Wet-WAG, a role-playing game to support stakeholder dialogue on wetland management

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SEVENTH FRAMEWORK PROGRAMME

WETwin

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CONTENTS

List of figures

List of tables

List of boxes

List of acronyms

AIR: African Ivory Route
CDF: Community Development Forum
CRCE: Centre for Rural Community Empowerment
DPSIR: Drivers, Pressures, State, Impact, Response
DWA: Department of Water Affairs
IWMI: International Water Management Institute
LDA: Limpopo Department of Agriculture
LEDET: Limpopo department of Economic Development, Environment and Tourism
MO / MOs: management option(s)
NGO: Non Governmental Organization
NRM: natural resources management
RPG / RPGs: role-playing game / games
SANBI: South African National Biodiversity Institute
UL: University of Limpopo

1 Introduction

Wetlands are ecosystems of crucial importance, as they are the support for specific plants and animal species and provide numerous services to the populations living next to them, ranging from water and plant collection to flow regulation and flood protection. However important they are, their fragility makes them especially sensitive to drivers of change and external pressures such as climate change and population growth. Moreover, wetlands generally fall in the gaps of regulation, their dual nature both terrestrial and aquatic putting them at odds with traditional rules for river or land management. As a consequence, new management solutions should be designed, involving the cooperation of all stakeholders, from community level to national government level.

The WETwin project had the objective "*to enhance the role of wetlands in basin-scale integrated water resources management with the aim of improving the community service functions while conserving good ecological status*". The project aimed at facilitating the process of wetland conservation, integrating the views from stakeholders and enhancing the discussion between those different partners.

To meet the challenge of successfully integrating the diversity of viewpoints into natural resources management plans, role-playing games (RPGs) are increasingly used to enhance participation and discussion of diverse stakeholders. They try to reconcile the "traditional" top-down and bottom-up approaches previously in use for natural resources management (NRM) into a collective learning process where every stakeholder has a say (Barreteau *et al.*, 2007a).

Irstea, supported by the International Water Management Institute (IWMI) has developed Wet-WAG, a role-playing game for wetland management with the objective of providing an efficient support for awareness raising, negotiation and environmental education. Wet-WAG reflects the case of a small wetland located in a South African village called Ga-Mampa. All the stakeholders involved aim at designing a management plan for the wetland guaranteeing environmental protection and sustainable livelihoods for the villagers, though they have different priorities and means of action.

The present report first gives a short description of the Ga-Mampa case study. A review of literature on the use role-playing games for natural resources management is then presented. Methods used for developing the game are introduced before the description of the game and of the main results of the development process. The next section presents how Wet-WAG was used to support the participatory multi-criteria analysis of management options for Ga-Mampa wetland. The report ends with some recommendations on the future developments of Wet-WAG and on how to adapt it to other case studies.

2 The Ga-Mampa case study

The Ga-Mampa wetland is a riverine wetland of about 120 ha that lies on the valley bottom of the Mohlapitsi River, a tributary of the Olifants River in the middle part of the Limpopo River basin in South Africa. The Mohlapitsi catchment is characterized by seasonal rainfall that largely occurs during the summer months, from October to April. Mean annual rainfall for the catchment is 771 mm, but varies significantly with altitude and aspect. Mean annual rainfall in the valley bottom, where the wetland is located, is typically 500 – 600 mm. Within the boundaries of the wetland, the valley floor consists of reasonably well-drained sandy soils upstream and poorly drained sand-loamy soils downstream.

The Ga-Mampa area is part of Lepelle-Nkumpi local municipality and is located in the former homeland area of Lebowa in the Limpopo province. It is predominantly rural with low population density. The main source of livelihood is small-scale agriculture (Ferrand 2004), complemented by social grants and pensions for senior people. Livestock farming is dominated by cattle and donkeys which are used for draft power and as a way of saving. Crop production is divided into wetland and irrigation crop production. Maize (the staple crop) is the main crop grown under irrigation and in the wetland. It is estimated that 394 households (2758 people) reside in the 5 villages situated around the wetland (Adekola 2007). More than 80% of the households in the area are poor and vulnerable (Tinguery 2006).

The main provisioning services provided by the wetland include crop production, livestock grazing, edible plants collection, reeds collection, sedge collection, water supply (Darradi 2005; Adekola 2007). Between 1996 and 2004 more than half of the wetland had been converted to agriculture (Sarron 2005). Conversion of the wetland to agriculture has been driven by three main factors: (i) collapse of the small-scale irrigation schemes in the area following the withdrawal of government support in the early nineties and the destruction of the remaining irrigation infrastructure by floods in 2000; (ii) frequent droughts experienced since 2000; and (iii) high dependence on the wetland for crop production and natural products due to limited access to fertile lands and other livelihood alternatives.
The wetland activities have an impact on the hydrological and ecological functioning of the wetland (Kotze 2005). However, the magnitude of these impacts is not well understood. Some external stakeholders had the perception that the wetland played an important role in maintaining dry season flows downstream (Darradi 2005), although recent hydrological research showed that the contribution of the wetland to the river flow is minimal (McCartney *et al.* 2011).

Initial analysis showed that trade-offs between wetland services occur locally and in the short term between crop production and other local uses of the wetland, including grazing. At catchment scale, there is a potential trade-off between crop production, on one hand, and the Mohlapitsi river flow regulation and water supply downstream, on the other hand. Finally, in a longer term, continuous use of wetland for agriculture without mitigating management practices may result in irreversible loss of wetland functioning (depletion of organic matter, soil erosion, lowering of shallow water table and reduced contribution to base flow), thus impacting on the wetland ability to provide ecosystem services, including crop production.

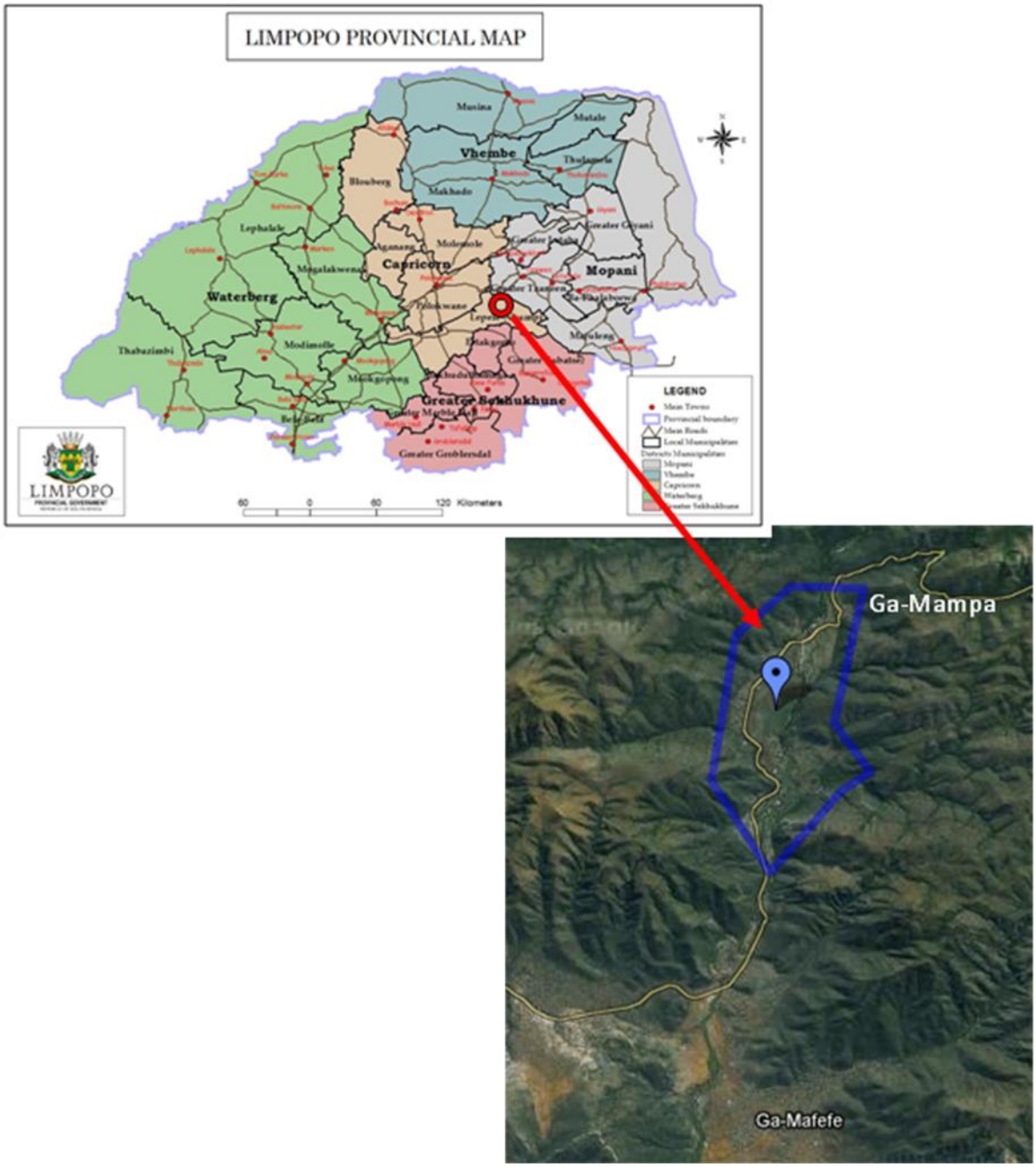


Figure 1: Location of Ga-Mampa in the Limpopo province of South Africa

Sources: http://www.limpopo.gov.za/about_otp/images/limpopo_map.jpg for the map of Limpopo province; Google Maps for aerial picture of Ga-Mampa. The blue line represents the limits of the village and the yellow one the road crossing it.

3 Literature review on the use of role-playing for natural resources management

Literature on role-playing game is quite abundant. The use of games to represent real-life situation is rather old, and find its origins in old German war games from the 19th century (Duke and Guerts 2004). However, using games in natural resource management context is quite new, as one of the first games designed for this purpose was the *River Wadu Role-Playing Game* made by Carruthers in 1981 (Dionnet *et al.* 2006). Since then, the use of RPGs for natural resources management has been extending in several fields and for various purposes.

3.1 Definition and basics concepts of RPGs

RPGs are defined as "*a goal-directed activity conducted within a framework of defined rules, involving characters who role-play*" (Dionnet *et al.* 2008). Games are made for a specific purpose, in order to answer a scientific question or to solve a real-life dilemma. The purpose is known for the developer of the game and must be stated when it is used later on. Specific actions done in the game must fall within the limits set by the rules, defined by the game designer. Several degrees of strictness can be set, depending on the game: a RPG designed for creating management options will leave as much freedom as possible, while others will constraint the player according to a scenario. The last important feature is the use of pre-defined roles, putting some distance between the player's behaviour during the session and his / her real-life personality. The possibility to say "*it was just a game*" always exists (Barreteau *et al.* 2007), stripping what happened during the game of any link with the real situation. This link is made during the debriefing step at the end of the session. The manager gets the participants' feedback of the session, and tries to make them project the results of the RPG into the real life. In the case of a game testing scenarios, players saw what the consequences of their decisions are, providing them with a basis for further discussions. For the manager, this step is the opportunity to see what the players thought of this experience and reflect on elements that could be improved in the game.

Games differ from simulation in several ways. A simulation represents the testing of participants' choices through a model, which is nowadays often a computer-based model. Simulations try to grasp the complexity of reality, while games can offer a simplified image of it. Simulations need to be able to represent correctly situations from the past to be validated, and thus make predictions for the future (Meadows 2001). On the other hand, games start from a given situation, which is almost always the present situation (or at least resembles it, due to simplification). This is due to human players interacting during a session of the game; they cannot stick to a scenario already written. However, Meadows (2001) pointed out that simulation and RPGs can work hand in hand. In his study, he used a game to make people aware of the underlying composition and functioning of the model he used to make simulations at first. In this case, the game functions as a popularization for the simulation; it broadens the audience of the model to non-specialists.

Games vary a lot depending on the context. The support used can either be a classic board (*Water Allocation Game* of Ferrand *et al.* 2009 - ; *River Basin Game* by Lankford and Sokile - Lankford *et al.* 2004) as in traditional party games, a computer (e.g. *BUTORSTAR*, developed by Mathevet *et al.* 2007), a video support (*VPA-KERALA*, developed by Witteveen and Enserink 2007)… or a mix of several media. Most games are played with physical participants, but computer-based ones allow the use of artificial intelligence to create virtual players.

3.2 Interest of RPGs for environmental management

NRM issues often involve conflicting uses of a resource by several stakeholders, who do not necessarily share a common vision regarding the resource. Interactions between stakeholders are

especially difficult to represent in “traditional” simulation approaches based on computerized models. Thus, there is a need for a tool able to simplify the reality and allowing the discussion to focus on the main problems at stake. In this case the RPG is part of a collective learning process. Some authors even recommend that stakeholders be part of the modelling process and influence its design and its use (Barreteau *et al.* 2007, Lankford *et al.* 2004). This approach allows multiple exchanges and integration of various types of knowledge (empirical, technical, scientific…). Researchers benefit from stakeholder’s field experience, while local stakeholders can take advantage of scientific expertise. Bots and van Daalen 2007 also underline that RPGs are able to represent non-rational behaviours of human beings, something that cannot be done with classic computer models. Those special features of RPGs make them a useful tool for NRM contexts, where human interactions are complex and multiple.

Role-playing games can fulfil diverse functions according to the context. Bots and Van Daalen (2007) identified six different categories:

- Research and analyse: the system cannot be studied or is difficult to study because of its complexity, and the game is used as a scientific experiment to generate data on this system;
- Design and recommend: building scenarios and alternative solutions to a problem, and possibly trying to figure out their consequences;
- Provide strategic advice: advise on the efficient strategy to be followed, by looking at other players’ reaction;
- Mediate: players (potentially stakeholders of a real project) use the game as a virtual negotiation table. The environment of the game, different though similar to the real life, is expected to help raising fresh ideas.
- Democratize: all the stakeholders are given the same importance during the process of the game, and all their views are equally considered.
- Clarify values and arguments: compared with a real-life situation, the game allows the focus of the discussion to shift from political consideration to values and arguments.

Role-playing allows participants to change their point of view on the subject of the game, and try to gain new insights of the situation. Endorsing news arguments, possibly arguments one used to dismiss in the real-life can make stakeholders grasp the diversity of viewpoints and the difficulty to balance them (Barreteau *et al.* 2007; Bots & Van Daalen, 2007). Games provide a common experience for stakeholders, and they can refer to it in the future for their negotiations. It has even been reported in some cases that participants discovered stakeholders when playing a game. Bots also considers the environment of the game to be fruitful for discussions, as it removes some problems existing in the actual situation.

3.3 Building a functional RPG

Two phases are to be distinguished when designing a RPG, the first being the design of the game component and the second the design of a game session sequence (playing the game).

A RPG is designed for a specific purpose (Cf. list of objectives proposed by Bots and Van Daalen 2007). As the form and structure of the game will be dependent on its objective, one should state clearly at the beginning what the objectives of the game are: Is the game mainly aiming at raising awareness on a specific issue? Is it targeting at supporting stakeholders’ negotiation? Are stakeholders going to develop their own scenarios for NRM? Once the purpose of the game is defined, the medium of the game can be chosen. As mentioned previously, various supports exist for games. This step should not be overlooked, as it has consequences on the future use of the game itself. For example, in places with low level of education, a computer-based game could prevent

some people from participating in sessions, as it requires a certain degree of familiarity with computer. It is therefore necessary to analyse the acceptability of a RPG by the intended players (Dionnet *et al.* 2008)

Designing roles for players is the second main step. The designer chooses who will be represented among the stakeholders of the project, and how many of each category. A game involving many players ensures a large participation from various stakeholders, but the session can become quite confused if not properly facilitated. Roles are defined by the assets they can mobilize during the game (money, fields, social position, etc.), and the actions they can undertake. The definition of those actions greatly influences the timeframe of the game. If many actions have to be done during one round, it is expected that only a few rounds will be played during a session.

In RPGs for natural resources management, a particular attention should be given to the representation of the environment. In general, the starting point is a real-life situation that is more or less simplified to suit the purpose of the game. The *River Basin Game* of Lankford (2004) depicts a highly simplified cultivated catchment, comprising only a riverbed and fields; while *BUTORSTAR* represents a virtual wetland with different land use and types of land ownership (Mathevet *et al.*, 2007).

The sequence of a session is the last step in the game design. The succession of individual thinking and decision and collective negotiation should be carefully thought to serve the purpose of the game and keep it interesting to play. The number and roles of facilitators should be identified. The manager is the keeper of the rules and makes them explicit at the beginning of the session. He (or she) has also to keep the focus of the game, balancing the discussion among participants and the respect of the timeframe set before the session. Each step of the game has to be timed to ensure the proper progress of the session. The spatial setting of the room is also important: there can be places for participants to discuss among themselves, without being heard by the manager or other participants.

The manager is also responsible for the debriefing of the session, when the discussion shifts from the game to the real-life situation, which served as the basis for the RPG. The debriefing also proves to be helpful for designers as it allows a feedback on the game itself. Before being functional, a game has to go through several tests to make changes that will shape it step by step, making it meaningful for the study case, and easy to play.

An interesting feature of RPGs is their flexibility. Authors agree upon the importance of this (Barreteau *et al.*, 2007a, Dionnet *et al.*, 2008, Bots & Van Daalen, 2007). A right balance should be sought between simplification, which impacts on the game playability, and realism, which helps players to relate the game to their day-to-day life. Through simplification, one can make the issue more accessible to every stakeholder, while a higher level of complexity can prove useful for education. The designer, by setting rules and roles, can also influence the openness of the storyboard. For example, *ATOLLGAME* by Dray *et al.* 2007, allow players to create new rules as the session goes on. The more open the storyboard, the more personal input the players can give. This can help raising new ideas and concepts during the testing of a scenario. Designing a RPG has to be thought carefully according to the purpose of the game, and it can evolve according to participants responses during the sessions.

Several authors have pointed out that the success of a RPG session depends greatly on logistics. Lankford and Watson 2007 underline that great care should be given to the organization of a gaming session, as the choice of time and place can deeply affect stakeholders' participation. Indeed, the facilitator should be aware of the schedule of each participant in order to find a time convenient for

all players. If the place is located in a remote area, transport may be provided for players who do not have access to a personal vehicle (e.g. farmers).

RPGs are considered a useful tool in the complex context of NRM. Several authors used it and gave recommendations on the designing process. It is widely regarded as efficient for enhancing negotiation processes and facilitating communication among stakeholders.

4 Method: Wet-WAG development process

4.1 The origin of Wet-WAG: the WAG platform

The concept of Wet-WAG derives from the role-playing game platform WAT-A-GAME (WAG) designed by the joint research unit G-EAU together with the South African non governmental organization (NGO) Award, to facilitate exploration and transformation of water management and water use at a small catchment scale (Ferrand *et al.* 2009)[1]. The platform was designed to facilitate the creation of new games adapted to local context and issues. Its target features are as follows:

- Representing any water basin with the right compromise between accuracy and playability;
- Being flexible and adaptable to the real structure of the basin, and to various resources use including water, land, labour, money;
- Being repeatable and transposable to various contexts, countries and players
- Providing measurable results
- Being scalable in terms of basin size and number of players
- Being easy to set and teach to new games organizers
- Having an adaptation time for a new case not longer than 2 man-days
- Being cheap and easy to set in poor countries
- Not requiring any computer for the game session
- Having an average session duration of half a day
- Possibility to calibrate it with real data or to use gross qualitative figures
- Interesting, funny, and attractive for many kinds and levels of participants
- Being able to be used to test and compare different policies
- Sessions can be self-designed by the players.

Wet-WAG is a direct application of the WAG platform to a wetland case study in South Africa.

4.2 Wet-WAG in WETwin: objectives and relationships between the game and other components of the project

Within the WETwin project, Wet-WAG is part of work package 2 on stakeholder involvement. However its development was inter-related with several other work packages of the project as shown in Table 1 below. Its purpose was set in the description of work of the WETwin project as *an awareness-raising tool or training tool rather than decision support*. The target group for Wet-WAG was identified during the project proposal development as stakeholders / decision-makers at basin or national level. Different sets of players (stakeholders) were considered: sector department officials, local government elected representatives, agricultural and environmental extension officers (people who work in close contact with wetland users).

Table 1: Interaction between the Wet-WAG development process and WETwin tasks

Steps of game design	Tasks of WETwin project
choosing roles	Task 2.1 Stakeholder analysis
choosing indicators of impact	Task 4.1 Performance indicators
defining decisions and interactions	Task 4.3 Analysis of management structures Task 7.4 Identification of generic measures
defining processes and vulnerability context	Task 3.3 Status, drivers, pressures (DPSIR analysis) Task 5.1 Initial vulnerability assessment

[1] For more information on the WAG platform see http://sites.google.com/site/waghistory/home

The objectives and target group were further discussed during the first consortium meeting in Budapest in November 2008. In addition to the initial awareness raising objective, it was suggested that the game could help enhancing the understanding of the Conceptual Framework, toolbox and DSS by stakeholders and decision-makers. The idea was to develop *Fictive wetland-basin systems* at different scales in order to incorporate the issue of scales into the game. It was also suggested to take into consideration sector integration (water, nature, livelihood, policy) in the game. It was ambitioned that the DSS and the wetland management game will have similar structures, the game being based on simplified/dummy models. Finally the meeting recommended developing the DSS and the game simultaneously. In terms of target groups, two versions of the game were envisaged: one for local stakeholders, and one for decision makers at a higher level.

The first consortium meeting decided to develop the game on the Ga-Mampa case study, leaving the possibility for other sites to adapt and test it later. The calibration of the game makes use of previous researches made on the site by IWMI, Irstea and South African research institutions. In particular, Wet-WAG is based on the same conceptual model as the Stella-based model developed for analysing trade-off between wetland ecosystem services of the Ga-Mampa case study (work package 7, Morardet *et al.* 2010). Because of the small size of the Ga-Mampa wetland, the design was focussed on issues at wetland scale and did not incorporate the catchment scale. Related to this, it appeared during the development of the game that it could also be useful to raise awareness of local wetland users (and not only of higher level decision-makers) and support discussions among local stakeholders, being thus complementary to the computer-based models developed for decision-support under work package 7.

4.3 Overview of the development process

The main steps of the development of Wet-WAG are summarized in Figure 2.

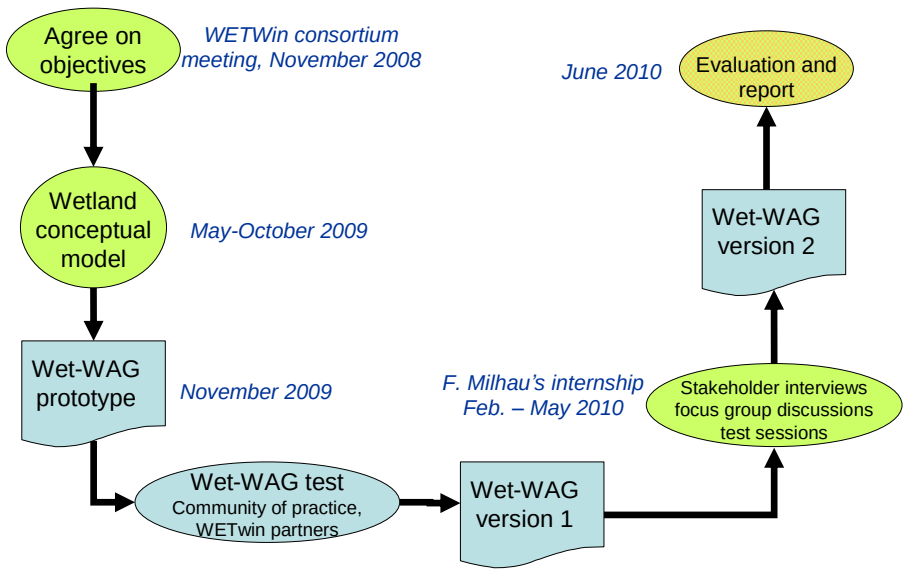


Figure 2: Overview of the Wet-WAG development process

A first prototype of Wet-WAG was elaborated based on the WAG experience and the knowledge accumulated on the Ga-Mampa case study. A first phase of development consisted in a series of test sessions conducted with researchers (Montpellier community of practice on participatory approaches for natural resources management – http://www.particip.fr , October 2009), WETwin project team members (WETwin consortium meeting, Bamako, November 2009), and African water resources managers and experts (EchelEau final conference, Nyamey, December 2009). Each time, an evaluation was conducted with participants, allowing for the identification of positive and negative points.

The second phase of development took place in South Africa and benefited from the internship of François Milhau, student at Montpellier SupAgro. Based on evaluations from former test sessions, the prototype was improved and simplified. Focus group discussions with wetland users and stakeholders at municipal and provincial levels helped identifying the most important issues to be included in the game in terms of roles, landscape components and management problems. New test sessions were then conducted with local university students and members of the wetland community.

The game was developed using a succession of desktop research and participatory methods. Desktop research based on previous research in the area and on wetland in general in South Africa gave a first picture of the situation in the village. This fed the participatory methods (focus group discussion, game test session) used at the university of Limpopo and in the village. Outcomes of participatory methods were processed and included in the new version of the game when possible. This two-ways approach provided a diversity of inputs from various stakeholders. The different approaches used for the development of the game are detailed in the following sections.

4.4 Focus group discussions

Three focus group discussions (on March 24, March 30 and April 24, 2010) were organised with members of the Ga-Mampa community. The initial intention was to gather wetland users according to gender and age. Indeed, previous researches in the area have made clear that women were not at ease to talk when men are present in the same setting and express their views. Age was also considered to be important, as it is linked with experience and respect. However, due to organization constraints[2], the attendance of first focus group discussion was not as expected as it gathered men and women all together. Discussions were conducted in Sepedi, the local language, which appears to be easier for participants. Meetings were prepared by François Milhau and Tumelo Masilela, a South African MSc student from University of Limpopo. Tumelo Masilela took on the part of chairing the discussion, while François Milhau only provided him with guidelines. At the same time, Mr Mashabela, the CRCE field assistant, was translating him in English the reactions of participants.

The purposes of the discussions were:

1. To confirm the importance of the constraints on agriculture identified through previous reports on the study area
2. To learn about other potential constraints on agriculture and wetland management
3. To rank the constraints according to their importance
4. To discuss their causes and potential solutions
5. To show the game to the farmers and get their opinions on it.

[2] Meetings were organized through the field assistant of CRCE, an outreach organization within the University of Limpopo, which is also conducting research in the area. This person is also a Ga-Mampa community member. Means of communication with the site are quite poor (there is almost no mobile phone network and only one malfunctioning public telephone).

Annex 1 presents the guidelines used to conduct the discussion sessions. The information collected during the session was then used to improve the game design.

4.5 Interviews with external stakeholders

Focus group discussions were complemented by individual interviews of external stakeholders at municipal or provincial levels. The main stakeholders targeted were the Limpopo Department of Agriculture (LDA), the Limpopo Department of Economic Development, Environment and Tourism (LEDET), the regional of office of the Department of Water Affairs (DWA), the Limpopo coordinator of the Working for Wetlands programme (SANBI) and Lepelle-Northern Water, a water board interested in the water quality of the Mohlapitsi river[3]. Unfortunately due to agenda constraints of the targeted persons and the difficulty to identify some of the responsible persons (especially for DWA), only two persons could be interviewed: Mr Netshikovhela from LDA and Mr Masindi from LEDET.

The aim of those interviews was to get external stakeholders' views on the Ga-Mampa wetland project. We wanted to know about their means of action (either financial, logistical...) and their priorities, from their organization's point of view (e.g. awareness creation, biodiversity protection, water quality...). Then, we presented Wet-WAG as it was done during the focus group discussions, and got their views on it: are they willing to play it, do they feel something is missing, what issues would they like to see the game tackle... It was made clear that the game was not completed yet. The purpose of the meetings was to help us improving the game, which in return should help to improve villagers' livelihoods or to meet external stakeholders' objectives. The game was not played during these discussions but only presented, as we did not want to confuse people with several versions of Wet-WAG.

4.6 Game testing sessions

Three test game sessions were organised in South Africa to see how people react when they are playing Wet-WAG, where the shortcomings are and what elements are to be kept. Authors recommend to test the game at several stages of the design process (Ferrand *et al.*, 2009). Dates, location and participants of the sessions are summarized in Table 2.

The first session used the first version of Wet-WAG, which was tested with researchers in Montpellier and Bamako. It included 12 players, two for each role and took place at CRCE, University of Limpopo in Polokwane. Participants were students from the University, young farmers from the nearby village of Ga-Mothiba, another CRCE study site and two villagers from Ga-Mampa (including the field assistant, Mr Bernard Mashabela) and Philip Mosima, the extension officer. A second session allowed a test of the first changes triggered by the first session and the first focus group discussion. 8 participants joined the session, from CRCE and Ga-Mothiba only. The last test made in South Africa took place in Ga-Mampa itself. The idea was to give a feedback to the villagers, so they could see what the discussions helped to construct. This also shed a new light on the game, as they had different reactions from participants in previous sessions. The version of Wet-WAG tested in the village included all the changes made during the development process.

At the end of each session, a debriefing was organised to collect perceptions of the participants. The debriefing sheet used during the tests is presented in Annex 3. The debriefing is very important, as this is the time when participants can react freely on the experience, and give valuable inputs for the

[3] For a description of the roles of these stakeholders see the Stakeholder analysis report for the Ga-Mampa case study (Masiyandima *et al.* 2009).

designer. During the game itself, the questions asked are of importance as well, as they can point out some elements which were not carefully thought. When bringing and testing the game in South Africa, the guiding idea was to see how people who know the local situation would react, as their behaviour can be different from players who are not familiar with the site. A report was produced for each session conducted in South Africa.

Table 2: Date, location and participants of the test game sessions

Date	Location	Participants	Facilitators
17/03/2010	CRCE, Polokwane	Youth leaders from Ga-Mothiba village (6) CRCE/ UL students (3) Ga-Mampa community members (2) extension officer, LDA (1)	Koketso Mphahlele (CRCE/UL), François Milhau (Irstea intern)
9/04/2010	CRCE, Polokwane	Youth leaders from Ga-Mothiba village (4) CRCE/ UL students (2) CRCE staff (2)	Sylvie Morardet (Irstea), François Milhau (Irstea intern)
11/05/2010	Ga-Mampa	Ga-Mampa community members (6) extension officer, LDA (1) CRCE staff (1)	François Milhau (Irstea intern), Tumelo Masilela (UL student) observer: Clément Murgue (Irstea intern)

(In brackets number of participants from each organization/group)

4.7 Additional data collection

Additional technical literature review and data collection were conducted in order to gather more information on several aspects of the game, in particular possible management solutions for the Ga-Mampa case study.

Information was sought out on sustainable wetland cultivation as it was clear from Kotze's report on Ga-Mampa wetland health that maize cultivation is definitely not suited for the specific conditions of this ecosystem. Literature on the subject is abnormally scarce, and most organisations working on wetlands are focused on wetland conservation, and thus are not willing to give hints about crops fitting wetland conditions. People consulted include: the extension officer in Ga-Mampa, Mr Philip Mosima, Donovan Kotze[4], from the CEAD (Centre for Environment, Agriculture and Development) at the University of KwaZulu-Natal, and Edward Chuma[5] a process facilitator for Picoteam, a consultant company. All worked on the Ga-Mampa case, and have a useful experience on wetlands.

Mr Philip Mosima also provided information on crops used in the village. He was able to give updated prices for the crops that were already included in the game. He could also establish a list of the most important crops used in the village, and give a rough estimate of their water requirements.

Information was also collected on the cost of reparation of the irrigation scheme, as we wanted to include this option in the collective decision farmers can choose during the game. The cost assessment was based on a report made by Munyai Malaka Engineers, a company specialized in

[4] Donovan Kotze's contact on the CEAD webpage: http://www.cead.org.za/About/Staff/index.asp?Login_ID=24 [retrieved on June 15th, 2010]
[5] Edward Chuma's contact on the Picoteam webpage: http://www.picoteam.org/team_unterlage/chuma.html [retrieved on June 15th, 2010]

rural engineering (now merged with a similar company, Vela VKE[6]). This report investigated the possible options for rehabilitating one of the irrigation schemes in the study area. Costs and prices were updated with the inflation rate of South Africa for construction materials and electricity, available on the website of Statistics South Africa[7].

[6] Vela VKE's official website and contact: http://www.velavke.co.za/index.htm [retrieved on March 28th, 2010]
[7] Statistics South Africa Online: http://www.statssa.gov.za/ [retrieved on April 20th, 2010]

5 Game description

5.1 General features

Wet-WAG represents a small-scale wetland in a developing country and the main features of the local community using it. Various activities implemented in or using the wetland are played by individual players. The players have to decide how they exploit their resources (land, livestock, water, cash). They can be confronted to new policies, management rules or external events to which they must react. They have to maintain their activities and livelihood to a viable level.

5.2 Game and room setting

Playing the game requires a large room with a very large table where the wetland board game can be displayed. Players are seated around the table, each close enough to her / his land plot card. Players should normally stay seated the entire game long, except when they want (and are allowed) to discuss separately. An additional separate table can be organised for the “banker”. The game facilitator circulates around the table to distribute the water tokens. Walls or standing posts are used to display various collective monitoring tools (weather board, wetland health status… see below).

A session lasts typically 3-4 hours including the presentation of the game and the debriefing. It can be facilitated by only one person, but it is usually easier when several people can help the main facilitator (flowing water, handling pay-offs, explaining rules, playing the environment (weather), deciding consequences, inventing rules…). Observers are also very useful to monitor what is happening during the game: decisions of individual players, players’ interactions, impacts on the system.

In the game itself, each role can be played by more than one person. Two persons playing the same role can usually be very rich as it requires discussion between players to take decision. It is not however recommended to have more than two players per role, as the room becomes very crowded and noisy.

Depending on the objective of the session the game can be played by real stakeholders (supporting stakeholder dialogue) or by students (educational objective). A session can mix stakeholders with different levels of literacy and various scales of intervention (from the local valley up to provincial government decision-makers). However, decisions about who to invite should be carefully made, as some people may feel uneasy to face external stakeholders, or representatives from higher levels of government may refuse the principle of “playing a game”.

Wet-WAG does not require any pre-requisite knowledge about wetland or smallholder agriculture.

5.3 Game topology

At present, the game spatial structure includes four A3 sheets representing the main elements of the ecological and socio-economic system of the Ga-Mampa valley (see Figure 4):

- an irrigation scheme divided into plots allocated to different types of farmers;
- the wetland, also divided into plots with a section already cultivated and allocated to farmers and a section where the natural vegetation is used for livestock grazing and collecting plants for building and crafting;

- range lands that can be used for grazing[8].

The game board also displays the Mohlapitsi river, of which the Ga-Mampa wetland is riverine, and the irrigation canal that withdraws water for the irrigation scheme (see **Figure 3**). Initially, it also included the shallow aquifer linked to the wetland but this feature was abandoned later for sake of simplicity. This structure has been designed such that it can be adapted to represent other situations.

Figure 3: Wet-WAG game board

[8] Pictures represented on the game board were taken from *Windows on our World : Wetlands*, an educational package developed by the Wetland Alliance for Training, Education and Research (W.A.T.E.R.), the Mondi Wetlands Project, WESSA (the Wildlife and Environment Society of South Africa), the Department of Water Affairs and Forestry and the Department of Agriculture.

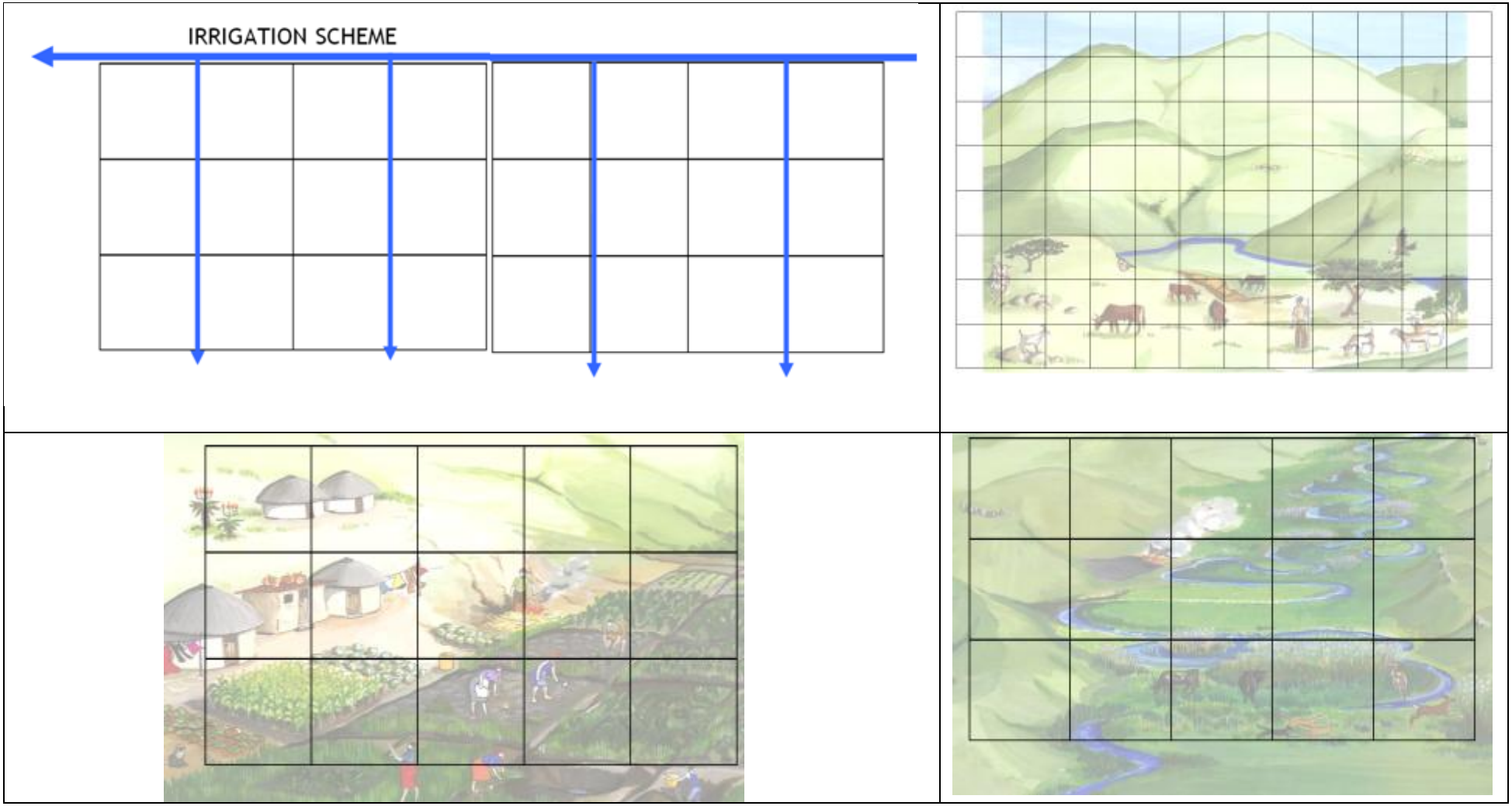


Figure 4: Landplots of Wet-WAG.

Clockwise from top left, the irrigation scheme, the grazing areas, the natural wetland and the cultivated wetland

5.4 Roles, activities, tokens

Six roles, each representing a farming household, are present in the game. Roles differ by their resources endowment (in terms of land in the irrigation scheme and wetland, livestock, and initial cash) and livelihood needs (food, cash and grazing area). A *role card* summarises this information (**Figure 5**).

ID	Irrigator 1	Young irrigation farmers with small family and no cattle
Resources		Irrigation plots: 7 Wetland plots: 1
		Cattle: 0 cattle units Grazing needs: 0 plots in summer 0 plots in winter
		Initial Cash: 106 money unit
Needs	Basic food needs: **9** food units Basic expenditures: **24** money units	

Figure 5: Example of a role card

Activity cards (**Figure 6**) give information on activities that can be performed on each type of land. Each activity is characterised by its season, where it can be done (irrigation scheme, cultivated wetland, natural wetland, range land), and its water requirements (and optionally costs and manpower requirements). The activity cards also provide information on the maximum yield (self consumption activity) or revenue (income raising activity) which can be attained when water requirements are met. Players show the activities they have chosen by placing activity tokens on their plots (**Figure 7**).

In the very first version of the game, players were endowed with units of manpower. During the game they had to allocate these units to their various activities. The first test session showed that the introduction of this additional resource did complicate the game and delayed decisions as players had to handle too many resources. Focus group discussions with local farmers confirmed that manpower is rarely seen to be a constraint; they can have workers when they need it, even during periods of intensive work such as the harvest. Therefore we decided not to use manpower in the game and the role cards were simplified accordingly.

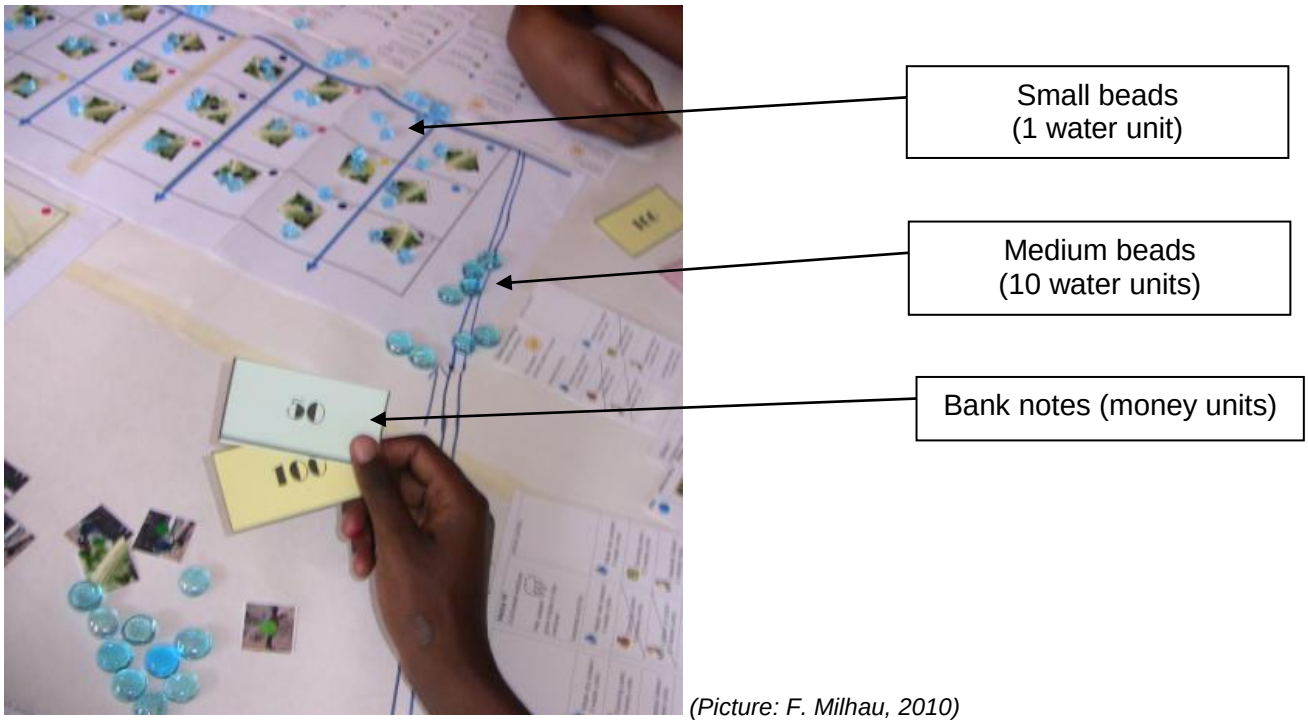
Blue beads of different sizes represent different *units of water* (**Figure 8**). The game manager makes them circulated in the system (see next section) from the river to the irrigation scheme and the wetland. Farmers receive water in three different ways:

- Water from the irrigation scheme: 6 water units are available for each secondary canal in wet season, only 3 during dry season.
- Rainwater occurs only during wet season. Its quantity (from 0 to 3 water units) depends on the climate of the year (very dry year, dry year, wet year, very wet year) (see **Figure 9**).
- Groundwater is not physically represented in the game, but players are informed that groundwater provides enough water for the crops in the wetland. There is no supply of groundwater in the irrigation scheme.

Figure 6: Example of an activity card

Figure 7: Examples of activity tokens

(Picture: F. Milhau, 2010)



(Picture: F. Milhau, 2010)

Figure 8: Water units and money units during a game session

Figure 9: Rainfall water depends on the season and the specific conditions of the year

Water feeds the crops planted by each player on his/her plots. The player can only get the optimum yield indicated on the action card, if the plot receives the number of water units indicated. The game also represents water losses due to the canal poor condition. At the beginning of the session, the game manager explains the water circulation from the river to the irrigation scheme and makes clear that 90% of the water is lost through leakages and bad design of the canal.

Farmers receives pay-off from their activities in the form of cash (bank notes, see **Figure 8**) or food (food tokens, see Figure 10).

Figure 10: Food tokens

Event cards are designed to bring unexpected events to the players (environmental events such as floods, economic events such as variation of prices) or management solutions supported by governmental policies. Usually one card can be drawn per year and per player. Event cards can either affect some particular players or have an impact on all players. The first two event cards designed represent respectively the rehabilitation of the gravity irrigation scheme (**Figure 11**) and its transformation into a sprinkler irrigation system (**Figure 12**). Other event cards were developed for the use of Wet-WAG to support the participatory multi-criteria analysis (see section 8).

The first card offers players the possibility to save some money in order to pay for the rehabilitation of the gravity irrigation scheme. The main features would be building a new intake of water in the river and cementing every canal in the system. The economic and technical data used are based on a report from a consulting company on the rehabilitation of one of the irrigation schemes in the Ga-Mampa valley (Munyai Malaka Engineers 2005). One can see that the increase of irrigation efficiency would solve water shortages during the winter. Each plot would get at least two units of water during winter, thus allowing players to plant more crops in the irrigation scheme.

<table>
<tr><td colspan="2">REHABILITATION OF THE IRRIGATION SCHEME</td><td colspan="2">Build concrete lined canals in the whole irrigation scheme, with short furrows</td></tr>
<tr><td rowspan="2">Cost</td><td>Construction activities
(including new gabion weir in the river and fixing the different canals)</td><td colspan="2">1900</td></tr>
<tr><td>Maintenance work made by farmers</td><td colspan="2">0</td></tr>
<tr><td rowspan="2">Gain</td><td rowspan="2">Improved water efficiency
6% → 40%</td><td>For each secondary canal :
40</td></tr>
<tr><td>For each secondary canal :
16</td></tr>
</table>

Figure 11: Event card "Rehabilitation of the irrigation scheme"

The second card (Figure 12) was designed following a focus group discussion, during which some farmers mentioned they would like to use sprinklers for irrigation rather than their traditional gravity system. Thus, we thought it could be interesting to offer players the choice between the two systems. Activities would include the installation of a pumping station and installation of pipes to carry water under pressure from the river to the scheme. Unlike the previous system, this one would require external maintenance and running costs (electricity). Figures included in the card are very rough assumptions and require further investigation to be more realistic. According to Munyai Malaka Engineers' report, irrigation efficiency could reach 70%. However, this system requires heavy maintenance, and is new for the farmers, thus there would be a period of adaptation. In the game, this is represented by a progressive improvement of the irrigation efficiency: the first season, efficiency would rise to 20%, then 30% and at last 50%.

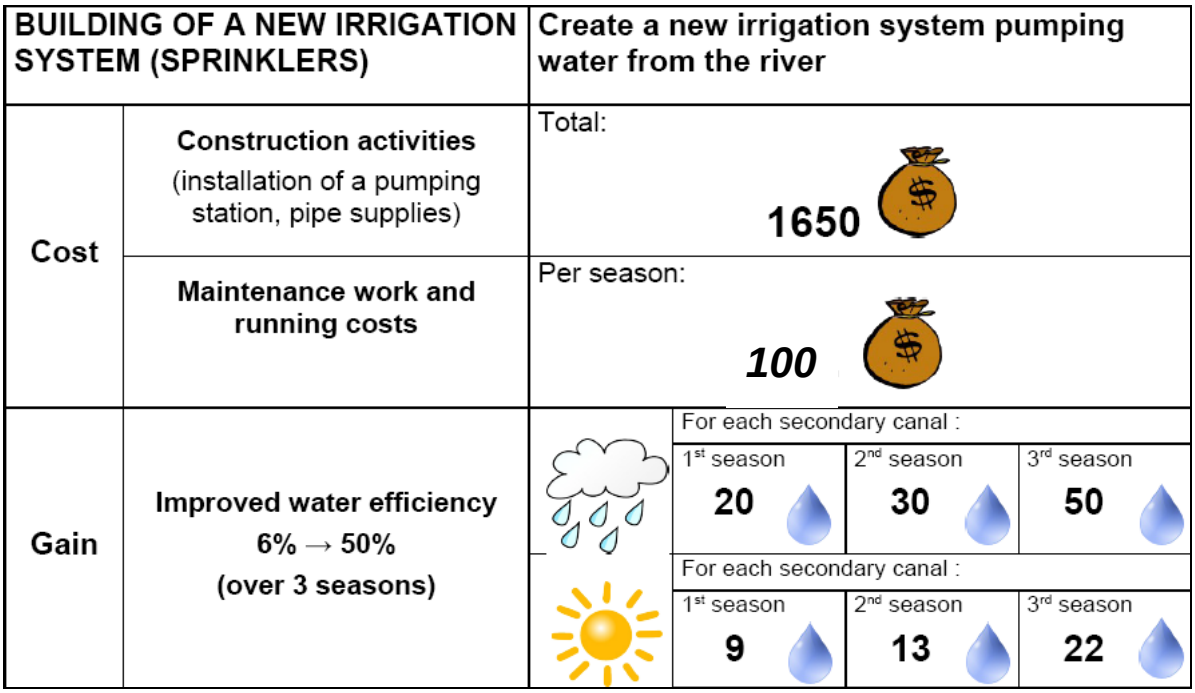


Figure 12: Event card "Building a new irrigation system"

5.5 Monitoring material

Individual monitoring sheets can be used by players to record the water received and their pay-off at each round (see Annex 2). These sheets are useful for recording what happened during a session and supporting the debriefing session. However, they are not always easy to use by players with low level of literacy. This manual monitoring sheet was transferred into an Excel spreadsheet later on to allow a quicker computation of pay-off at the end of each round (see section 8).

A monitoring table was developed to stress the environmental consequences of socio-economic decisions of players. It is used to show some indicators of the state of the wetland system (number of wetland plots under cultivation, grazing and natural vegetation). Its principles are described in Box 1. The scores used in the monitoring sheet are arbitrary, but reflect the magnitude of the impact of each type of use. They are based on Kotze's report on the ecological assessment of the Ga-Mampa wetland (Kotze 2005), as well as on the *WET-Health* tool developed to assess the ecological status of wetland (Macfarlane *et al.* 2008).The limits set for the wetland score were also roughly derived from the same documents. A wetland score of 30 represents around one third of the plots cultivated along with some cattle grazing, which is not expected to excess the carrying capacity of the ecosystem. Five levels of ecological status of the wetland were described along with their consequences (see Box 2). The wetland health monitoring sheet was also integrated into the Excel sheet.

Wetland health record

How to use this tool:

For each season, the game manager writes down the number of plots used in the wetland for each of the mentioned land use.

Then, the game manager multiplies the number of plots used for each action with the score of this action. The result is the « action score ». If the « action score » is lower than 5, it is lowered to 0.

Finally, the three « action scores » are added to get the « wetland score » for the season.

- if the wetland score of the season is lower than 30, the wetland health improves of one level
- if the wetland seasonal score is comprised between 30 and 50, the wetland health stays at its previous level
- if the wetland seasonal score is higher than 50, the wetland health degrades of one level.

The condition at the beginning of the session should be the "baseline condition", though this could be adapted to suit the local situation.

Action	**Crop (Maize, Tomato...) 3 points**		**Cattle 2 points**		**Plant harvesting (reeds, sedges) 1 point**		
	Number of plots	Action score crop	Number of plots	Action score cattle	Number of plots	Action score harvesting	Wetland score
Example	*4*	*12*	*7*	*14*	*3*	*0*	*26*
Season 1							
Season 2							
Season 3							
Season 4							
Season 5							

Box 1: The wetland health record monitoring sheet

The various wetland conditions and their consequences

Wetland condition	Description of the wetland condition	Consequences
Highly degraded	• Over-working of soil is depleting the soil organic matter • Erosion is rapidly degrading the banks of the river and the plots • Removal of indigenous vegetation causes large losses of species • Draining of soil deeply affects the groundwater level	• All crops yields or revenues are lowered by one level on the production table • Reeds and sedges can be harvested on 5 plots only • 2 more plots are unusable in the cultivated wetland
Degraded	• Erosion occurs but at a limited extent • Over-working of soil is affecting the soil organic matter • Indigenous vegetation tends to disappear	• Reeds and sedges can be harvested on 10 plots only • 3 plots in the cultivated wetland are unusable due to lack of organic matter • Water quality is degrading and the municipality imposes a fine of 10 money units to each farmer
Baseline condition	• Cropping systems tend to overpower natural vegetation • Hydrology is slightly affected	• None, yields and water requirements are at their initial level
Upgraded	• A right balance is found between cropping and preservation of undisturbed patches of natural vegetation • Soils water content is improved	• Yields and revenues are increased by one level compared to the baseline condition
Highly upgraded	• Natural vegetation is dramatically expanding throughout the wetland • Soil organic matter is at its highest • Fauna benefits from large undisturbed areas of natural vegetation • Soils have a high water content	• Reeds and sedges can be harvested in the formerly cultivated parts of the wetland • As water quality has improved, the municipality accepts to help funding collective investments

Box 2: Wetland conditions designed for Wet-WAG

Consequences listed in box 2 are a transposition into the game of real life consequences listed in WET-Health (Macfarlane *et al.*, 2008). They are supposed to make players aware of the environmental consequences of their actions. Of course, the time scale has been reduced to fit the game time frame. Soil organic matter depletion does not occur in one season (6 months) but over

the course of several years. Among the consequences, some are the result of the game designers' decision. As an example, the fine of 10 money units for poor water quality is not planned by the Municipality or any other stakeholder.

6 A typical game session

6.1 Game process

The game facilitator explains the game to the players by introducing the different components step by step: the game board, the circulation of water and succession of seasons, the roles and activities. Role cards and activity cards are distributed to the players and their content is detailed. Initial cash is distributed.

The game is played at a seasonal step, with an alternation of wet and dry seasons. Each season, players must feed their family, pay for their basic costs and choose the activities they perform on their plots: cultivation, grazing, natural plant collection (in some sessions, they also had to pay the corresponding seasonal costs and affect manpower to them).

The first round (usually a rainy season) starts with the provision of information on the yearly situation (expected climate, policy and management rules, and objectives). Each player chooses the activities he/she wants to undertake on his/her plots. Once players have chosen their activities, the seasonal water (rain water, water withdrawn from the river, groundwater) is run by the water manager (or game facilitator) and distributed to the plots. Players who have access to the irrigation scheme share irrigation water among them. This step generally gives rise to intense discussions among players. Other points generating discussion include the use of unallocated plots in the wetland or the presence of livestock around cropping fields. Then players receive their gains according to the activities they chose and the water they got on their plots. An assessment of the wetland state is recorded on the monitoring table. When the wetland is degraded, crop yields or harvest of natural products are reduced with impact on players pay-offs. Some plots in natural or cultivated wetland can even be "blocked" so that no human activity can be undertaken. The game then moves to the next round.

6.2 Game devices used to trigger collective discussion

Several kinds of "devices" can be used during the game to trigger discussion about wetland management issues:

- General rules of the game, such as the fact that irrigation farmers have to share irrigation water among themselves
- Wetland monitoring sheet: discussion can either happen during the game at the end of each round, to decide collectively upon the use of the wetland in the following round or during the debriefing after the session. This was done for example during the last testing session in Ga-Mampa. It made farmers aware of some of the consequences of over-cropping and they started discussing on how to control what farmers are doing in the wetland.
- Event cards: the cards on irrigation schemes rehabilitation can be used by the game facilitator during the course of the game, after one or two seasons. Players need to realize first how scarce the water is in the system. Then, they can decide to save some money, and to contribute to the cost of the irrigation rehabilitation. The mode of contribution has to be decided among players: who will participate (every player, only irrigation farmers), how much will each farmer give… There are several interests. As the game is a representation of the reality, external stakeholders would realize the need for a better irrigation system in Ga-Mampa. Then, it would allow farmers and/or representatives from the administration to discuss which option would be better, whether rehabilitating the existing gravity system or building a new pressurized system. Discussions during the game and the debriefing can provide room for players to think on this issue and help them make decisions about Ga-Mampa real resources management.

6.3 Debriefing

Debriefing is an essential part of the use of role-playing game in natural resources management and should not be overlooked. There are two main components of the debriefing: the first one is about the game itself: What works or not? What is difficult to understand? What is pleasant or not? This first part was very useful during the testing sessions to improve the game design.

The second component consists in helping participants commenting on their role in the game and reflecting on their role in the real life. This discussion is part of a collective learning process and can help further discussion in the real life, because participants can refer to it later. The following questions can guide the discussion of this second component:

- Did some of you feel bad during the game?
- What happened during the game? What are the key features? What can you take from it?
- Do you think that this kind of situation can happen in real life?
- Is there anything unrealistic in the game or something missing?
- We agreed that some changes need to happen in the reality. How can we commit for it?

In the testing sessions organised in France, West Africa and South Africa, the discussion around the game itself was based on the evaluation form (see Annex 3) filled by individual players, followed by a collective discussion. The discussion comparing the game and the reality occur mainly during sessions organised in South Africa with participants from villages, especially the last session organised in Ga-Mampa.

7 Results

Results of the first test sessions showed that the game is well received and can be played by a wide range of people (students, researchers, local community members, water management professionals). Most participants found it funny, interesting and educational. Some improvements are however needed, especially regarding the length of the sessions, the clarity of game rules and the scenarios played. Further developments of the game could include the introduction of new roles (e.g., regulator), external events triggering discussion around specific issues of interest, and representation of other wetland ecosystem services (e.g., flood retention) to increase the genericity of the game. Another version of the game representing the interaction between the wetland management and river basin management would also be useful. Some of these aspects are discussed in the following sections.

7.1 Roles in Wet-WAG: relevance and additions

Roles in Wet-WAG are limited to farmers. First tests of the game prototype prompted questions about the representativeness of the existing roles and the need for additional ones.

The typology of farmers used in Wet-WAG was based on typologies developed during previous research in the area (Chiron 2005, Masclet 2007). It is based on the following characteristics:

- Access to land (irrigation scheme and/or wetland)
- Number of cattle
- Basic food needs (related to the family size)
- Basic expenditures (related to the family size, but also to the external incomes provided by family members working outside the village and social grants).

During the meetings in Ga-Mampa, roles were presented and great care was used to explain the differences between them. Every time, participants agreed and confirmed that the diversity of roles resembles what exists in Ga-Mampa and that these characteristics are indeed important to classify farming households. In addition they said that there was no significant category of household overlooked by the game.

No additional role was developed during the design process, although some thought were given to adding roles for regulators in charge of keeping rules, such as traditional leader, or external regulator representing the interests of other stakeholders such as the Department of Environment, the Department of Water Affairs or the Municipality. The absence of regulator in the game mimics the reality where traditional authorities are loosing their hold on wetland management and control from external regulators remains very weak. The game facilitator plays the regulator in the current version of the game, but it could be interesting to make someone else play this role.

7.2 Developing new action cards

During the development of the game in South Africa, new actions cards were introduced to diversify the choices of farmers and make the game more interesting. This was based on previous research done in the area (e.g., Chiron 2005) and interviews of local stakeholders (e.g., the extension officer). Crops identified in the village include:

- Dry beans during the dry season, cultivated in the irrigation scheme
- Groundnuts, during the wet season, in the irrigation scheme and the wetland
- Sweet potatoes, during the wet season, only in the irrigation scheme
- Pumpkins, associated with maize in the wetland

- Wheat, a dry season crop for the irrigation scheme
- Sugar cane, planted on the border of the fields
- Also mango trees, avocados and pawpaw.

A right balance between diversity of choice and game complexity was necessary therefore not all those crops were included as action cards in the game. We decided to choose only new crops which differed sufficiently (in terms of water requirements and pay-offs) from those already present in the game. Moreover, it was agreed that semi-perennial or perennial crops such as sugar cane and trees were either too marginal or difficult to play in the game. Furthermore only the most important crops in terms of area were selected to be represented in the game. Finally, the three crops chosen were dry beans, groundnuts and sweet potatoes. It was really important to include new wet season crops as initially there was only maize. At the same time, onions were removed from the list of crops present in Wet-WAG, as its characteristics were close to cabbage's ones. Thus, the list of crops available in the game was modified as shown in Table 3.

Table 3: List of crops available in Wet-WAG

Wet season	Dry season
- Maize (only food crop) - Sweet potatoes - Groundnuts	- Tomatoes - Cabbages - Dry beans - Coriander + Harvesting of reeds and sedges

Mr Philip Mosima, the extension officer of Ga-Mampa, was able to give figures for the prices of every crop, according to the market prices of 2009. On the other hand, he was unable to give exact figures regarding water requirements. He provided relative figures, comparing crops to each other ("Sweet potatoes require two times more water than maize"). Given his experience, we considered these data to be valid in the context of the game, where we simplify the reality.

Another important point for the game was the introduction of new crops that suit wetland conditions. This cannot be achieved as literature on the subject is very limited in South Africa. Several crops were suggested such as rainfed rice (for example using the System of Rice Intensification (SRI), already successfully tested in Eastern Asia and Africa[9], which requires less water than traditional rice cultivation and no tillage). Another crop suggested by Donovan Kotze, ecologist specialized in wetlands, is *Colocasia Esculenta*, which has a high tolerance to water logging, but requires deep tillage. Further investigation is needed to include such crop in the game.

7.3 Simplification and changes in the design of the game

Overall, the game was often perceived as being quite complex to understand at the beginning. Participants have to become familiar with this new tool, and there is a lot of information (rules, elements) to be learnt. Thus, the game has to be kept as simple as possible, and each element not fully relevant for the purpose of the game must be removed. As mentioned above, manpower was not considered to be a constraint of importance for the farmers. It was thus removed from the game. This triggered a series of changes on action and role cards. Participants were often taken aback by the cards designed in the first version of Wet-WAG. They had troubles understanding which

[9] The SRI project homepage: http://ciifad.cornell.edu/sri/index.html [last retrieved on June 16th, 2010]

information was useful, and where they could find the right indication (e.g. where the crop can be grown). New role cards and action cards were then designed (they were presented in section 4.4).

New role cards display the information into two distinct categories: resources available to the role and requirements. External income of the player was merged with its basic expenditures, in order to limit the exchanges of money at the end each round. Some terms were adjusted to increase understanding. For example at the beginning, a role was supposed to be a group of farmers sharing similar socio-economic characteristics. However, participants had troubles understanding this, so it was decided to say that each role corresponds to one farmer.

Action cards were also simplified focusing on visuals rather than text to ease their use by players with low level of literacy. Manpower, running and starting costs were removed, and directly included in the crop net revenue. The season when the crop can be grown was put at the top of the card. Indeed, some participants did not understand at first that some crops can only be grown during a specific season. To avoid this, it can be useful to introduce activity cards (and generally speaking all elements of the game) progressively and only when they are needed (i.e., wet season crops when the wet season round is played, and dry season crop cards when the dry season round is played). Pictures reproducing the land plots represented on the game board were used to indicate the place where the crop can be planted. There are several empty boxes in the new card. It was decided that when information was not relevant for a particular action (e.g. water needs during the dry season for a crop grown in wet season), it was better to leave an empty box rather than a 0 that would confuse participants. These empty boxes are linked to the semi-automatic generation of action cards through a spreadsheet associated with card model using the mass mailing function of Word ®. Overall, the new cards were well received during the tests of the game.

7.4 Additional event cards

Some events are likely to affect livelihoods in Ga-Mampa. The first we could mention would be floods, as everybody remembers the one that occurred in 2000 and which damaged the irrigation scheme. Mr Netshikovhela from LDA confirmed that floods are common events in the region, and a major one can happen every ten or twenty years. One of the services provided by wetlands is a “protection” against floods. If they are in good condition, they can act as a sponge, and thus lower the extent of flooding. As the Ga-Mampa wetland is considered to be damaged (Kotze, 2005), new floods could have dramatic impact on livelihoods, destroying the numerous plots along the river. Thus, an event card could be designed to represent what would happen to the village if a flood were to happen. However, further data from what happened in 2000 would be useful to design such event card.

Two other events can be considered, given the inputs from the discussions in Ga-Mampa and the local situation. The first one is the construction of a proper road to the village. This would open new possibilities for farmers to sell their products to the local markets, making transportation easier. In the game, we can think this would increase farmer income farmers and alleviate the limitations imposed on some crop cultivation.

The other major opportunity for Ga-Mampa is the development of eco-tourism. A tourism centre was built in 2005 by the Lepelle-Nkumpi Municipality, but has never been used since. Infrastructures are slowly degrading. The opening of the centre could represent a new source of income for Ga-Mampa households, through selling of agricultural or craft products and new jobs opportunities (guided hikes, catering...). Once again, further information is needed to assess the potential of the tourism sector in the village and draw consequences for livelihoods, and design corresponding new event and activity cards.

8 Use of Wet-WAG in the participatory assessment of management options for Ga-Mampa wetland[10]

In March 2011 as part of WETwin work package 8 on trade-off analysis, Cemagref (now Irstea) and IWMI research team used Wet-WAG in a total of 5 sessions with community and external stakeholders. This took place as part of the stakeholder consultation aiming at validating management options (MOs), elaborating management solutions and building evaluation criteria for the management of the wetland[11]. Wet-WAG sessions were conducted by Clément Murgue assisted by Tumelo Masilela and under the supervision of Sylvie Morardet.

8.1 Research questions, assumptions and objectives of the sessions

Two research questions motivated and guided the organization of the sessions:

- How can Wet-WAG be used to discuss management of the Ga-Mampa wetland with the community and other stakeholders?
- What scope does Wet-WAG have in supporting action and research?

Our assumptions were that

- the RPG could support the crafting process of management options and allow the identification of the main conflicting points in the management of resources in the Ga-Mampa valley;
- Wet-WAG would support the discussion on the implementation details and consequences of MOs; and
- Wet-WAG would help to reveal stakeholders expectation on management orientations and evaluation.

In consequence, the game sessions had three main objectives:

- To make use of the awareness raising capacity of the game by introducing the socio economic and environmental challenges of Ga-Mampa wetland to external stakeholders;
- To support the understanding of the WETwin concepts (management options, evaluation criteria, multi-criteria analysis) by introducing some of the previously identified management options (irrigation scheme rehabilitation and wetland use planning) into the game and evaluating their economic and environmental consequences;
- To test the potential of the game to support discussion and decision making in real life by introducing the discussion on management options within the game session.

The first three sessions, conducted only with community members, focused on management options validation and refinement of the game to allow its use in the multi-stakeholder workshop.
The last two sessions were held in parallel during a multi-stakeholder workshop on the 16th of March 2011. They aimed first at improving or comforting external stakeholders' knowledge on local issues around natural resources. They also intended to introduce stakeholders to the challenges of choosing and implementing management options, to prepare further discussion on the multi-criteria analysis process (Figure 13).

[10] This section is based on the report prepared by Clément Murgue (Murgue 2011).
[11] see report on WETwin Multi-stakeholder workshop 4 in March 2011 (Murgue 2011)

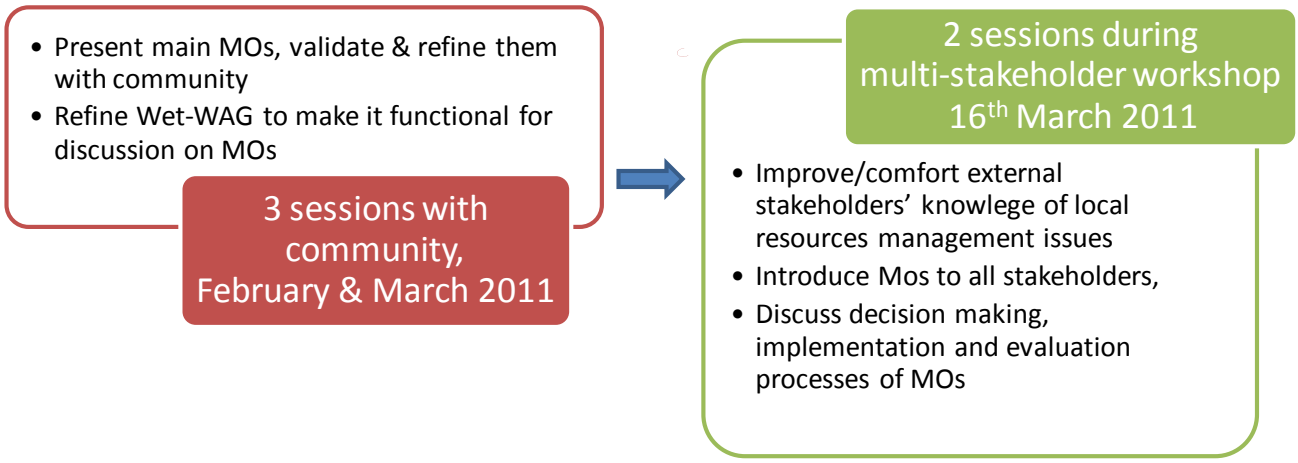


Figure 13: *Overview of the Wet-WAG utilization in the WETwin project, February and March 2011*

8.2 Elements added to the game set

New elements were added to the game set in order to fulfil the above mentioned objectives:

Management Option cards were designed to describe MO alternatives. They were based on alternatives described in Murgue 2010 but focussed only on irrigation scheme rehabilitation and wetland use planning. Economic consequences they would have on the players and environmental consequences they would have on the resource system were made explicit (Annex 4).

Wetland use cards: Moveable cards, the size of a plot on the game board, were created to indicate the wetland status and visualize the land use management options (Annex 5). These cards were introduced to support the discussions on land use planning (Figure 14).

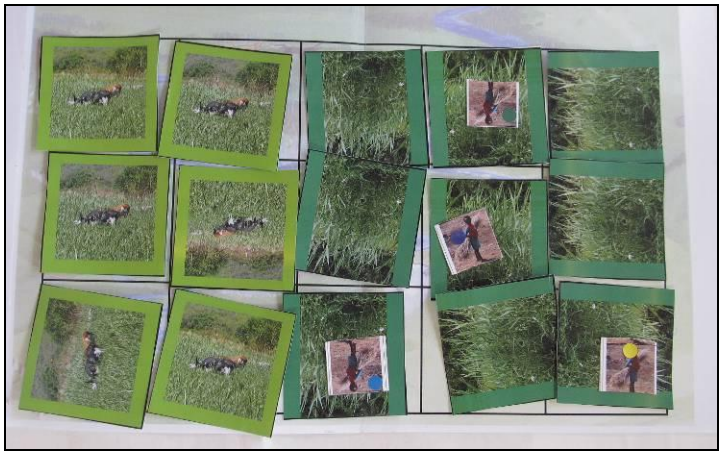


Figure 14: Use of the wetland use cards to visualize the state of the wetland

A computerized wetland health monitoring sheet was made under Excel (See screen capture in Annex 6) as to provide a live monitoring of the wetland status, making use of the manual monitoring

sheet previously developed by Milhau (see section 5.5). It was also linked to the computerized monitoring sheet used to compute players' pay-off.

8.3 Sessions with the community

8.3.1 Session organization and development

Table 4 summarizes the development of the three game sessions held with the community.

8.3.2 Main lessons learnt and recommendations

They relate to three main areas:

Game organization and setting

- The game is relatively complex for players: they had to deal with a lot of material and information, and possible actions differ depending on the season.
- A specific workshop should be dedicated to the game session as it requires a specified number of players and all players must be present before starting.
- It is more difficult to explain the game and attract attention from players when there are many (in particular because of the size of the game board) → Limit the number of participants
- The best way for players to learn and understand the game is to play it, especially because local people are good at learning through experience rather than listening. It is necessary in the first round to assist players, highlighting the consequences of their choice.
- The alternation of dry and wet seasons is closer to reality but makes the game more difficult to understand and play. It is a source of debate on which crop to crop when.
- The pay-off computation phase was too long and should be reduced to avoid losing momentum and so that players become aware of linkages between actions and consequences.
- The pay-off matrix should be simplified and adjusted so as to trigger lack of cash and food for at least some of the players. Impacts of excess of water on yields must be taken into account.
- The individual monitoring sheet is too complicated to be filled up by local farmers themselves but is useful for facilitators to compute pay-offs and track decision made during the game.
- Monitoring of wetland use should be simplified as much as possible.
- Good facilitation skills are required to adapt quickly to players decisions in the course of the game, to be able to trigger discussion on the topics of interest.

Players' behaviour in the game and in reality and conclusion for management of resources in Ga-Mampa

- Local farmers tend to act in the game as they would act in reality (e.g., not cropping all their wetland plots, because it is harmful for the wetland even if he/she cannot cover his/her food needs; or choosing gravity irrigation system over the drip system). Therefore the game can be used to reveal stakeholder preferences in reality or technical constraints for option implementation.
- For security reason, farmers would never give up a plot neither in irrigation scheme nor in the wetland even if they do not use it. Irrigation scheme rehabilitation will not be sufficient to stop wetland farming.

Table 4: Summary of Wet-WAG sessions held with Ga-Mampa community in February-March 2011

	Session 1	Session 2	Session 3
When	After a wetland committee meeting and a focus group discussion on wetland management principles	Workshop specifically dedicated to the game session	
Participants	12 members of the Ga-Mampa wetland committee (males & females) playing in pairs	6 Ga-Mampa farmers (males & females)	5 Ga-Mampa farmers (males & females) + Tumelo Masilela
Facilitators	Clément Murgue Tumelo Masilela	Clément Murgue Tumelo Masilela	Clément Murgue Tumelo Masilela
Objective	Introduce and test MO cards	Play 6 rounds (3 years) and introduce irrigation rehabilitation MO cards after year 1	Discussion of wetland management and land use planning rather than on management of the irrigation scheme and economic performances
Innovation		Individual monitoring sheet to ease computation of pay-offs and keep track of individual decisions	1 year per round (instead of 1 season per round) Decrease of rain variability Averaged water availability in IS Invasion of a plot in the wetland makes its neighboring plots drier and available for cropping. If wetland use is over 15 plots: cropping yields divided by 2. Change in gazing carrying capacity of rangeland and wetland and pay-off of cattle production

	Session 1	Session 2	Session 3
Session development	- Presentation of the game components & rules and players objectives (1 hour) - Only 1 round (normal wet season) could be played because of time constraint - Decisions on actions to play (30 mn) - Discussion on water sharing in irrigation scheme (5mn) - Computation and distribution of pay-offs (30 mn)	- Presentation of the game components & rules and players objectives (30 mn) - Round 1 (wet season, 45 mn): no extension of wetland farming - Round 2 (dry season, 45 mn): increased constraint on cattle grazing by limiting rangeland to 6 plots per cattle so as to trigger the need for wetland grazing. All IS plots were cropped but facilitators allocated more irrigation water than normal, yields were enough and players did not realize their mistake. 6 natural wetland plots were invaded, but not by the players most in need. In consequence 3 extra plots were made available for cropping and yields were lowered in the wetland in the next round. - Round 3 (wet season, 45 mn): introduction of MO cards on IS rehabilitation. Quick choice of the gravity IS alternative on the ground that it is necessary to diversify crops. However, more sweet potato was chosen in 60% of plots over tomato (short time of conservation). Invasion of 3 newly available plots in the wetland by the best-off players.	- Presentation of the game components & rules and players objectives (30 mn): focusing on consequences of players' actions on wetland status. - Round 1 (45mn): only 3 plots used for reed harvesting. 3 unallocated wetland plots invaded (wetland 50% cropped). Decrease of wetland farming income by 2. Allocation of IS water on a first come first served basis. Allocation of 2 rain water units to limit economic difficulties. - Round 2 (40 mn): increase of cultivated wetland area. No spontaneous collective organization to manage wetland resources (illustration of the tragedy of the commons). Yields again divided by 2 and no more land available for cropping in the wetland. However, players did not suffer from shortage because basic needs were set too low. - Round 3 (40 mn): introduction of land use planning MO card. Alternatives presented thanks to moveable wetland use cards. Discussion on land use options successfully triggered by the game
Feedback from participants	- The game reproduces well Ga-Mampa valley in terms of resources and farmers' situation - Some crops presented as wet season crops can be cropped in both seasons. - In reality there is not such a difference between households in terms of irrigation plot distribution (only one plot per household) - Most important lesson = learning to plan and budget for their cropping in relations to family needs	Players were satisfied with their choice of IS rehabilitation which allows more cash cropping without compromising their independence of choice Again discussion of which crop can be planted when. Players confirm that rehabilitation of IS will not make people abandon their plots in the wetland. Only maize and coriander can be cropped in wetland without risk, but there a risk for maize in a rainy year. The only time when they feel the lack of water is at the junction between dry and wet seasons (September to November).	No specific feedback

- Players tended to secure their access to land before others do it, even if they do not really need the plots to cover their subsistence needs, and without considering potential consequences on the community. This is a good illustration of the tragedy of the commons and of the lack of spontaneous social organization over resources management.
- When discussing management options in the game, farmers referred immediately to the real life context in terms of technical aspects ((e.g. "*This plot is too wet and we cannot put cattle on it*", "*it is too much work to plough a plot with natural vegetation*", "*cattle should not graze in reed areas*")) but were able to make abstraction of real personal tensions and rather referred to tensions between players in the game.
- Reed harvesting was very limited in the sessions highlighting that cropping remains the main objective of wetland use for the community or at least for the group of community members who participated to the game sessions.
- The discussion over wetland use planning highlighted that
    - Land use planning would be required to ensure fair distribution of land and sustainable use of the wetland.
    - Some of the technical aspects of this MO designed by the research team are not adapted to the real context: rotation between cropping, grazing and regeneration of natural vegetation is not accepted by community members for several reasons (farmers would not agree to reorganize their plot, cattle owners do not want their cattle in the wetland, and labour constraints are too high).
    - Releasing cropping pressure on the wetland can only be dealt with if IS rehabilitation is successful as no authority has enough power to change current land tenure. However, on top of that, land management plans should be validated by the traditional leader (Kgoši), and then implemented under the extension officer's control.
    - Integration of livestock can take the form of wetland grazing but only in the dryer areas of wetland if they were farmed before (no reeds). It could mean setting up a communal kraal and most importantly rationalizing wetland grazing in dry season (use of crop residues and natural grassland in dryer areas).

  As a consequence, the proposed MO on wetland use planning and rotation was separated into two MOs: land use planning and livestock integration. Land use planning will focus on reducing the cropped areas in the wetland for environmental sustainability and social equity. Livestock integration will focus on controlling grazing activities to limit pressure on wetland and intensify livestock production.

Game usefulness for discussion and decision making about wetland and other resources management

- The game allowed initiating discussion on difficult topics, such as unequal land distribution, that are rarely tackled in real life.
- The game was also useful to highlight management challenges (e.g. uncontrolled access to land).
- However, it is not sure that agreement made during the game will be translated into real life decision.

8.3.3 Conclusion

During the sessions with community members, **Wet-WAG provided useful information for WETwin research** mainly by supporting the validation of proposed management options. The gaming platform eased the understanding of alternatives, providing visual and concrete descriptions,

and it was appropriate for testing their socio-economic consequences. In addition, game sessions provided useful information to further develop more context-adapted MOs in view of the multi-stakeholder workshop, especially regarding the land use planning option.

The game sessions were also useful **to identify existing social organization/protocols over resources management**, mainly through observation of the players in action and their spontaneous reactions to proposed changes.

Regarding discussion and decision-making on wetland management, **the game triggered discussion on topics which had proved to be difficult to tackle** in more traditional type of workshops. Players talked about controversial issues with ease, taking roles/colours as examples instead of real people (ex. "*take the pink IS farmers out of wetland because he already accesses enough land in IS*"). On the other hand, players were able to point out the constraints limiting the implementation of proposed MOs in reality. Therefore if the game was useful for discussion, its use for supporting decision-making in real life is limited.

However, after the three sessions, it appeared clearly that the game requires a long time to be understood and played, especially if one wants to use it to support discussion about resources management. It is a good discussion platform on the condition that players have experienced at least two rounds. Therefore we recommend using it in several successive sessions over a relatively short period of time with the same group of participants in order to take advantage of the learning capacity of players.

Based on the community sessions, we decided to simplify the game as much as possible for its use in the multi-stakeholder workshop, so that 3 rounds could be played in 2 hours. We also agreed to limit the objective of the game session during the multi-stakeholder workshop to raising awareness about local challenges and triggering discussion about management options, without trying to use it reach a decision which management options.

8.4 Wet-WAG use in the multi-stakeholder workshop

8.4.1 Adaptations of the game

Changes made to the game aimed at i) making the game easier to play and more visual so that management options could be introduced earlier in the session, and ii) shifting the focus of the game from farming system economic performance towards natural resources management.

- 1 round is 1 year: to speed up the game progression, as it was successfully experienced during the third session with the community. Therefore action cards can all be used at each round, availability of water is constant, and calculation of pay-off can be standardized.
- Less material distributed to players to reduce the time used for game presentation and ease players' concentration, making use of oral memory of players and their capacity to learn by doing. Grazing cards were thus removed from the game set.
- No water variability between rounds as it is a source of complication for players, and not the focus of the workshop.
- Lower calculation time by simplifying the pay-off matrix: there would be only three levels of pay-off per crop: maximum if it receives water according to requirements; half of the maximum if

water is too little or in excess; and 0 if it receives no water. It was also decided that water availability in wetland would always match crop requirements. Finally, the facilitating team developed a computer assisted calculation tool on Excel and monitoring sheet was prepared for players to provide data under the necessary format.

- Stating the objectives and live monitoring: Objective of the game sessions and of each round must be clearly stated by the game manager at the beginning and frequently recalled along the session.
- Introducing constraints on players' possibility of action in order to make clear that pressure on natural resources was the main topic to be discussed. Grazing opportunities were limited so that not all livestock owners could find grazing land if no arrangements were made. Yields and revenues were lowered. Water availability was strictly limited.

8.4.2 Description of the sessions

Two sessions were held in parallel during the multi-stakeholder workshop, with two groups and two facilitating team. The main objectives were:

1. **to introduce local stakes about resources management to external stakeholders**: the trade-off between farming systems strategies and community needs for social equity and environmental sustainability (Wet-WAG as an awareness raising tool)
2. **to present the WETwin concepts of management options and alternatives**, and the decision making process linked to it; to evaluate potential objectives for the two main current management challenges (irrigation scheme and wetland use planning) (Wet-WAG as a participatory research tool)
3. Third, **to introduce the game to external stakeholders as a possible discussion and decision making tool** (Wet-WAG as a discussion and decision making tool for development).

It was intended to play three rounds in 3 hours: round 1 with the current situation, introducing the MO on irrigation scheme rehabilitation in round 2, and wetland use planning MO in round 3. Facilitating teams were composed of a game manager in charge of explanation, monitoring and facilitating discussions, and an assistant responsible for computer calculation of pay-offs and help facilitation. There were no formally appointed note takers in the facilitating team, which resulted in a lack of notes on the session's development. Table 5 summarizes the sessions main developments.

Table 5: Summary of Wet-WAG sessions during the multi-stakeholder workshop

	Group 1	Group 2
Participants	SANBI provincial representative, LDA representative, African Ivory Route representative, ward councillor, traditional leader, Ga-Mampa farmer, local extension officer, representatives of Vela VKE (engineering consulting company)	UNDP representative, 2 extension officers, AIR representative, CDF secretary, 2 LDA representatives, wetland committee chairman
Facilitators	Clément Murgue (Irstea) & Yvan Altchenko (IWMI)	Tumelo Masilela (CRCE) & Sylvie Morardet (Irstea)
Round 1	Questions and discussions focused on economic stakes (maximizing individual pay-offs), with little attention paid to how the resources were managed at community level. Players quickly understood the need to cover	As in group 2, players decisions were targeted at maximizing individual pay-offs. There was no particular conflict over grazing land (6 plots grazed) and discussion on irrigation water sharing was quick.

	Group 1	Group 2
	their cash and food needs. Only 3 new plots were invaded in the wetland. A conflict occurred over grazing opportunities in the mountain: one cattle owner grabbed all the available grazing land excluding another one, Despite disapproval by other players there was no spontaneous group decision to solve the conflict. Another conflict occurred about sharing irrigation water: water was allocated on the basis of plot distribution between players at secondary canal level without paying attention to crop requirements. Each focused on individual achievement rather than on equitable share at scheme level. Some plots were left without irrigation and some other received more than needed. Players pay-offs were very unequal: depending on the access to water and grazing. Some of the players had to borrow money while others had extra income available.	3 plots were invaded in the wetland
Round 2 & 3	Technical and economic consequences of MO on irrigation scheme rehabilitation were presented. Then the group was asked to debate on which alternative to implement and to come up with a common decision. Discussion was intense, and quickly moved from the game fictitious and simplified setting to the more complex real situation. To bring the discussion back into the game, the game manager proposed to evaluate the economic consequences of each alternative on one player. This helped supporting participants' arguments. Discussion then moved towards the construction of a third alternative trying to build common objectives. No final decision could be made due to lack of time. The game set was then used as a visual tool to support discussion on the wetland use planning option, without playing roles. The discussion focused on reallocating access to high value land (both in irrigation scheme and wetland), while maintaining present land ownership. It was concluded that some of the wetland should not be farmed because it was too risky, and that farmable areas should be lend to those who need it most.	The group was able to reach an agreement on which alternative to implement for the rehabilitation of the irrigation scheme: The respective advantages of the alternatives were discussed: low reliability of electric power supply, higher maintenance cost, higher efficiency and control of water supply, loss of plot ownership and independence of action and higher coordination needed in the case of drip irrigation. The group finally concluded that even though drip irrigation was more challenging in terms of organization, it would be economically more profitable. Adoption of drip irrigation resulted in an impressive increase of economic performance of irrigation farmers, leaving behind the wetland farmers. Participants pointed out that this option was interesting in economic terms but challenging in terms of social organization and equity. MOs on wetland use planning were not discussed.

8.4.3 Lessons learnt

The game helped making participants aware of the risk involved in uncoordinated use of resources: the possibility for some players to capture all the resources at the expenses of other community members.

It also showed that one round, if well explained and strictly monitored by the facilitating team, is sufficient to point out the main challenges at farming system level and in resources management at community level.
When dealing with MO, the game proved to be useful in evaluating the economic consequences and discussing operational difficulties of management alternatives. For example, in group 2, playing the implementation of the drip irrigation alternative allowed participants to experience its economic benefits as well as its challenges. The game can thus be used as a tool to support discussion over resources management by pushing participants to evaluate the consequences of a common management decision on each farming system entity. However the game is limited in terms of decision-making because the situations represented are too far from reality.
The game sessions helped implementing the WETwin trade-off analysis framework by making participants more aware of potential consequences of the management options. However, because the game design was initiated before the implementation of the framework, it was not easy to integrate all the elements of the framework into the game (evaluation criteria). Time was also limited to allow for testing all management options.
Changes made in the game for these sessions were successful, especially the use of the computerized monitoring sheet.

8.5 Feedback from participants

At the end of the sessions, participants were asked to write their positive appreciation of the game on green cards and their negative ones on red cards. This procedure left a lot of freedom of expression, and the results show a large range of topics.

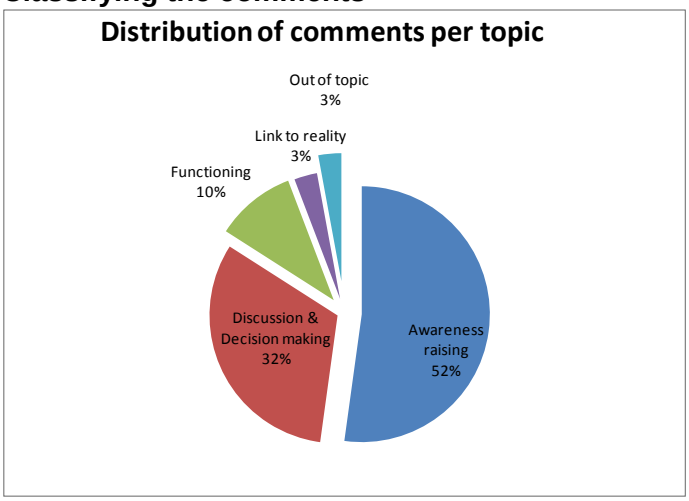
A look at negative comments
Some of the negative comments provided by players directly criticize the game (10% in total):

- Transgression of reality (e.g. "*The game assumes that the crop to be planted (commercial) is only tomato, which is not necessarily the case*");
- Complexity (e.g. "*Too complex for community member/farmers senior people*") and therefore its uselessness in particular with local community.

Other comments written on red cards expressed views on Wet-WAG usability and achievements (28%) more than negative comments on the game itself:

- Some revealed players' discovery of a management challenge (e.g. "*Allocation of land is not balanced*").
- Some expressed the frustration that no agreement was found on MO proposals in group 1 (e.g. "*No clear solution is unanimously adopted*"). It shows that the session was a discussion platform enhancing collective wish to make a decision.
- Some were related to the link between the game world and reality (e.g. *It is only a game and in real life, some of the things it shows are very difficult to engage).*

Classifying the comments



As shown on Figure 15, most comments were related to the achievements of the sessions rather than to the functioning of the game itself. This is a first indication that the game was considered as useful by the players. The first most important group of comments are related to awareness raising aspects, whereas the second most important group of comments dealt with support to discussion and decision making.

Figure 15: Distribution of participants' comments per topic

- **WetWAG as an awareness raising tool**

The relative importance of this category confirms that Wet-WAG was successful in raising awareness of participants. External stakeholders stated that playing Wet-WAG had made them familiar with the local situation and stakes. Local stakeholders often reflected on the fact that Wet-WAG allowed them to realize the importance of economic management and planning in a farming system.

- **WetWAG as a platform for discussion and decision making**

From players' comments, it comes out clearly that the game simulated the decision making process, and stimulated discussion between stakeholders for real life decision making. Comments in this category can be shared between those which thinks that the game can be used by for discussing resources management with the community and between stakeholders (e.g. "*Helps the development facilitators to consult with the community and obtain applicable input"*), and those which describe Wet-WAG as a tool to directly support decision making process. (e.g. "*Relevant and applicable to situation in Mampa, it can help in making appropriate decisions"*). On the other hand some comments pointed the difficulty to link decisions in the game to reality (e.g. "*It is only a game and in real life, some of the things it shows are very difficult to engage*").

Figure 16: External stakeholders reflecting on how to use the wetland

- **Limits of Wet-WAG**

Comments on Wet-WAG functioning are mainly negative. They point out either game weaknesses or player's frustration due to difficult rules, but most interestingly, they put two opposite things in parallel, sometimes in the very same statement: i) the game is too complex/long to be used with community, and ii) the conclusion drawn in the game are too simplistic to be applied directly to reality.

8.6 Discussion

This section reflects on initial research questions stated in paragraph 8.1.

How can Wet-WAG be used to discuss management of Ga-Mampa wetland with the community and other stakeholders?

The sessions held in Ga-Mampa proved that Wet-WAG is an adequate tool to support discussion on wetland management. It is a **communicative/participatory tool.** It levels the playing field between stakeholders, allowing them to sit at the same table informally. Freedom of speech is higher in the game than in reality allowing the discussion about difficult, conflicting topics. In short, Wet-WAG proved to be efficient in opening the consultation and discussions process, and building trust amongst stakeholders.

It is an **awareness raising tool**, both for local community and external stakeholders. Because it represents accurately the economic reality of farming households, external stakeholders can experience the challenges faced by the community and their vision. Using the farming system entry (household level), it shows its repercussion on natural resources at community level. The community stressed the fact that the economic modelling of cropping, grazing and harvesting actions showed them the importance to plan and budget for their family and farm needs. Although it was not straightforward in the feedback of the sessions, our feeling is that it also raised consciousness of the players on the current social inequity of resource allocation and the need for rationalizing their use. By building awareness and understanding, Wet-WAG was successful in encouraging discussions between stakeholders.

It is a **capacity building tool** because it provides visual, material and cognitive structure to the discussions. The visual and material aspects of the game allow a straightforward description of proposed ideas in comparison to normal discussions. This guarantees understanding and permits rectification by the players. This is one of the most useful aspects of Wet-WAG when discussing resources management, but requires a good understanding of the game functioning before it can be fully exploited. In addition, the game can illustrate the consequences of natural resources use on

private farming systems as well as on collective environment and players can refer to these consequences observed by all participants in their argumentation.

Figure 17: Ga-Mampa decision makers (traditional leader and ward councillor) discussing resources management in the game

The game sessions allowed stepping back from reality's conflicting situation but helped to bring about challenging issues. In general, Wet-WAG sessions held in Ga-Mampa were quite successful in triggering discussion over natural resources use, although some limitations can be pointed out:

- Discussing resources management resources with Wet-WAG is more interesting when the game is fully understood and all complexity of economic and environmental consequences are taken into account by players. Therefore it is a time consuming activity.
- Players have different ways of dealing with differences between the game and the reality. People with local knowledge tend to refer to reality and therefore have less possibility to imagine or debate situations that are socially or technically challenging in real life. On the other hand this ensures a better transposition in the reality of decisions made during the game. In addition, the more formally discussion is introduced, the more reluctant people will be to hold innovative and challenging discussions as illustrated in Figure 18.

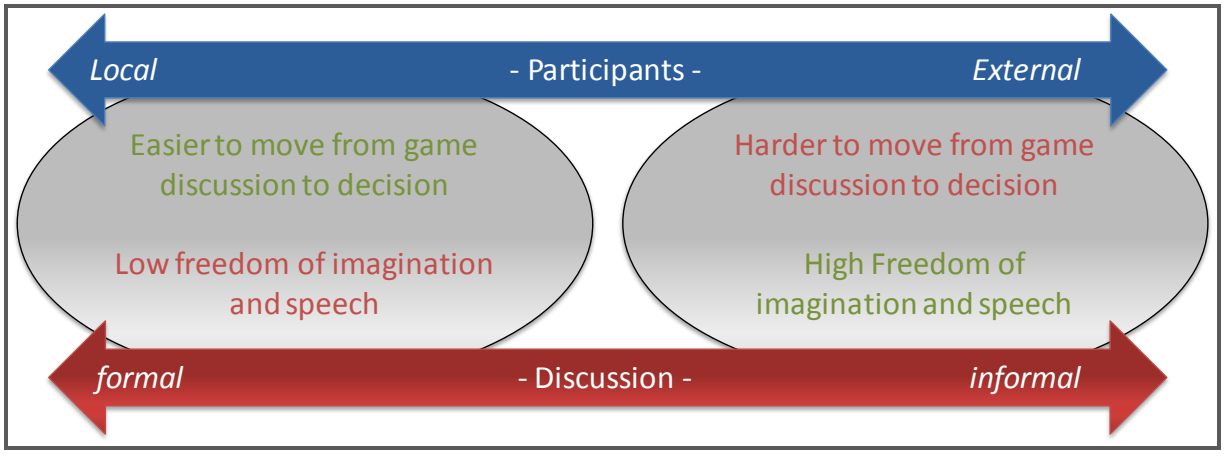


Figure 18: Linkages between types of participants, modalities of discussion over resource use in the game, and consequences on discussion and decision in real life

In consequence, following recommendations can be made to optimize the use of Wet-WAG for discussing natural resource management:

- The facilitating team must be clear about the objective of the session, and adapt the game component and session development accordingly to orientate the discussion phases towards the targeted topics. Two main types of issues can be addressed with Wet-WAG: farming system strategies and collective management of natural resources.
- Wet-WAG should be played repeatedly with the same people in order to guarantee full understanding, progressive learning and to be able to deal with all resources related issues. This is time consuming but ensures better knowledge development.

What scope does Wet-WAG have in supporting action and research?
Sessions conducted so far with Wet-WAG did not fully prove the capacity of Wet-WAG as a decision support tool. The game brought out interesting discussions and proposals for management of resources. Nevertheless, discussions were always limited to the game's context and there is no evidence that decision made during game session can be translated into real life.

Two dimensions, time and complexity, seem important with regard to the possibility of using Wet-WAG for supporting real decision making on wetland management.

Investing in time is necessary to allow the players to fully understand the rules of the game and the consequences of their action before being able to enter meaningful discussion on management options. It also takes a while before game facilitators can understand the dynamics of the game and be effective in orientating the debate on management issues. For a decision to be taken in the game, sufficient time should be taken to test and discuss all the options.

There is a trade-off between game complexity and its playability. Realistic representation of real life situations often increases game complexity but makes it more difficult to play. However, for players to agree that decisions made during the game can be implemented in the reality, it requires a collective agreement that all important aspects of the reality are represented in the game.

The application of Wet-WAG in Ga-Mampa showed that uses of Wet-WAG with stakeholders differ according to these two dimensions, as illustrated in Figure 19. Using Wet-WAG for awareness raising and facilitating simple discussions facilitation requires only a low degree of complexity and a game session of about 3 hours. Developing a game clearly oriented towards action and decision-making would require more investment from game managers and players (as pointed out by one player, *the game should be played during one week).* Complexity however should not be too high as it lowers the chances of coming to an agreement. For research oriented purpose, specifically the WETwin research on trade-offs analysis, no real life decision making is required but only validation of management options, the elicitation of preferred options and their evaluation. The level of complexity needed is quite high as several aspects of resources management should be addressed but development time remained reasonable. Therefore, Wet-WAG appeared to be quite adapted to research purpose as it allows introducing and testing management options and identifying stakeholders preferences over various alternatives.

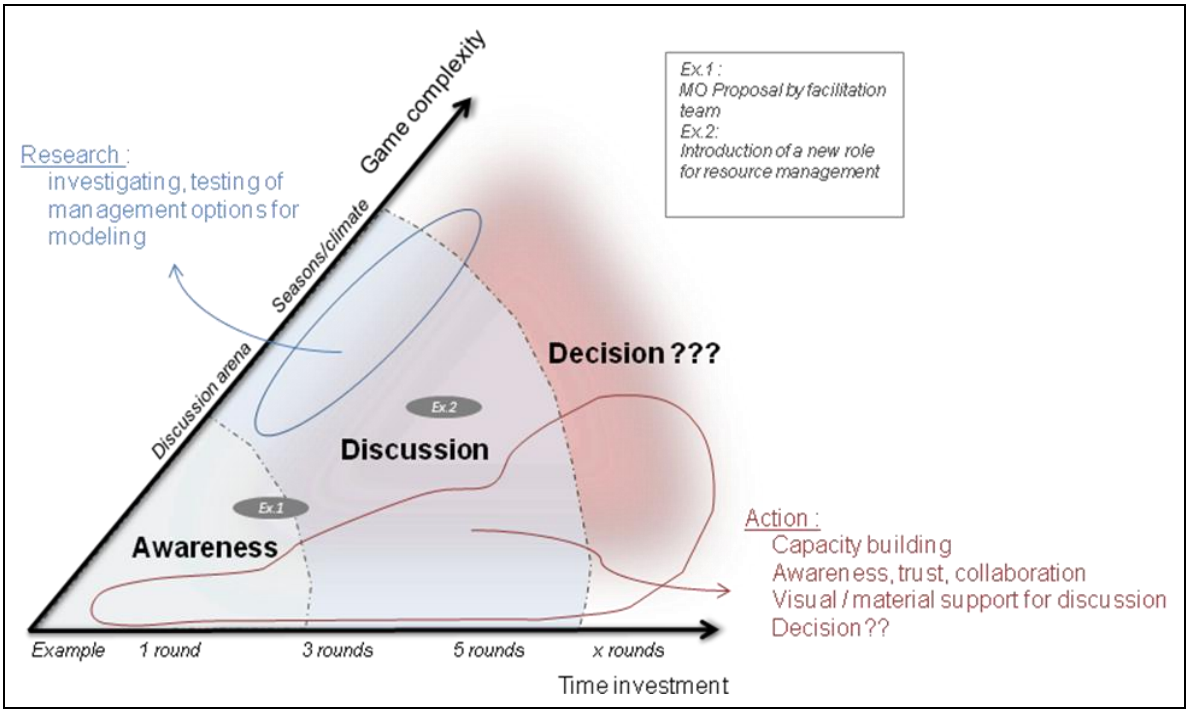


Figure 19: Potential uses of Wet-WAG depending on time investment and game complexity

9 How to adapt the game to other case study

9.1 Genericity / specificity of Wet-WAG

The general structure of the game (roles, land plot cards, tokens, action or activity cards, pay-off matrices) and the session process, the objectives of the game are generic. The detailed list of roles, land plot cards, resources, actions and activities and the related figures are specific to a case-study. They can rather easily be adapted to another case with few days of work with experts of the case study site. As in WAG, a spreadsheet gathering all the information used in the cards is linked to card models and can be used to generate new cards.

9.2 How to represent wetland ecosystem services in the game?

Ga-Mampa wetland being a small riverine wetland, the version of Wet-WAG designed for this case does not incorporate all the categories of ecosystem services that are expected from wetlands. Table 6 below gives some indications on how these various services could be represented in another version of the game.

Table 6: How to represent wetland ecosystem services in Wet-WAG

	Ecosystem services	How to represent them in the game?	Comments
Provisioning	Food production (natural resources collection such as fishing, hunting, edible plant harvesting)	Activity cards with indication of - Land plot cards where it can be implemented - season - resources (money, labour, smileys, etc.) requirements - average returns Activity tokens to be placed on land plot cards	Production functions displaying returns depending on water supply (and other events if necessary)
	Food production (cropping, grazing)	Activity cards with indication of - Land plot cards where it can be implemented - season - resources (money, labour, smileys, etc.) requirements - average returns Activity tokens to be placed on land plot cards Action cards for various agricultural practices (draining, burning natural vegetation, etc…)	see maize production in the Ga-Mampa setting Production functions displaying returns depending on water supply (and other events if necessary) Table indicating how the practices modify the livelihood returns (money, smileys) and the impacts on the ecosystem
	Fresh water collection	Tokens representing water abstraction devices (pumps, wells)	Table indicating price of the device and the number of water units abstracted par period for each type of device
	Fibre and fuel collection	Activity cards with indication of - Land plot cards where it can be implemented - Season - resources (money, labour, smileys, etc.) requirements - average returns Activity tokens to be placed on land plot cards	see reeds production in the Ga-Mampa setting Production functions displaying returns depending on water supply (and other events if necessary)

	Ecosystem services	How to represent them in the game?	Comments
Regulating	Hydrological flow regulation	water tokens stored in the aquifer during period 1 and then released during period 2 water transfers strips between wetland and aquifer and between wetland and river	at least 2 periods per year need to define the storage capacity of the aquifer and the water transfer capacity of the strips (water units/period) water tokens managed by the game facilitator
	Water purification	the wetland plot receives brown water tokens (polluted water) during period 1 and then releases blue water tokens (clean water) in period 2	at least 2 periods per year need to define the water purification capacity of the wetland (water units/period) water tokens managed by the game facilitator
	Climate regulation	specific tokens to represent carbon and CO2 the wetland land plot card can store carbon tokens during X periods, and release CO2 depending on actions taken by players	need to define the carbon storage capacity of the wetland, storage time and impact of wetland activities on carbon storage carbon tokens managed by the game facilitator
	Flood/storm control	Flood event cards with impact on neighbouring/downstream settlement varying according to wetland area	monitor wetland area as an indicator
	Erosion control	high water event cards with impact on land size of land plots depending on natural wetland area	
Cultural	Recreation for outsiders	Tourism land plot card Tourism activity card indicating - Land plot cards where it can be implemented - Season - resources (money, labour, smileys, etc.) requirements - average returns	Production functions displaying returns depending on water supply (and other events if necessary)
	Recreation for locals	action card for village land plot close to wetlands with smileys depending on natural wetland area	monitor wetland area as an indicator of wetland health
Supporting	Habitat for certain species	specific tokens to represent abundance and/or diversity of animal/plant species the number (and type) of tokens are affected by the activities performed in the wetland or in the surrounding land plots	define which characteristics of the wetland are important for the species (level of water, length of inundation, physical intervention, quietness…) characteristics monitored by the facilitator (or an observer) define impact function for each possible activity

10 Conclusion

Ga-Mampa wetland, like many small scale wetlands in Southern Africa is threatened by human activity. In the last ten years, the natural vegetation has decreased to occupy less than 40% of the wetland area. Agriculture is the main pressure on this wetland. Moreover, current agricultural practices are harmful for the wetland health and are degrading the soil organic matter. As a consequence, there is a need for a coordinated action from stakeholders interested in the wetland: local wetland users on the one hand; and on the other hand the provincial government, research organizations and NGOs. The Wet-WAG game created by Irstea under the WETwin project aims at providing the basis for discussions among stakeholders, and raising their awareness on each other's problems.

The development of Wet-WAG mobilized several methods to take into account inputs from the widest range of stakeholders. Participatory methods such as focus group discussions were conducted in Ga-Mampa, and representatives from the provincial government were interviewed. In addition, most stakeholders were able to experiment the game and comment on it during the sessions organized with the community and the multi-stakeholder workshop in March 2011. These methods were complemented by a review of reports made on the Ga-Mampa study site and additional data collection to get a comprehensive vision of the situation in the village.

New elements were designed to reflect stakeholders' views in the game. The focus of the game shifted from a socio-economic one to a broader approach including environmental concern. The design of the game was simplified to make its understanding easier for every participant. Several sessions were conducted with a large range of stakeholders. Overall, the game was well received though some participants expressed their skepticism at the beginning.

Sessions held in March 2011 were specifically targeted at supporting the implementation of the WETwin project trade-off analysis framework. The game was used with local community members to introduce them to the concepts of management options. The game was then used during the multi-stakeholder workshop, with both local and external stakeholders, as an introduction to the debate on management elicitation and evaluation. It was successful in doing so as the game sessions triggered awareness of the local challenges and oriented discussions on the main management issues which were to be dealt with during the workshop. Because it links challenges at household level (cash generation and food security) to community level challenges (equity and sustainability of resources), it thus eases the understanding of the tragedy of commons situation. Wet-WAG proved to be a good awareness raising tool and an efficient device for participatory research approaches.

Wet-WAG was also used as a tool for discussing natural resources management objectives as well as technical and organisational details.
Regarding research objectives of the WETwin project, Wet-WAG helped refining management alternatives and providing information on stakeholders' vision and preferences. In particular, the use of visual game elements was very useful to discuss management options with stakeholders. In order to exploit the full capacity of the game, there is a need for improved monitoring tools (computerized or not) and a large facilitating team to ensure improved observation and better exploitation of session outcomes.
The use of Wet-WAG to support decision-making in real life appeared to be more difficult, mainly because the game is simpler than reality and not all players behave in the game as in reality. Another reason is that the game should be exploited on a longer term in order to explore its real capacities in terms of decision-support. One can assume that because stakeholders have played the game, they are better prepared to take decisions in real life, in particular community members. However, the question of how to assess impacts of Wet-WAG use on future management of Ga-Mampa natural resources remains open in any case.

The use of Wet-WAG for development was limited during the WETwin project but the game has some potential in this area. The local community appreciated very much its capacity building aspects regarding economic rationalization of farming systems, but it was not possible to reach an agreement on a compromise solution for wetland management and irrigation scheme rehabilitation. To improve the management of resources, more attention should be given to community scale economic performances and environmental impacts. However to tackle these issues, a sound understanding of the game's basis is necessary, which means that the game should be played on a long term basis and repeatedly. For example, it could be used by extension officers or development project implementers to support their activities with the community. In conclusion Wet-WAG proved to have a high potential in assisting concerted management of resources but is a time consuming activity.

Wet-WAG could also be used as an educational tool in schools, in order to raise youth's awareness on environmental issues. This would require the identification of a relevant South African organization to develop the game further and disseminate its use in the country.

Further investigations are required to improve Wet-WAG. The game could include wetland activities more adapted to the environmental context, and take into account some events that are likely to affect significantly the livelihoods in Ga-Mampa (such as floods, development of ecotourism and construction of new road). Moreover, a specific role for a regulator could be designed to relieve the game manager from some of its duties and to help starting new discussions on regulation aspects.

Wet-WAG could also be used in other regions of South Africa or in other developing countries. The game is abstract enough to be adapted to other cases or understood by external participants. Data collection would be required to make the game fit to the new context (e.g. include the crops used in the region, design new roles), but the main elements (boards, rules, sequence of events during a round) would remain the same. Guidelines are provided on how to include other wetland ecosystem services in the game. Wet-WAG is well suited for small-scale wetlands, and additional adaptations would be required to upscale it to larger cases, such as the Niger Delta in Mali.

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ANNEXES

ANNEX 1 : GUIDELINES FOR FOCUS GROUP DISCUSSION

Groups: 4/5 persons at one time, facilitated by myself and field assistant (and CRCE student if possible)

Groups identified according to: gender, location of plots (wetland or irrigation scheme), type of activity (croppers, livestock owners), age (?)

Objectives: identify main concerns about agriculture in the wetland and/or the irrigation scheme (livestock conflicts, access to the land, access to the water must be tackled during the discussion)

get their views on matters about wetland protection

get their opinion on the game as it is designed now

Focus on constraints on their livelihoods and on the development of their agriculture. The points identified so far that could be of interest for the game are the following:

- Conflicts between croppers and cattle grazing: what would be the use of fencing? Are there other places to put livestock safely?
- Erosion of the banks: to what extent is it important?
- Manpower: is manpower (for cropping and/or livestock keeping) a constraint in the village? Are there manpower limitations for all households in general or for some households at some specific periods or for some specific activities?
- Access to the market: can farmers sell their production easily? Who buys their products? What improvements they see for this situation (upgrading of the road access to Tzaneen)?
- Access to the land: how many farmers are excluded from the irrigation scheme? Would it be possible to expand the irrigation scheme? Would it be possible to share the land available in the IS so people cropping in the wetland would have access to it?
- Water scarcity in winter: reparation of the canal to give more water for croppers so they can have cash crops in this season? What are the reasons for not cropping in the wetland during the dry season?

We should not propose more constraints, because we have to deal with time limitation.

General direction:

First part: identification of concerns and proposed solutions

- Introduction, presentation the context.

  We are developing a game as a tool for environmental and social management in this area. We believe this tool is efficient to raise issues and make people discuss about it. I will present this game in detail a little later. First, I am currently collecting data and views about the situation here in the village. We would like to do some focus group study to gather information to help us collect some data and learn about important concerns for your community. Then, we will present you the game we are developing and ask about your views, if you find it useful, if you find some things are missing...

  Tumelo, student at the University of Limpopo and Bernard Mashabela will be assisting me in facilitating these discussions, which will be carried out in the local language.

  Our target audience for this study is the rural households who are the water users as well as other stakeholders like DWAF, Municipality and department of agriculture. There will be different focus group discussions which will be carried out in the next weeks, as well as some personal interviews with members of the community. Today, we will work in a small group, and all group members will have a chance to talk.

The results of this research will be used to facilitate discussion between the community and policy-makers and help them discuss feasible solutions to protect the wetland while providing sustainable livelihoods for the community.

Does anybody have any question about the objectives of this meeting, or what will be discussed? If anybody has a question, please feel free to ask, it is important that people understand the same things and participate in the discussion.

- So far, we have identified some constraints (write them on the flipchart in English and Sepedi, try to illustrate with drawings). We will ask you to rank them (use stones or beads from the game), one after the other. Each farmer comes, and puts beads on the different constraints. The more beads he uses, the more the constraint is perceived as important. Facilitators take note on the number of beads used for each constraint, then remove the beads and a second farmer comes.

After all the farmers have done it, we display the results on the flipchart and start discussing.

- What are the causes of those constraints? Try to raise the questions mentioned in the description of the constraints.

- What solutions do they see for these constraints? Who could implement those solutions, or help them to implement?

Problems	Causes	Who is responsible?	What solutions?

Have a short break (10 min)

Second part: presentation of the game and their advice on it.

- Present the whole game: boards, players and roles, crops, water circulation. Present the water cycle in the wetland.

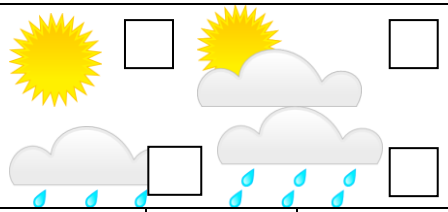
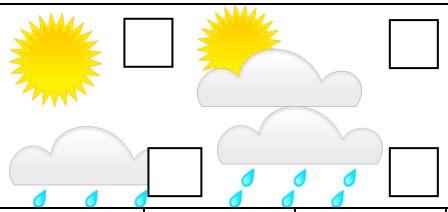
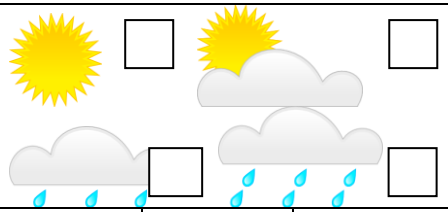
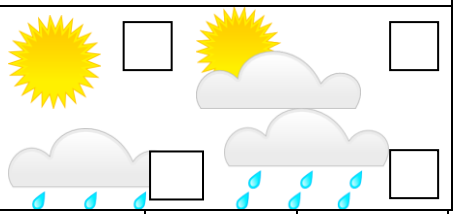
Make people touch it and have a close look. Recapitulate on a board what are the main elements to refer back to it later. Precise the expected outcome of the game: a discussion on matters that affect the community and possible solutions. Are there any questions on the general understanding of the game? Is the game easy to understand?

- General opinion: do you think it can be useful and help you? Do you feel something has been completely overlooked or forgotten? Can you relate this game to your daily life?

Opinion on some points: are the roles relevant and do they correspond to real situations? We have designed different farmers corresponding to different social categories. Are they realistic?
Who has a control over the wetland?

ANNEX 2 : INDIVIDUAL MONITORING SHEET

Role :

Round												
Season	WET			DRY			WET			DRY		
Weather												
Activities	Number of plots	Income or yield per plot	Total income or yield	Number of plots	Income or yield per plot	Total income or yield	Number of plots	Income or yield per plot	Total income or yield	Number of plots	Income or yield per plot	Total income or yield
Maize I												
Groundnut I												
Sweat potato I												
Maize W												
Groundnut W												
Grazing W												
Grazing Mount.												
Coriander I												
Cabbage I												
Tomato I												
Dry bean I												
Coriander W												
Cabbage W												
Tomato W												
Reeds												
Sedges												

ANNEX 3 : EVALUATION FORM

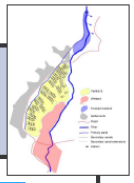
(with translation in Sepedi)

	fully agree Ke a dumela	**rather agree** Ke dumela gannyane	**rather disagree** Ke gana gannyane	**fully disagree** Ke a gana
It was funny E be e le segisa				
Rules were clear Melao e be e le bonolo				
It was interesting E be e le bose				
It was too long E be e le e telele				
I learnt about wetland issues Ke e thutile ka ditlhohlo tsa mahlaka				
It was too abstract E be e le bothata go e bapetsa le seemo sa nnete				
It may be useful for teaching E ka ba le mohola ge e ka rutwa batho				
It may be useful for decision making E ka thusa go tsea dipheto				
Can be played with policy-makers E ka bapalwa le ba balaodi				
Can be played with people from Ga-Mampa E ka bapalwa le bakgathatema ba Ga-Mampa				

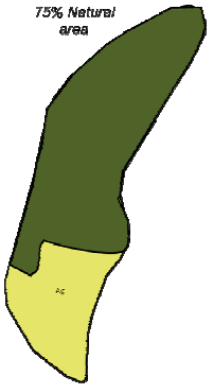
What was good? Ke eng seo se bego se le se sebotse? 	**What was not good?** Ke eng seo se bego se le se sempe? 

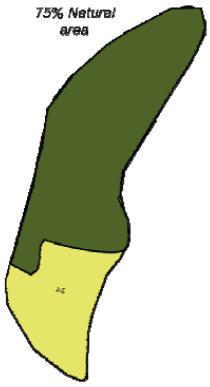
ANNEX 4 : MANAGEMENT OPTION CARDS AS PRESENTED IN THE MULTI-STAKEHOLDER WORKSHOP IN MARCH 2011

Management Option: **Rehabilitation of the Irrigation scheme**	Alternative: **Drip irrigation infrastructure and destruction of gravity system**
Costs 	Irrigation Farmers: **→ 30/plot/year**  
Cropping possibilities & consequences	Only "**intensive Tomato**": Higher water needs (+ 1 water unit) Revenue improved (200),
Water availability in IS Improved water efficiency → 90% Uniformity of water availability	Each farmer who invested and pays 4 



Management Option: **Rehabilitation of the Irrigation scheme**	Alternative: **Restoration of the existing infrastructure**
Costs 	Irrigation Farmers: --> **15/plot/year**  
Cropping possibilities & consequences	Any production is possible Same prices
Water availability in IS Improved water efficiency → 60%	For each secondary canal 12 

Management Option: **Land use planning**	Alternative: **65% of wetland is natural vegetation**
Description 	6 cultivated plots in dryer area 6 grazing plots in dryer area 15 wet plots Fencing of the cultivated area
Social consequences	**Farmers must agree on who will give up plot**
Economic Consequences Higher Yields	Wetland cultivated plots have high yields (**9 maize bags , + 20 revenues**) Grazing in the dryer areas of the wetland has higher revenue (15**/cow**) Higher yields in Reed Harvesting (20**/plot)**

Management Option: **Land use planning**	Alternative: **50% of wetland is natural vegetation**
Description 	15 cultivated plots in dryer area 0 grazing plots in dryer area 15 wet plots Fencing of the cultivated area
Social consequences	Farmers do not have to give up their plots
Economic Consequences: Average yields	Wetland cultivated plots have **average yields** (**6 maize bags**) Normal reed harvesting & cow revenues

ANNEX 5 : WETLAND USE CARDS

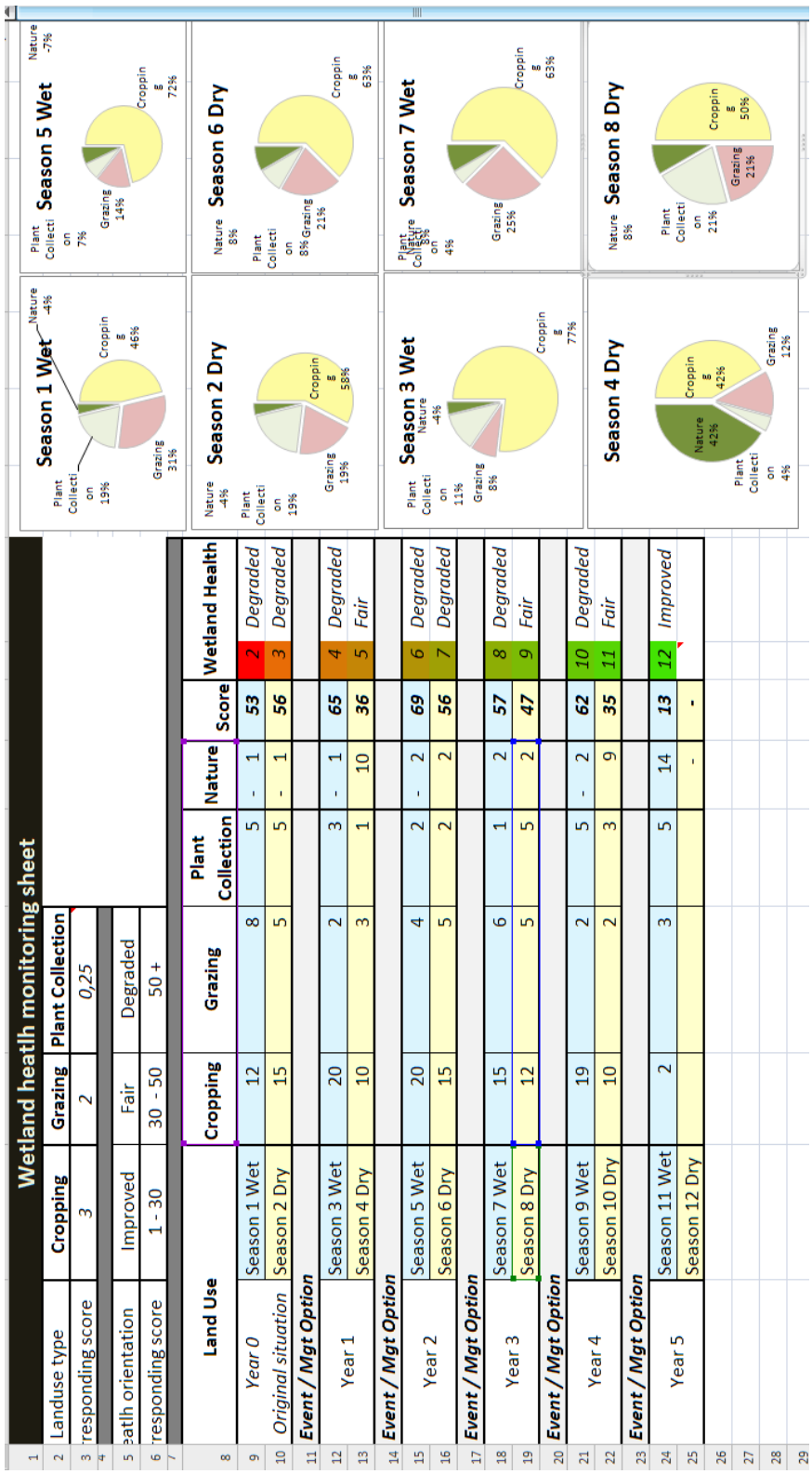
Wettest areas with high natural vegetation

This card was originally planned to represent areas that are preserved for natural vegetation conservation or regeneration. Along the game sessions, the card was refined to represent natural wetland, an area that is too wet for cultivation or grazing, with limited possibilities for natural product harvesting.

Drier areas that can be drained for maize cropping and possibly grazed

This card was originally planned to represent areas that are used for cattle grazing of natural vegetation. Along the game sessions, the card was refined to represent an area that is dry enough to be grazed by cattle without risk and that can be cleared for maize cropping.

ANNEX 6 : WETLAND HEALTH COMPUTERIZED MONITORING SHEET



The computerized monitoring sheet gives an overview of the wetland land use (diagram) and environmental heatlh (color coding).