tibtenga aux autres communautés, valider la vision, les actions et les partenariats et définir des changements de comportement pour chaque partenaire, y compris les communautés elles-mêmes. Enfin, les outils ont été appliqués séparément aux hommes et aux femmes pour appréhender les différences liées aux genres, ceci pour éviter la discrimination basée sur le genre dans la planification de l'adaptation.

L'analyse des résultats obtenus montre qu'il existe des différences et des similitudes entre les femmes et hommes dans l'analyse de la vulnérabilité aux aléas climatiques et des stratégies d'adaptation. Ces différences résident dans la perception sur les principales ressources d'existence fondées sur l'accès de chaque groupe aux ressources du territoire communautaire. Par exemple, au niveau de la catégorie des ressources naturelles, le bois énergie est identifié comme une ressource importante par les femmes qui sont responsables de la fourniture d'énergie dans les ménages ruraux, alors que les terres pastorales ont été retenues par les hommes qui gèrent en général le bétail du ménage. Au niveau des trois principaux aléas climatiques, les femmes n'ont pas mentionné les inondations certainement parce que les ressources affectées par cet aléa sont généralement gérées par les hommes qui l'ont cité. Les différences de centres d'intérêt ne signifient pas pourtant une séparation stricto sensu des ressources ou une absence de conscience sur un aléa non cité par l'un ou l'autre genre.

Au niveau des stratégies d'adaptation mises en œuvre et/ou identifiées par chaque groupe, il ressort également de légères différences. Toutefois, une stratégie est apparue commune aux deux genres. Il s'agit de l'aménagement des terres agricoles associé à la régénération naturelle assistée qui permettrait de lutter contre la sécheresse et les vents violents (identifiés par les deux genres) et les inondations (identifiés par les hommes). Sur la base de leur niveau d'accès (intérêt) aux ressources d'existence, les femmes et les hommes ont montré une relative différence dans l'analyse de l'importance des ressources pour la mise en œuvre des stratégies d'adaptation. Ainsi, d'une manière générale, les hommes accordent plus d'importance aux ressources naturelles et physiques, tandis que les femmes sont plus portées vers les ressources sociales et humaines. Cette différence est peut être liée au fait que les hommes ont toujours bénéficié de plus de formation et d'information que les femmes, mais elle peut s'expliquer aussi par la divergence des intérêts et d'accès liés aux ressources.

Malgré cette relative différence de perception de la vulnérabilité aux impacts des aléas climatiques, les éléments de vision du futur (5 à 10 ans) élaborés par les femmes et les hommes sont soit similaires, soit complémentaires. Tous les deux genres aspirent à une société saine, éduquée et compétente capable de restaurer les écosystèmes naturelles de leurs territoires et d'assurer une sécurité alimentaire pour les personnes et le bétail. Les actions identifiées dans le cadre du programme changement climatique, agriculture et sécurité alimentaire sont cohérentes avec cette vision. Mais, d'autres actions non liées au programme doivent être mises en œuvre par d'autres acteurs (limitrophes) pour la réalisation de la vision. Les partenaires et les communautés ont ensemble défini des défis de changement de comportements devant soutenir le progrès vers la vision.

En définitive, les cinq communautés rurales du Yatenga ont développé des actions d'adaptation autonomes aux effets des aléas climatiques dont elles font face. Elles ont également la capacité de les analyser et de développer des actions d'adaptation planifiées. Dans ce processus de planification de l'adaptation, il faut s'assurer que les stratégies identifiées contribuent à une vision plus large de développement durable et identifier des indicateurs ce qu'il faut suivre pour vérifier que l'adaptation a lieu. La recherche action participative en soutenant la mise en œuvre des actions identifiées, doit favoriser les changements de comportements que les acteurs ont définis.

Mots clés : Aléas climatiques, vulnérabilité, capacité d'adaptation, planification, suivi-évaluation, Yatenga, Burkina Faso.

I. INTRODUCTION

1.1. Background

In the tropics, especially in Africa, climate changes are often considered very harmful to livelihoods in agricultural sector (Dixon et al, 2001. Dinar et al, 2008.). Thus, the impact of climate change on food security is a thorny issue, particularly in the Sahelian countries with marginal and volatile weather conditions. According to several recent studies, climate change will have serious implications for the food system and more particularly for agriculture (Vermeulen et al., 2012) and disproportionately affect the poor and marginalized groups who depend on agriculture and have low adaptation capacities (World Bank, 2007).

Burkina Faso is one of those countries where agriculture is mainly rain-fed type, and thus highly dependent on agro-climatic parameters such as rainfall, temperature, sunshine, wind, etc. In its northern part, described as a Sahelian climate zone, these agro-climatic parameters are undergoing major changes over years (MAHRH / DADI / FAO. 2010), which increase the vulnerability of rural populations that are already experiencing a vicious poverty cycle.

Vulnerability is the degree to which a system is susceptible to, and unable to cope with the adverse effects of climate change, including climate variability and extremes (IPCC, 2000). It depends on the nature, scale and pace of climate change and variability to which a system is exposed, its sensitivity, and its adaptive capacity. In other words, the fact that a system is exposed to the adverse effects of climate change and climate variability does not necessarily imply that it is vulnerable if its sensitivity and ability to adapt are not well understood.

Adaptation to climate change and variability by people has been implemented through the diversification of their activities, irrigation, water management, risk management and disaster insurance (Adger et al., 2007). Adaptation practices are defined as the actual adjustments or changes in the policy environment that could increase resilience and reduce vulnerability vis-à-vis the observed and projected climate changes (Adger et al., 2007).

Challenges to engage small farmers in adapting to the impacts of climate change and climate variability are enormous. Indeed, studies on the vulnerability of human and natural systems to the effects of climate change and variability are relatively recent (Brooks, 2003). Yet, efforts in support to climate change adaptation practices of small farmers are increasingly important, particularly in Burkina Faso, where agriculture employs 86% of the workforce and generates around 40% of gross domestic product (MAHRH, 2008). Agropastoral production is mainly extensive and agriculture is mainly rain-fed. This further increases the sensitivity of agriculture to climate hazards.

1.2. Justification

The program on Climate Change, agriculture and food security objectives are (1) to identify and test pro-poor adaptation and mitigation practices, technologies and policies for food systems, adaptive capacity and rural livelihoods; and (2) to provide diagnosis and analysis that will ensure the inclusion of agriculture in climate change policies, and the inclusion of climate issues in agricultural policies, from the sub-national to the global level in a way that brings benefits to the rural poor (CIAT, 2011).

In Burkina Faso, this program operates in Yatenga province identified by Ericksen et al. (2011) as an area of high tension of exposure and sensitivity to climate hazards and food insecurity. This province is representative of the northern region of Burkina Faso which comprises four provinces (Yatenga Passoré, Loroum, Zondoma). Efforts have been made by the country's authorities to improve food security, but the situation remains precarious, even critical for rural populations. Based on the livelihoods resources, Yatenga province in a socio-

¹Agriculture includes crop production, fishing and animal husbandry.

rural zone characterized by a Sahelian climate (MAHRH/DADI/FAO, 2010). Livelihood resources are derived from agriculture (cereals, millet, sorghum, cowpea and gardening), livestock (semi-nomadic and ranching) and other (artisanal gold mining, arabic gum).

With these features and in the context of climate change, achieving sustainable food security in an area with high population growth is a major challenge. Adaptation and mitigation of strategies for climate change then become essential at all levels and particularly at the local level, where poverty is most prevalent among populations. But the success of mitigation and adaptation strategies to climate change will involve changes in the behaviour of actors, in technologies and institutions put in place and the current food production systems. These changes themselves need to be planned, monitored and evaluated to ensure they are in line with the adaptation and / or mitigation of climate change.

The actors then need to improve their capacity for planning, monitoring and evaluation of the required changes in their behaviors, technologies they use, institutions and their food production systems. Improving the capacity of actors requires the development of a new approach for planning, monitoring and evaluation. This new approach must promote the effective involvement of all stakeholders in the planning cycle and monitoring and evaluation of research and development. The Participatory Action-learning approach can therefore enhance the skills of stakeholders for planning, monitoring and evaluation of adaptive capacity.

The use of such an approach is expected to improve understanding of the implications of climate change on the lives and livelihoods of people in the Yatenga region in general and in the intervention sites of the (CCAFS) program in particular. All this could help better identify and test technology and good practices for adaptation and mitigation to climate change in order to influence national policies. The research questions are as follows : (1) Can the involvement of stakeholders in the use of tools for planning, monitoring and evaluation foster changes in behaviour, relationships and actions to adapt to climate change? (2) How do rural actors make use of these tools?

II. METHODOLOGY

2.1. Conceptual framework

The conceptual framework of this study is based on the approach of sustainable livelihoods. Livelihoods include people, their capabilities and resources, including food, income and assets (Chambers and Conway, 1992). The choice of this framework is justified by the fact that it puts man and woman at the center of the analysis of issues related to climate change and associated adaptation strategies.

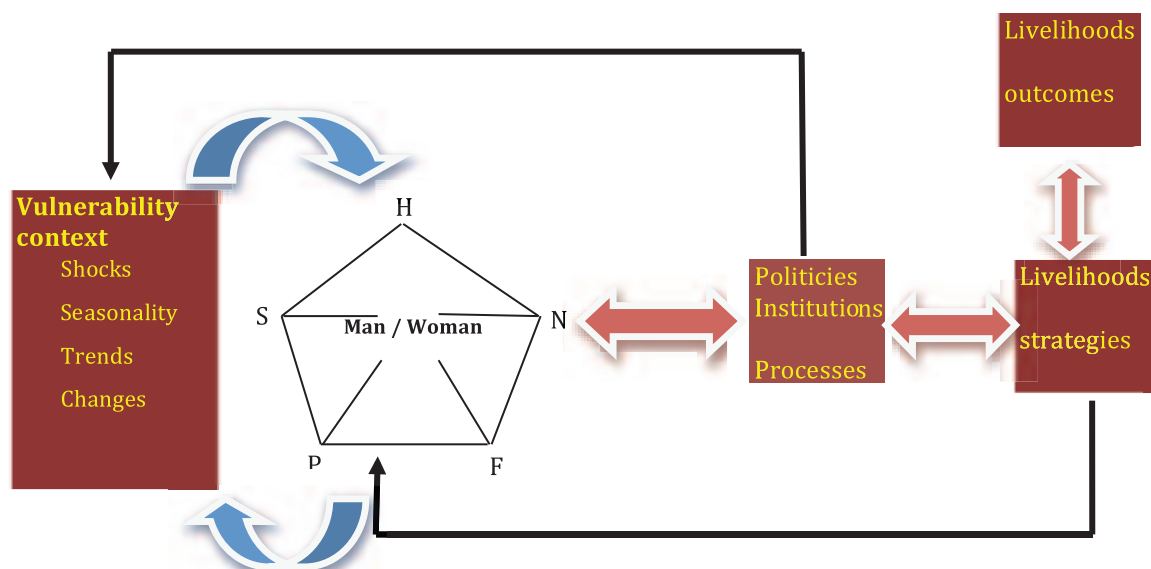


Figure 1: Sustainable livelihoods framework

Source: Adapted from Carney and al. (1999)

In fact, Figure 1 shows that people affected by the effects of climate change are at the center of a network of interrelated influences that have an impact on how they create livelihoods for themselves and their households. These people may have or not resources or assets and associated livelihoods, namely, natural resources (N), technology/infrastructure and equipment (P), skills/knowledge (H), the sources of income and credit (F), or the social networks (S). Access to these resources affects and is affected by the vulnerability context. Policies, institutions and processes interact directly or indirectly on the vulnerability context such as shocks (natural disasters, epidemics, etc.), seasonality (production, prices, employment, etc.), and trends (economic, political, and technological). Policies, institutions and processes directly influence the livelihood strategies implemented by people. Finally, livelihood strategies determine the outcome of livelihoods and vice versa.

This framework provides a good way to consider the livelihoods of people in relation with climate change taking into account the relationships with non-climatic factors such as policies, institutions and processes. It helps stimulate debate and reflection on the many factors influencing these livelihoods, how they interact and their relative importance in the CCAFS intervention villages. The application of this framework has been made possible using an appropriate toolkit for planning, monitoring and evaluation (Somda et al., 2010) that focuses on outcomes challenges in terms of change in behavior, relationships, actions and activities undertaken by rural communities and development partners. The tools are further described in sections 2.4 and 2.5.

2.2. Characteristics of the study area

This study was conducted in the province of Yatenga, the intervention site of the CCAFS program in Burkina Faso. The priority area (Figure 2) is a square block of 30 km x 30 km (900 km²) with the centre being the village of Tougo (Förch et al., 2013). This area includes approximately fifty villages and five rural municipalities.



Figure 2: Location of CCAFS intervention area in Burkina Faso

Source: Förch and al. (2013)

A baseline survey conducted in this area showed that agriculture remains the main economic production activity and rural households mainly depend on it for their livelihood (Somé et al., 2011). According to the same study, the majority of households (74%) in the program intervention area face food insecurity. This brings them to adopt new attitudes in the management of crops, farming practices and use of forest goods and services. Driving factors (or triggers) of these behavioral changes are among other climate vagaries, markets, agricultural land, labor, pests/diseases and external interventions by projects. These factors are reported by 80% of households surveyed (Somé et al. 2011), as key factors in the occurrence of changes in agro-sylvo-pastoral production systems in the area.

Thus, the impact of climate change in the intervention area is well-perceived by the local population. It is therefore important to improve the knowledge on this phenomenon and its relationship with the livelihoods of local populations.

2.3. Selection of the entry community and scaling up to the Yatenga province

Tibtenga village was selected as the entry point for the collection and analysis of data on the relationship between climate change and livelihood resources. The community in this village is the pilot from which we scaled up the learning and dissemination process for the adaptive capacity of agriculture and food security. The following criteria were used to select the village of Tibtenga as pilot community:

- village to be part of the seven villages where the baseline survey was conducted at household level;
- Village showing low intervention of agricultural extension services and of projects that will facilitate a better understanding the endogenous adaptation strategies to climate change;
- Village community's members committed to the participatory data collection and analysis and to participate in participatory action research;
- Village community's members accept to share information with other villages within the CCAFS block and to contribute to the implementation of a new approach to participatory action research.

2.4. Data collection and analysis at the community level

Data were collected using participatory tools for assessing vulnerability and capacity to adapt to climate change. They are extracted from the toolkit of planning, monitoring and evaluation of adaptive capacity - TOP-MECAC- (Somda et al. 2011). These tools allow going from (1) the analysis of the vulnerability status and adaptive capacity to climate change within a community, to (2) the development of a community vision, (3) the setting of outcomes challenges, (4) the identification of a plan of actions in order to strengthen adaptive capacity of people and their livelihood resources, and institutions. Finally, the tools allow identifying partners that can contribute to the implementation of adaptation actions. The tools are:

- Tool 1: **Climate Vulnerability and Capacity Analysis**. It consists of participatory mapping of resources and climate hazards in order to approximately locate in the village territory the main major livelihood resources and climate hazards faced by community members. Then a vulnerability matrix is developed to analyze how community-members perceive the influence of climate hazards on their main livelihood resources. Finally, a adaptation matrix is developed to identify and analyze adaptation strategies (current and/or future), including the level of importance of the main livelihood resources needed for the identified strategies;
- Tool 2: **The CRiSTAL** (Community-based Risk Screening Tool - Adaptation and Livelihoods). This tool allows the research team to computerise the data collected with the tool 1 in order to generate cross-tabulations on (1) climate hazards and their impacts on key resources and adaptation strategies of communities, (2) the extent to which the community's resources are influenced by climate hazards and the importance of different resources for the implementation of adaptation strategies, (3) the proposed actions and their influence on the most affected resources by climate hazards on the one hand, and secondly the influence of these actions on the most important resources for adaptation.

- Tool 3: **Participatory Analysis of vulnerability factors.** This tool provides a rough overview of the magnitude of the effects of climate hazards for local communities. It allows estimating in a participatory manner with communities' members, the proportion of households that are most vulnerable to each identified hazard ; and the proportion that is actually sensitive to the hazards because they have lost all or part of their livelihoods due to the effects of the hazard.
- Tool 4: **Vision-Action-Partnership (VAP).** This tool allows community members to project themselves into the future of the climate change context. In a participatory manner, the community members define an ideal situation in which they would like to be, despite the existence of climate hazards. The definition of the ideal situation is based on the different observed impacts of climate hazards. They then identify actions to be implemented by themselves and partners to whom they address specific requests.

It should be noted that the four tools are fundamentally linked, and the results of one tool are used as inputs in the application of the other.

All this information is entered into the CRiSTAL tool which makes automatic synthesis in Excel spreadsheet. With these synthetic data, the research team continues to facilitate the analysis of vulnerability through guiding community-members into participatory analysis of vulnerabilities factors for each major hazard. Three vulnerabilities factors are analyzed: the exposure, sensitivity and reasons of sensitivity. This analysis is done keeping in mind the participatory map to cross-check the consistency between (i) the spatial distribution of climate hazards and livelihood resources and (ii) the extent of exposure and sensitivity of households. The main observed impacts are then grouped by category of impacted livelihood resources to help community members conducting a prospective analysis in order to identify elements of their vision. For each element of the vision, community members identify actions they will implement themselves and one or more partners to whom they formulate specific requests.

The information collected with these four tools are analyzed by the research team and synthesized for the next step which is the collection and analysis of supra-community level data on vulnerability, adaptive capacities and vision elements. In addition, the partners identified by the communities are invited to a supra-community (provincial) level workshop.



Assessment of vulnerability and adaptive capacity by women group



Assessment of vulnerability and adaptive capacity by men group

2.5. Data collection and analysis at the supra-community level

The objective of the supra-community step is threefold: (1) ensure that the entry community is not a special case in terms of climate hazards and adaptation strategies and that it has similarities and / or differences with other communities in the same area, (2) promote exchanges between communities and technical services and NGOs working in the region to harmonize understandings of climate hazards and their impacts, as well as adaptation strategies, vision, actions and partners as identified by communities, (3) validate all the information and identify the outcomes challenges that each partner can set up to contribute to the validated vision.

Thus, the information collected and analyzed using tools 1 to 4 with community members of the Tibtenga village were shared at the supra-community workshop. This workshop was attended by representatives of four other village communities (Pabio, Ramdola, Lemnogo Mossi and Koubi-Thiou), central and decentralized technical partners (research institute, technical services and NGOs) and policy makers at decentralized level (municipal, provincial and regional).

After a plenary session to present results from Tibtenga village, participants were divided into two groups (men and women) to enrich the above results from tools 1 to 4, in order to take into account the specificities of the four new villages. After this validation, participants were grouped into categories of actors defined as boundary partners of the CCAFS program in the five villages.

Five groups of partners were formed: the local communities, agro-sylvo-pastoral extension/technical services, scientific research institutes, non-governmental organizations, organizations for conservation of nature. Each group identified an outcome challenge using tool 5 from the TOP-MECAC toolkit. This tool allowed the different groups of partners to identify changes they will implement if adaptation to the effects of climate change was a success.

Thus, each group of partner presented changes in its behavior, activities and relationships that it would put in place to contribute to the vision of the local communities. Proposed outcome challenges from one group of partners were discussed and validated by the other groups. The validated outcome challenges were then considered as the most significant behavioural changes that the CCAFS program would help partners to implement in support to the vision previously formulated and validated using the tool 4.

2.6. Mainstreaming gender dimension in data collection and analysis

The gap of gender equity in agriculture means that women and men in developing countries have unequal vulnerabilities and capacities to cope with the impact of climate change on agriculture (Ashby and al.2012). In order to ensure that interventions of the CCAFS program in the Tougou block are inclusive for women and men, it is essential to involve both genders in the process of planning, monitoring and evaluation of adaptive capacity to climate change. The assumption underlying this approach is that adaptation to climate change will be greater if both women and men are able to monitor and assess the behavioral changes they put in place.

Thus, the gender differentiation was constant throughout the process of collecting and analyzing data on climate hazards, livelihood resources and their interrelationships. Tools 1 to 4 were applied in gender-based group discussions, before discussing the results in plenary for the overall situation of the five communities. This differentiation aims to ensure the inclusion of differential effects of climatic conditions on the livelihood resources that women and men from the villages considered as important to them. It helped to ensure that the defined vision includes the perspectives of both socio-economic groups.

The definition of a consensual vision by men and women, and their development partners is important for the success of adaptation measures in the agricultural sector. Indeed, several studies indicate that climate change adaptation programs are often biased against women, by implementing activities predominantly male. This discrimination between women and men in adaptation programs is a limiting factor in achieving the common vision which men and women have complementary roles to play in. Thus, mainstreaming gender into policies and making resources available for the development of women have promising significant benefits to the families and the entire economies (Kabutha, 1999).

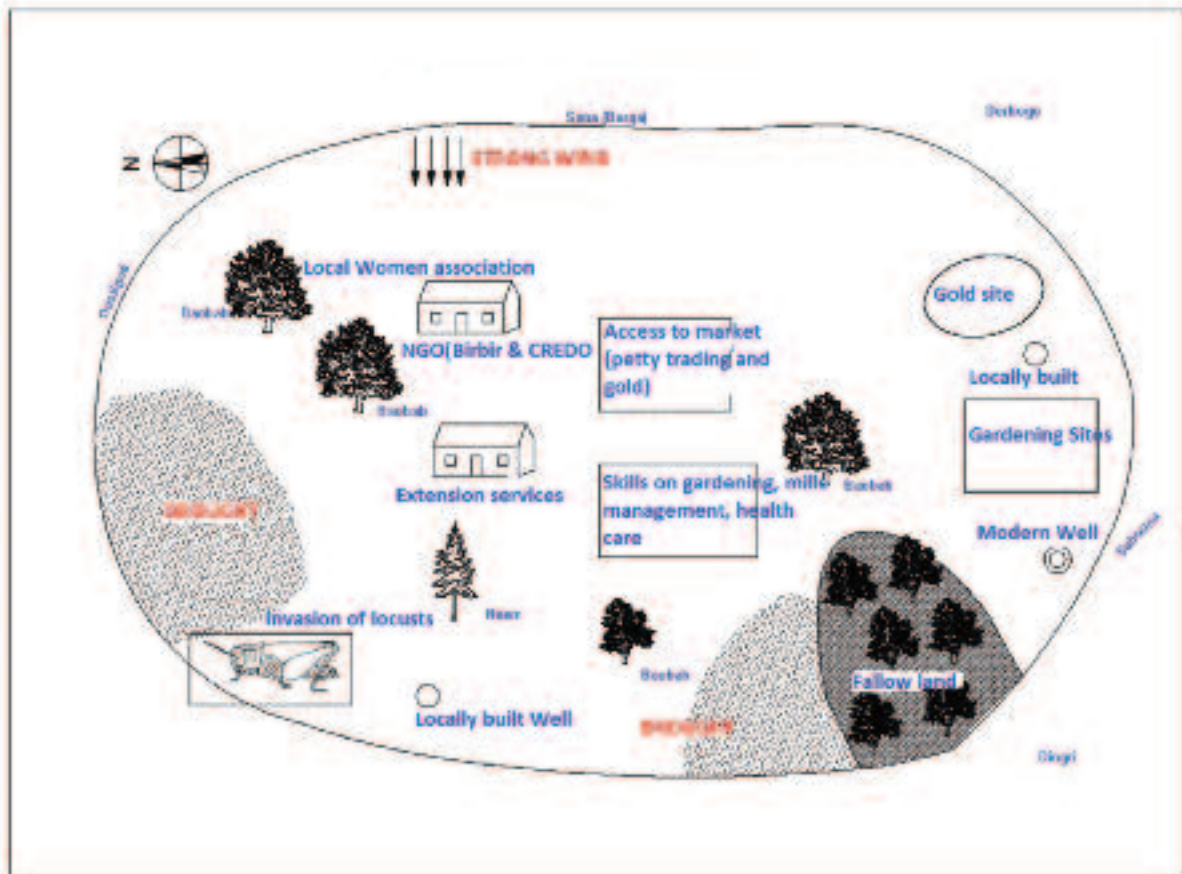
III. ASSESSMENT OF THE COMMUNITY VULNERABILITY AND ADAPTATION TO CLIMATE CHANGE

3.1. Livelihood resources map and vulnerability matrix

The results obtained at the community and at the regional workshops showed that all categories of resources (Natural, Physical, Human, Financial and Social) exist in the villages and are of different types (Figure 3a & 3b). However, natural, physical and financial resources are considered by communities as being the most important categories of resources to their livelihoods. The emphasis on a category of resource is based on gender, which indicates the gender-specific importance of that resource. For example, beside the agricultural land, livestock and pasture are the natural resources that contribute mostly to the livelihoods of men, while women considered fuel wood.



(a): Participatory mapping of resources and climate change hazards as perceived by Tibtenga men



b): Participatory mapping of resources and climate change hazards as perceived by Tibtenga women

Figure 3: Participatory maps of key resources and climate hazards in Tibtenga, Yatenga, Burkina Faso.

The participatory mapping of resources and climate hazards suggests that men and women in five communities have points of convergence and divergence. Thus, among the four most important natural resources, agricultural lands are equally important for men and women. While livestock and pasture lands seem more important for men, fuel wood is considered more important by women. In terms of physical resources, men and women have equally identified water infrastructure. Agricultural equipment and mosques (important for prayers to ask God for more favorable climatic conditions) have been identified by men, whereas women have referred to houses.

The analysis of the vulnerability matrix for livelihood resources shows that three climate hazards (drought, strong winds and floods) are considered by men to be the most influencing on the community resources. On the other hand, women identified drought and strong wind as the most influencing. Both groups are unanimous that drought is the most important by its degree of influence on the resources, followed by strong winds. Indeed, the evaluation of the degree of influence of all hazards on resources (Table 1) using a scale from 0 to 5, shows that natural resources, especially agricultural land, livestock and pasture land, are the most influenced by climate hazards. Financial resources (incomes derived from the sale of cash crops) are the second most influenced resources by climate hazards. Water infrastructure (wells as physical resource) and, to a lesser extent, revenues from the sale of gold are also importantly affected by climate hazards.

Table 1: Assessment of the extent to which climate hazards influence livelihoods resources

Climate hazards	Drought		Strong wind		Flood		Total		
	M	W	M	W	M	W	M	W	T
<i>Natural Resources</i>									
Farm lands	5	5	5	4	4	-	14	9	23
Livestock	5	-	5	-	4	-	14	-	14
Pasture lands	5	-	4	-	2	-	11	-	11
Fuel wood	-	5	-	3	-	-	-	8	8
<i>Physical resources</i>									
Water facilities (wells)	5	0	2	2	2	-	9	2	11
Agricultural material/equipment	3	-	0		0	-	3	-	3
Mosques	0	-	1		0	-	1	-	1
Houses	-	0	-	3	-	-	-	3	3
<i>Financial resources</i>									
Income from the sale of animals	4	-	1	-	0	-	5	-	5
Income from the sale of cash crops	5	3	5	-	2	-	12	3	15
Income from the sale of gold	0	3	3	0	3	-	6	3	9
Total conditions/gender	32	16	26	12	17	-			

Note: - means that the group did not report the resources or the climate hazards as important.
M = Men group; W = women group and B = both groups.

Source: Field data (2012)

These results reinforce the need for a gender-based approach to analyzing the vulnerability to climate change. Resources that are considered important by men are not necessarily the same for women and vice versa. This also applies to the most important climate and non-climate hazards. Indeed, men and women have different perceptions of the level of influence of climate hazards on the most important livelihoods resources. This information is the entry point for adaptation to climate change because it allows understanding the location of the main livelihood resources and climate hazards in the communities' territory. It also helps to prioritize actions on the most important resources and hazard which has a strong influence on the vulnerability of women and men.

3.2. Assessment of the impacts of climate hazards and related adaptation strategies

Communities have demonstrated some awareness vis-à-vis climate hazards through the development of the strategies they implement to curb the impacts on livelihoods resources. Participatory assessment of impacts and current strategies was used to assess their effectiveness and sustainability and to identify alternative strategies. These alternatives were analyzed against factors limiting their effective adoption by members of the five communities, for each gender-based group (Table 2). This section analyzes the potential impacts of climate variability on the most important livelihood resources and the appropriate adaptation strategies. The analysis is conducted for each climate hazard. For the same climate hazards, impacts observed by men and women showed similarities and differences.

3.2.1. Drought and the related adaptation strategies

The observed impacts of drought by men are the declining of agricultural production, water scarcity and the degradation of pastures. Current responses described by men consist of buying foodstuff with income from trade, over-digging wells, the combined feed rationing and the use of agro-industrial by-products (SPAI) and crop residues for livestock, respectively. They did not identify alternative responses to buying food when agricultural production drops down as a consequence of the drought. They reported alternative strategies to feed rationing for livestock and to over-digging of wells. In the first case, they reported the use of fodder trees as an alternative to food rationing for livestock. But, the effective adoption of this alternative is constrained by the forest legislation which prohibits the cutting of trees. For the over-digging wells, alternative identified by the communities is the boreholes. But the lack of financial resources and partners prevents them to perform drilling.

From the women perspective, the observed impacts of drought are the declining of agricultural production, water scarcity and trees mortality. Current strategies described by women to counter these observed impacts are, respectively, the use of soil restoration and water conservation techniques (SR/WC), rationing of water and planting trees. The alternative strategy to the use of soil restoration and water conservation techniques (SR/WC) as reported by women is the use of improved and adapted seeds. For water rationing, they identified the increasing of the availability of water resource as an alternative. Finally, the alternative to planting trees to counter their mortality is the development of agricultural land and assisted natural regeneration.

Table 2: Observed impacts from drought and related adaptation strategies

Observed impacts from drought	Adaptation Strategies	Factors preventing the adoption of the strategy
Men		
Decrease in agricultural production	Buying foodstuff with money from various petty trading (BF)	No preventing factor was identified
Water shortage	Building boreholes (BB)	Insufficient financial resources.
Degradation of grazing lands	Valuing fodder Trees(VFT)	Inappropriate legislation.
Women		
Decrease in agricultural production	Use improved/adapted seeds (UI/AS)	Low availability of adapted seeds.
Water shortage	Increase the availability of water resources (IAWR)	Insufficient material and technical assistance.
Mortality of trees	Development of farm lands and assisted natural regeneration (DFL&ANR)	Insufficient technical and material assistance.

Note: - means that the group did not mention this particular resource or condition as important.

M = Man; F = Woman and B = both groups.

Source: Community groups discussion (2012)

3.2.2. Strong wind and the related adaptation strategies

Like for the drought, the observed impacts of strong wind (Table 3) are different depending on the gender-based group. In the men group many observed impacts of strong wind were recorded, including the decline in fruit production, the decline in agricultural production, uprooting of trees, and the destruction of houses and the death of animals. Among the observed impacts by women, two are similar to those of men (up roofing of houses and uprooting of trees), while the third appears to be specifically observed by women (falling of crops).

Adaptation strategies implemented by men against the observed impacts of strong wind are:

- ***The development of farm land associated with assisted natural regeneration*** to fight against the decline in fruit production and uprooting trees;
- ***The purchase of food using incomes from petty trading*** to manage the decline in agricultural production,
- ***Strengthening of houses designed with local materials*** to prevent the destruction of homes and,
- ***The increased surveillance of animals*** to reduce their death.

Some of these strategies have been found to be ineffective and unsustainable and alternatives have been identified. Thus, the strengthening of buildings designed with local materials was considered inefficient and unsustainable because local materials cannot withstand the wind for long. The construction of buildings with permanent materials was then identified as an effective and sustainable alternative. However, the lack of financial resources prevents them using such materials for residential buildings. Likewise, increased surveillance of animals was inefficient and unsustainable against animal mortality; and the construction of habitats was identified as more effective and sustainable. However, the construction of habitats requires financial resources that are deemed insufficient at this time by the communities.

From the women perspective, coping strategies currently implemented to address the three main impacts of strong wind are to grouping community houses to reduce up-roofing, planting adapted tree species to prevent their uprooting and practicing hilling of crops against falling down. The assessment of these strategies has shown that they were not effective and sustainable. As an effective and sustainable strategy to reduce houses up-roofing is the strengthening of the houses' roofs. To effectively and sustainably fight against the falling of crop caused by strong wind, women have identified the development of agricultural land combined with assisted natural regeneration. But the adoption of this option is constrained by the lack of technical assistance and equipment.

Table 3: Observed impacts from strong wind and related adaptation strategies

Observed impacts from strong wind	Adaptation strategies	Factors preventing the adoption of the strategy
Men		
Decrease of fruit production	Development of farm lands and assisted natural regeneration (DFL&ANR)	Insufficient technical and material support
Decrease in agricultural production	Buying foodstuff with money from various petty trading (BF) (BF)	No preventing factor was identified
Uprooting of trees	Development of farm lands and assisted natural regeneration (DFL&ANR)	Insufficient technical and material support
Destruction of houses	Building houses with permanent materials (BHPM)	Insufficient financial resources
Mortality of animals	Building habitats for livestock (BHL)	No preventing factor was identified
Women		
Up-roofing of houses	Strengthening house roofs (SHR)	No preventing factor was identified
Up-rooting of trees	Planting adapted species (PAS)	No preventing factor was identified
Uprooting of crops	Development of farm lands and assisted natural regeneration (DFL&ANR)	Insufficient technical and material support

Source: Community Group Discussions (2012)

3.2.3. Flood and related adaptation strategies

The flood, only identified by men as a hazard which substantially affects their resources, also causes the decline in agricultural production, the habitat destruction and the death of livestock (and sometimes even human being) (Table 4). To adapt to the effects of flood, men reported using the same strategies as those implemented against the effects of wind. Thus, the strategy of building houses with permanent materials, already being implemented against the up-roofing of houses caused by strong wind, was identified against the death of animals due to flooding. However, the implementation of such a strategy is also constrained by the lack of financial resources.

Table 4: Impacts of flood and adaptation strategies

Observed impacts from flood	Adaptation strategies	Factors preventing the adoption of the strategy
Decrease in agricultural production	Buying foodstuff with money from various petty trading (BF)	No preventing factor was identified
Destruction of houses	Building houses with permanent materials (BHPM)	Insufficient financial resources
Mortality of animals (and rarely humans)	Building habitats for livestock (BHL)	No preventing factor was identified

Source: Community Group Discussions (2012)

3.2.4. Vulnerability assessment for planning, monitoring and evaluating adaptation capacities

Planning is a process of organizing resources to achieve a defined objective in a given time. This objective itself is defined from the problems which are identified and analyzed. Vulnerability analysis in view of planning, monitoring and evaluation slightly differs from vulnerability analysis with the view to improve knowledge on the population situation with respect to climate change. The first proceeds by targeted analysis of problems in order to identify actions to be implemented, monitored and evaluated, and then be re-analyzed and so on. The second focuses on documenting problems and solutions without necessarily providing concrete interventions. In our case, the conduct of the vulnerability analysis aimed at planning, monitoring and evaluating actions geared toward climate change adaptation, particularly the changes in partners' behavior (relationship, action) induced by the adaptation actions.

The vulnerability analysis then focused on three main climate hazards in five communities, knowing that there are other climate and non-climate hazards. In fact, in addition to the three hazards analyzed with men group, it is worth mentioning the high temperatures whose effects were found lower than those of drought, flood and strong wind. In the women group, although floods and high temperatures was reported in the list, they have limited the in-depth analysis to two climate hazards (drought and strong wind) considered as the most influential on their livelihood resources. Women also reported the locust invasion as a non-climate hazard. Although its effects are important, locust invasion is not recurring on plant resources.

These results confirm previous studies (Burkina Faso, 2007; Ouedraogo et al, 2010. Romero et al, 2011.). In particular, Ouedraogo et al. (2010) reported the same climate hazards, impacts and adaptation strategies adopted by rural communities in the Sahelian, North-Sudan and South-Sudan areas. The authors noted that factors such as the level of wealth, technical endowment, education, information, skills, and access to financial resources are important for adaptation to the impacts of climate hazards.

The results of the participatory assessments conducted with the five communities suggest that adaptation must be done by connecting each climate hazards to the associated impacts on key livelihood resources. Indeed, it is clear that three different climate hazards in their nature, territorial control and frequency can create the same observed impact. This is the case of the three main climate hazards (flood, drought and strong wind) impact that reduce agricultural production. This observed decrease in production from the three climate hazards reflects the risk of food insecurity reported by several authors (Somé et al, 2011; Billaz, 2012).

Moreover, the territorial control of the three hazards is not the same according to the participatory mapping. If agricultural land is considered as the main livelihood resource influenced by the three climate hazards, it is worth noting that parts of the most flood prone areas in a village are not necessary drought sensitive. On the other hand, strong wind affect the entire territory and even beyond the boundaries of a given village. The implication of these results is that the identification of adaptation actions must take into account the hazard, its observed impacts and territorial influence (scope).

Once the hazards, their impacts and territorial influence are known, it is important to note that one adaptation strategy can be used to reduce the impacts of several climate hazards. For example, the development of agricultural land combined with the assisted natural regeneration has been identified as a effective and sustainable strategy to adapt to the effects of drought (women) and strong wind (men). Thus, there exists coping strategies with multiple objectives in terms of building capacity of rural communities.

Taking gender into account in the process of assessing the vulnerability and livelihood resources also allows identifying strategies that can be described as gender-neutral in that they are geared to both women and men. It is likely that observed impacts by one or the other gender-based group are related to resources it can access and make use. The gender-based analysis therefore has the advantage of developing actions to strengthen women-oriented capabilities, or men or both.

Finally, although the communities are aware of the existence of effective and sustainable coping strategies against the effects of climate hazards, they do not always have all the necessary capabilities to implement them. According to Ouedraogo et al. (2010), the identification of important factors to the adaptation will not be enough to guide the adaptation action if an analysis of limiting factors is not made. Such an analysis provides additional information for projects / programs to better direct their contribution to building adaptive capacity. In this way, the project and the beneficiaries would share the investment (in kind and/or cash) at the onset of the intervention to ensure successful adaptation. This implies for both the beneficiaries and the project/program managers to put in place changes in the way they behave, interact and implement actions and activities. These kinds of changes are needed to support the strengthening of climate change adaptive capacity.

3.3. Extent to which the livelihood resources are important to implement the adaptation strategies

The set of adaptation strategies requires available livelihood resources for their implementation. This section analyses from the communities members perspective, the importance of each main resource for the implementation of the identified strategies. The results are presented as scores ranging from 0 to 5. The 0 score is given to resource which is not important to implement a specific strategy. On the other hand, resource is scored 5, if it is deemed very important for the strategy. If a resource is on average important to implement the strategy, score of 3 is assigned. Other scores indicate below average importance (score 1 or 2) or above average (score 4). The analysis is also made by gender (men and women) group.

3.3.1. Analysis of the importance of resources to implement the adaptation strategies as per men group

Table 5 summarizes the results of the participatory analysis conducted with the group of men. The individual importance of the main livelihood resources for the implementation of each coping strategy can be seen. The total column indicates the level of importance of resources for all three strategies per climate hazard. Thus, three resources can be considered very important to implement the three coping strategies (buying foodstuff, using fodder trees and building boreholes) when drought occurs. These are the income from artisanal gold mining, equipment and farming tools and livestock herd. In general, Men considered natural, physical and financial resources groups as medium to very important for the implementation of the identified adaptation strategies. Human and social resources are deemed less important.

Table 5: Assessment of the importance of resources to apply adaptation strategies identified by men

Climate hazards	Drought				Strong winds			
Resources / Strategies	BF	VFT	BB	Total	DFL/ANR	BHPM	BHL	Total
Natural resources								
Farm lands	0	5	0	5	5	0	3	8
Livestock	5	5	3	13	3	3	5	11
Pasture land	3	3	3	9	0	3	3	6
Physical resources								
Water facilities (wells)	3	3	3	9	3	5	5	13
Agricultural equipment/materials	3	5	5	13	5	5	3	13
Mosques	0	0	0	0	0	0	0	0
Financial resources								
Income from the sale of animals	5	3	3	11	3	5	5	13
Income from the sale of cash crops (sesame, peanuts, beans)	3	3	3	9	3	3	3	9
Income from the sale of gold	5	5	5	15	3	5	5	13
Human resources								
Knowledge on DLR/CWS	3	3	0	6	5	0	0	5
Knowledge on AGF	0	3	0	3	3	0	0	3
Techniques on livestock breeding (fattening)	0	3	0	3	0	0	0	0
Social resources								
NGOs	3	0	0	3	3	0	0	3
Rural development agencies	3	3	0	6	3	0	3	6
Total per strategy	36	47	25		39	29	35	

BF = Buying foodstuff; VFT = Valuing fodder trees; BB = Building Borehole;
 DFL/ANR = development of farm lands / assisted natural regeneration; BHPM = Building houses with permanent materials;
 BHL = Building habitat for livestock. DLR/CWS = Defence and land restoration /conservation of water and soil. AGF = agro forestry

The total score per strategy allows comparing adaptation strategies in terms of their resources requirement. Thus, valuing fodder trees to combat the effects of drought is likely the most resources-demanding strategy, as compared to buying foodstuff and building boreholes. For strategies to adapt to the effects of wind, the development of farmland associated with assisted natural regeneration was scored as the most resources-demanding. This strategy is followed by the construction of habitats for livestock. The less resources-demanding strategy is the construction of residential houses with permanent materials.

3.3.2. Analysis of the importance of resources to apply the adaptation strategies as per women group

The results of the participatory analysis of the importance of resources to implement adaptation strategies conducted with the group of women are shown in Table 6. The total column indicates that in terms of decreasing importance, the most important resources to adapt to the effects of drought are farmland, technical extension services and knowledge in agricultural techniques. To implement adaptation strategies against the effects of strong wind, the most important resources are: farmland and residential houses.

Table 6: Assessment of the importance of resources to apply adaptation strategies identified by women

Climate hazards Resources/Strategies	Drought				Strong wind			
	DFL/ ANR	IAWR	UI/AS	Total	SHR	PAS	DFL/ ANR	Total
Natural resources								
Fuel wood	0	0	0	0	0	0	0	0
Farm lands	5	0	5	10	0	5	5	10
Gold mining sites	0	0	0	0	0	0	0	0
Physical resources								
Water facilities	0	4	4	8	0	2	0	2
Houses	3	3	2	8	4	3	3	10
Financial resources								
Access to credit	0	0	0	0	0	0	0	0
Income from the sale of gold	0	0	4	4	5	0	0	5
Access to market	0	0	0	0	2	0	0	2
Human resources								
Knowledge on farming techniques	4	0	5	9	0	4	0	4
Knowledge on managing mills unit	0	0	0	0	0	0	0	0
Knowledge on health cares	2	0	3	5	0	3	0	3
Social resources								
NGOs	3	0	0	3	0	-	0	0
Rural development agencies	5	0	5	10	0	-	5	5
Local Women's Association (e.g. Delwendé)	3	0	5	8	0	3	5	8
Total per strategy	25	7	33		11	20	18	

DFL/ANR = development of farm lands /assisted-natural regeneration; IAWR = Increasing water the availability of resources; UI/AS = Using of improved/adapted seeds; SHR = Strengthening houses' roofs with adapted materials; PAS = Planting adapted species.

Comparing the resource requirements of the adaptation strategies to the effects of drought, the use of improved/adapted seeds would require more resources. It is followed by the development of agricultural land associated with assisted natural regeneration and then by the increase of water availability. For the adaptation strategies to strong wind, planting adapted species require more resources. The development of agricultural land associated with assisted natural regeneration and the strengthening of roofs with suitable materials are scored respectively in second and third position in terms of resource requirement.

3.3.3. Comparative analysis of the importance of livelihood resources to apply the adaptation strategies

The overall analysis of the importance of resources to implement all identified coping strategies indicates differences of perspectives between the group of women and men. This analysis is done by summing the score attributed to each resource in a given category of livelihood resources (Table 7). According to men, the most important category of resources to implement adaptation strategies to drought are, in terms of decreasing importance: financial, natural, physical, human and social. For the women group, the category of social resources was scored the highest, followed by physical, human, and natural and financial.

Table 7: Aggregate score of the importance of the resource categories to implement strategies to adapt to droughts and strong winds

Category of resources	Drought		Strong wind	
	Men	Women	Men	Women
Natural	27	10	25	10
Physical	22	16	26	12
Financial	35	4	35	7
Human	12	14	8	7
Social	9	21	9	13

For men, adaptation to observed effects of strong wind is heavily dependent on financial resources, followed by physical, natural, social and human. Women considered social resources as paramount to adapt to the observed effects of strong winds. They are followed by the physical, natural, financial and human resources.

These differences in perspectives between men and women are probably due to differences in access to information and trainings, and in the degree of scarcity of resources that each genre-based group faces. Previous studies have reported unequal access to climate information between the two genders. Thus, Somé et al. (2011) reported that more men (62%) than women (1%) have access to climate information in Tougou block. Romero et al. (2011) reported that women are more vulnerable to climate change because of their precarious livelihoods resources. This seems to explain the differences in the importance of resources for adaptation to the effects of the different climate hazards. Socio-political and macroeconomic factors may also explain this discrepancy, but these aspects are not addressed in this paper.

3.4. Analysis of the vulnerability factors to climate hazards

3.4.1. Vulnerability factors analysed by men group

The observed impacts of climate hazards are those that affect people in rural communities with varying degrees. Table 8 gives an idea of the perspective of men. According to them, all households in the five communities are exposed to the decline in agricultural production due to strong wind, but 70% are deemed sensitive to it. The same impact is observed from the drought with 70-80 % of households exposed and 50-60 % sensitive. The third climate hazard (flood) also causes the decrease in agricultural production. At this level, men have estimated

that 50% of household resources are exposed to flood, but 30% are sensitive. The main reason why a household is sensitive to a hazard is mainly due to the fact that much of its resources are under the territorial control of the hazard against a small proportion outside its control. The second reason given regarding the sensitivity is that the available crop varieties are not adapted to the hazard and therefore cannot resist to its effects.

Table 8: Perceived level of households' vulnerability to climate hazards by men group

Climate hazards	Observed key impacts	% of households exposed	% of households impacted
Drought	Decrease in agricultural production	70-80	50-60
	Degradation of grazing land	70	40
	Water shortage	60	30
Strong wind	Decrease in agricultural production	100	70
	Mortality of trees	50	20
	Destruction of houses	30	10
Flood	Decrease in agricultural production	50	30
	Destruction of houses	40	20
	Mortality of animals (and rarely humans)	0	0

Source: Community Group Discussion (2012)

Other important impacts in terms of households affected in the community are: degradation of grazing land (70% exposed and 40% sensitive), water shortage (60% exposed and 30% sensitive), mortality of trees (50% exposed and 20% sensitive) and destruction of houses (40% exposed and 20% sensitive). Note that in this case, the death of human-being (especially children) and of animals due to floods is rather rarely observed impact. Over a long period, the level of exposure and sensitivity of households to this impact approaches zero.

3.4.2. Vulnerability factors analysed by women group

Table 9 summarizes the analysis of vulnerability factors from the perspective of the women group. According to them, all households in their communities are exposed to tree mortality and the insufficiency of water due to drought. But, 60% and 80% of households are affected by tree mortality and lack of water, respectively. For the tree mortality, the presence of termites and insufficient water in the plots explain why 60% of households. The high demand of water for people and livestock has led 80% of households sensitive to water shortage. The decline in agricultural production due to drought concerns 80% of households in the communities are sensitive, but 60% are sensitive because of the poor quality of the soil in their farmland.

Table 9: Perceived level of households' vulnerability to climate hazards by women group

Climate hazards	Observed key impacts	% of households exposed	% of households impacted
Drought	Mortality of trees	100	60
	Water shortage	100	80
	Decrease in agricultural production	80	60
Strong wind	Up-roofing of houses	40	20
	Up-rooting of trees	100	100
	Up-rooting of crops	100	100

Source: Community Group Discussion (2012)

In relation to the strong wind, the vulnerability analysis made with the women's group shows that all households in the communities are exposed to uprooting of trees and falling of crop. They are also all sensitive to both impacts. The main reasons are the low density of trees and the attacks by soil pests in the territories of the communities. In contrast, the level of exposure of households in up roofing of houses due to strong wind is relatively low (40%) and only 20% are affected by this impact due to poor construction techniques and use of inappropriate building materials.

3.4.3. Implications of households' exposure and sensitivity to climate hazards on food security

The levels of exposure and sensitivity of households vis-à-vis climate hazards were estimated during group discussion. They must therefore be considered with caution because they can be either undervalued or overvalued. But, whatever the cases, they reflect the perception of each gender-based group on the vulnerability of their communities. In particular, they suggest that all farm households are not necessarily vulnerable as indicated in the National Adaptation Plan of Actions (Burkina Faso, 2007). To be considered as vulnerable to climate change, a household must first be exposed to at least one climate hazard, be sensitive to it and with no capacity to adapt to it.

The results also indicate that agricultural production is affected by drought, strong wind and flood. This raises the question of food security when taking into account the precarious of livelihood resources in rural areas. This relationship between climate hazards and food security was analyzed by Somé et al. (2011). According to these authors, about 91% of households in the project area are facing food insecurity for at least three months (July to September) in the year. In addition, 83% of surveyed households were faced with crises in climate over the last 5 years. In the northern region of Burkina Faso, the cycles of climate crises coincide with that of the food insecurity (Billaz, 2012).

Finally, the vulnerability is not homogeneous within a community. It is the same for food security within a community. This heterogeneity among households in a community should be considered in actions to adapt to climate change aiming at improving food security. The implementation of a phased approach, based on a good understanding of sensitive households and those households exposed but not being sensitive at a given time, is important and necessary for decision making with respect to the need for emergency assistance.

IV. FROM VULNERABILITY ASSESSMENT TO PLANNING, MONITORING AND EVALUATION OF ADAPTATION CAPACITIES TO CLIMATE CHANGE

The planned adaptation (IPCC, 2000) is a complementary form of spontaneous adaptation discussed above. It aims at strengthening adaptive capacity (with regards to the impacts of climate change) defined as the ability of a system to adapt to climate change (including climate variability and extremes) in order to moderate potential damages, take advantage of opportunities, or to cope with the consequences (IPCC, 2000). Thus, using information from the participatory assessment of vulnerability and adaptation strategies, it was possible to plan, monitor and evaluation adaptation in the five communities of the Tougou block in Burkina Faso. This section describes the planning process and the results achieved.

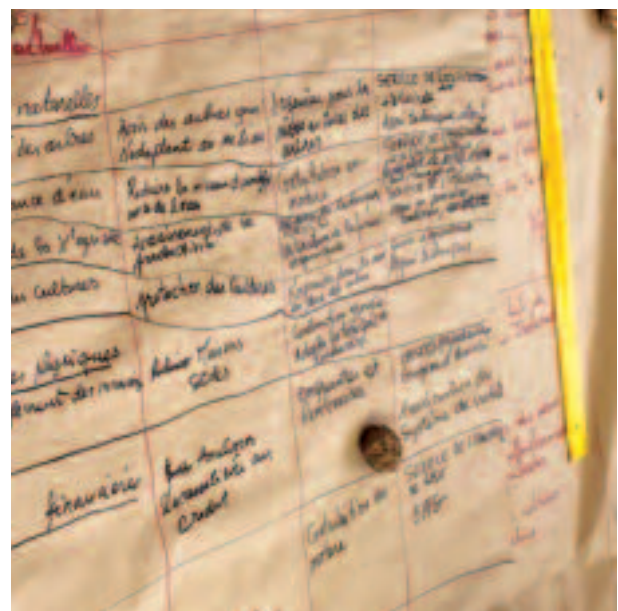


Adaptation planning with the group of women

4.1. Vision for the future and behavioural changes challenges of partners

The vision describes the long-term aspirations of local communities and their development partners. It incorporates the current situation of climate hazards in the area, including climatic variations and their impacts. The vision was originally developed by Tibtenga's community-members, based on the observed impacts of three main climate hazards.

It was further discussed and validated during a supra-community workshop that brought together representatives of the five local communities (Tibtenga, Koubi-thiou, Ramdola, Lemnogo-Mossi and Pabio), technical services in charge of rural development (agriculture, livestock, environment and sustainable development), research institutions, non-governmental organizations and international organization of nature conservation. The vision covers a period of 5 to 10 years and embraces various aspects of socio-economic development (Table 10).



Partial view of the Vision-Action Partnership matrix developed by the group of men.

Table 10: Defining the vision of the CCAFS program boundary partners

<p>Abstract of the vision statement: «In the five rural communities, men and women are healthy, educated and skilled in agricultural production. Men and women restore natural resources with species adapted to climate hazards and strengthen their partnership with technical services for food self-sufficiency of both humans and livestock, and financial autonomy and improved infrastructure».</p>
<p>Detailed statement of the vision as per the men and women groups</p> <p>«In the communities of Tibtenga, Koubi-thiou, Ramdola, Lemnogo-Mossi and Pabio, men harvest enough to ensure food security. They value feed for the intensification of livestock production and ensure healthy animals. Water is sufficiently available and accessible to both humans and livestock. The territories are well wooded. Houses and infrastructure (stores, vaccination parks) are resistant to climate hazards and the villages are opened up. People are educated and have knowledge and skills to diversify their sources of income. Communities strengthen their partnership with technical and administrative services. Women use adapted tree species to restore the canopy. Drinking water is available and sufficiently accessible to both humans and livestock. Women protect crops to increase agricultural productivity, have enough food for humans and livestock and ensure food security. Houses are strong enough to resist the effects of climate hazards. People improve their access to credit and become financially independent. People are well trained, competent and healthy. Animals are healthy. People have an increased access to technical and administrative services.</p> <p>In summary, in the five rural communities, men and women are healthy, educated and skilled in agricultural production. Men and women restore natural resources with species adapted to climate hazards and strengthen their partnership with technical services for food self-sufficiency of both humans and livestock, and financial autonomy and improved infrastructure».</p>

Source: Supra-community workshop of the CCAFS boundary partners (2012)

The analysis of the vision (abstract and detailed statements) shows a convergence with the CGIAR's vision as stated in the document of the program on climate change, agriculture and food security (CGIAR, 2011), but goes beyond agriculture and food security by integrating aspects on finance, health, infrastructure and education. As defined by communities and their partners, no single organization can bring about such a vision. Organizations working for the welfare of people are all challenged by this vision. Therefore, understand this vision enables all relevant development partners to make effective their contribution. It appears in this vision that CCAFS program could make a contribution in the area of strengthening agricultural skills of the people to help them restore their natural resources with adapted species and strengthen their partnership with other development partners.

The type of the contribution expected from the CCAFS program involves changes in the behavior of its stakeholders. The change that was repeatedly raised by the stakeholders at the supra-community workshop is related to the establishment or consolidation of the partnership in all actions. While all stakeholders reported the development / strengthening of the partnership, it was not clear whether they had the same understanding of this concept. It is therefore appropriate for the programme to enhance the understanding of the concept of partnership and to develop appropriate measures to support other activities such as the participatory action research. This suggests that the programme should specifically take into account the development of partnerships as an important expected outcome. In fact, partnership is still to be developed in Burkina Faso in general and in northern region to support the development of the climate change adaptive capacities.

4.2. Challenges of the behavioural changes to achieve the vision

The challenges for the behavioral changes (or outcomes challenges) as reported by the partners are deemed to be influenced by the programme. They describe how behavior, relationships, activities or actions of a person, group or institution will change if the programme is very successful (Earl et al., 2002). They are stated by each group of partners and validated by other groups with the facilitation of the research team (Table 11). At the end of the process, the CCAFS program internalizes all behavioral changes or outcome challenges and shall help these changes to occur.

Table 11 : Vision and behaviour change challenges of CCAFS partners

Abstract vision statement: "In the five rural communities, men and women are healthy, educated and skilled in agricultural production. Men and women restore natural resources with species adapted to climate hazards and strengthen their partnership with technical services for food self-sufficiency of both humans and livestock, and financial autonomy and improved infrastructure".	
Partner 1: Rural communities	Outcome challenge 1: The CCAFS programme would like to see the village communities regularly engage with the various technical and financial partners, be organized into domains of agro-forestry-pastoral production and adopt the advices provided by partners.
Partner 2: Decentralised and local agencies	Outcome challenge 2: The CCAFS programme would like to see government technical services (central and decentralized) intensify their collaboration with producers for the modernization and professionalization of the agro-forestry-pastoral production in order to increase their productivity by 10%.
Partner 3: Research institutions	Outcome challenge 3: The CCAFS programme would like to see thenational and international research institutes (INERA, INSS, ICRAF, etc.) strengthen the partnership with local populations and technical services for enhanced action research in the areas of water and soil conservation, soil protection and restoration, agroforestry, livestock and seed production and local governance of natural resources.
Partner 4: NGOS	Outcome challenge 4: The CCAFS programme would like to see NGOs and local associations engage in networking and synergy to harmonize their interventions in the field of climate change adaptation in the northern region through capacity building, equipment and financing.
Partner 5: Organisation for the conservation of nature	Outcome challenge 5: The CCAFS programme would like to see international organizations conservation such as IUCN, develop and strengthen partnerships with research organizations, decentralized technical services and local NGOs for synergic action in order to achieve high efficiency with village communities.

Source: Supra-community workshop of the CCAFS boundary partners (2012)

It can be seen from the above outcomes challenges that the development or strengthening of partnership would be a key contribution from the CCAFS program. Participants seem well aware that adaptation to climate change in the agricultural and food security areas will require the participation of all stakeholders. They consider that the partnership is an essential contribution to progress towards achieving the stated vision.

It is therefore crucial for the CCAFS program to include the effective development of partnership in the implementation of participatory action research to ensure that the achieved results are built on changes in behavior, relationships and activities of the communities and their development partners.

4.3. Required actions and partnership for the identified vision

All the identified partners during the Vision-Action-Partnership exercise can be considered as the basis for developing an effective partnership to strengthen the climate change adaptive capacity. These include also the local communities who are often regarded as beneficiaries rather than partners (Earl et al., 2002). A partnership is defined in relation to a common vision that many people or organizations seek to achieve (Haberman, 2008). It is also defined as relationship between individuals or groups characterized by mutual cooperation and responsibility to achieve a particular vision (American Heritage Dictionary, 1992). In other words, partnership cannot hold in the absence of a common vision among several people or organizations. It does not exist without a clear definition of responsibilities and acceptance of mutual cooperation.

The application of tool on Vision-Action-Partnership helped to define a common vision between local communities and organizations working in the area according to their respective domains of intervention. Thus, this group of stakeholders can serve as a basis for the development of partnership for successful adaptation to climate change in the CCAFS intervention area in particular and Burkina Faso in general. Based on the common vision, a set of priority actions and partnerships has been identified. Actions are those that community members will be running by themselves. Communities made requests to enable the implementation of their actions. Each request is formulated to a group of partners currently working or not yet in their village. Thus, the partnership includes the partner whom a specific request may concern.

Table 12 summarizes the priority actions, partners and requests that were made by the communities in order to effectively and sustainably address the effects of climate variability on natural resources.

Table 12: Actions and partnership for adaptation in relation to natural resources

Observed impacts	Actions that communities will apply themselves	Elements of the desired partnership by communities	
		Requests to partners	Target Partners
Decrease in agricultural production (crop loss, falling of crop, wilting of plants, etc.	Develop farm lands and plant trees	Support/advise on farm land development and tree planting	NGOs and Associations (FNGN, BIBIR, etc.), Research (INERA, INSS, ICRAF/ICRISAT, etc.), Agricultural extension agencies
	Apply new farming techniques for water and soils conservation and use of improved seeds	Organise various training sessions on new farming techniques for water and soils conservation and the use of improved seeds	
Deforestation (mortality of trees, uprooting / falling of trees)	Plant trees for timber and non-timber products	Support / advise on the selection of suitable tree species and other inputs	Agricultural extension agencies, Research (INERA, INSS, ICRAF, etc.), NGOs and Associations (SOS Sahel International, women association (Delwindé, etc.)
	Establish nurseries	Build capacity in the area of reforestation and nursery	
Degradation of pasture	Stock feed and crop residues	Support and advice in livestock rearing technique (proposed by the research team)	NGOs and Associations (FNGN, BIBIR, etc.), Research (INERA, INSS, ICRAF, etc.) Agricultural extension agencies
	Plant fodder trees	Support / advise on the choice of forage species adapted to the area	
	Establish grazing areas	Support / advise on the feasibility of the establishment of grazing areas	
Water shortage (Insufficient water, Drying of water points)	Contribute to build new water facilities (wells, boreholes, etc.) and protect them	Support / advise on sanitation techniques	Agricultural extension agencies NGO (BIBIR, ADEFAD, FNGN), Research (INERA, INSS, ICRAF, etc.)

Source: Supra-community workshop of the CCAFS boundary partners (2012)

Table 13 shows the identified priority actions and partnerships needed to reduce the negative effects of climate hazards on structuring resources: physical, financial, human and social. It should be noted that in this group of resources, communities only reported observed impacts of climate variability on physical resources. No observed impact was reported on the financial, social and human resources, but their current level was deemed insufficient to support the achievement of the stated vision. Therefore, actions and partnerships are also needed to improve the current status of these resources so that they effectively contribute to the stated vision.

Table 13: Actions and partnership for adaptation in relation to physical, financial, human and social resources

Observed impacts	Actions that communities will apply themselves	Elements of the desired partnership by communities	
		Requests to partners	Target partners
Destruction of infrastructures (houses, shops, healthcare centre, parks, places of worship, schools, etc.)	Strengthen the foundations	Support and advise on the construction of habitats for livestock	Livestock extension agencies, BIBIR,
		Support the opening of roads	Municipality
	Establish windbreaks	Build capacities in reforestation and nurseries	Research
Low level of financial resources	Diversify income generating activities (fattening, cash crop, arboriculture, sales of grain)	Support the acquisition of improved seeds	Agricultural extension agencies, Research (INERA, INSS, ICRAF, etc.), IUCN, Micro-finance institutions (Credit unions), NGOs and associations (Delwindé)
		Support the improvement of the access to credit	
Low level of human resources	Participate in local trainings of trainers	Support the training of local trainers	Agricultural extension agencies, basic education agencies,; NGO, Municipality
		Increase the supply of trainings	
	Educate and inform the community about health, hygiene and sanitation	Support for training and awareness on health, hygiene and sanitation	Healthcare agencies, Agricultural extension agencies, Associations, NGO, Municipality
		Support the acquisition of latrines	
Low operational capacity of social resources	Boost the local groups and associations	Improve support and advise on the management of associations	Healthcare agencies, Agricultural extension agencies, Associations, NGO, Municipality
		Implement close supervision	
		Pay more attention to and take into account the concerns of groups and associations	

Source: Supra-community workshop of the CCAFS boundary partners (2012)

Overall, the implementation of the Vision-Action-Partnership helped to highlight that neither the communities affected by climate hazards, nor the partners who support them, can succeed alone in adaptation to climate change. Indeed, spontaneous adaptation strategies implemented by the communities are often limited by the precariousness of some resources at their possession. In contrast, planned adaptation strategies need to engage communities to create an environment that is conducive for participatory action and learning. Fully understanding the actions that communities can implement by themselves and those for which they need partners for their implementation is therefore a crucial step in planning for adaptation to climate change.

V. CONCLUSION

The existence of diverse adaptation contexts implies that there is no one approach to assess, plan and implement adaptation measures (Fussler, 2007). But whatever approach is used, actors must keep in mind the need to (a) decentralize the process, (2) promote inclusive decision through participatory planning and (3) to boost the action through education and awareness. The approach and tools applied in the five rural communities of the Tougou block in Burkina Faso have these three characteristics. In fact, the participatory approach built on gender-based groups from one community level to provincial (supra-community) level was helpful to understand the specificity between women and men with regards to the climate change adaptation and their implications for food security. The applied tools promote learning for all stakeholders of the program on climate change, agriculture and food security. They facilitated the participatory generation and analysis of information about the vulnerability of rural communities and their use in planning, monitoring and evaluation of climate change adaptive capacity.

Three major lessons can be learned on how communities in Yatenga have used simple tools for planning, monitoring and evaluation of their capacity to adapt to climate change:

- Rural communities have demonstrated a good understanding of the relationship between climate hazards and their observed and future impacts, as well as the limits of autonomous adaptation strategies they have implemented to date. If technicians and rural communities speak the same language on issues related to climate change, they would be able to show that the levels of exposure and sensitivity of agricultural production are not the same in rural areas. Therefore, the vulnerability is not homogeneous and intrinsic characteristic of a given sector, but is function of both the level of exposure, sensitivity and the capacity of actors to implement adapted technologies;
- Rural communities have shown that in addition to implementing autonomous (spontaneous) adaptation strategies, they have the capacity to plan for adaptation. In particular, when the planning tools are sufficiently participatory, they can develop coherent vision of development that takes into account climate change adaptation. This vision represents the desired situation in which they would like to be despite the climate hazards. They also realize that for the change in their current situation to happen, they need to change their behavior, relationships, activities and actions in ways that are favorable to the achievement of their vision. This takes into account adjustments in the relations between actors, but also individual adjustments regarding the ways everyone implement his (her) activities;
- Finally, rural communities have shown awareness that adaptation to climate change will not come only from the outside. They are also aware of the local possibilities and constraints to adaptation to climate change. They are likely to propose measures to implement their actions and solicit external support from partners for greater effectiveness of adaptation to climate change.

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