

Article

Participatory Approach for Integrated Basin Planning with Focus on Disaster Risk Reduction: The Case of the Limpopo River

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Abstract: This paper defends the idea that a participatory approach is a suitable method for basin planning integrating both water and land aspects. Assertions made are based on scientific literature review and corroborated by field experience and research carried out in the Limpopo River basin, a transboundary river located in southern Africa which is affected by periodical floods. The paper explains how a basin strategic plan can be drafted and disaster risk reduction strategies derived by combining different types of activities using a bottom-up approach, despite an institutional context which operates through traditional top-down mechanisms. In particular, the “*Living with Floods*” experience in the lower Limpopo River, in Mozambique, is described as a concrete example of a disaster adaptation measure resulting from a participatory planning exercise. In conclusion, the adopted method and obtained results are discussed and recommendations are formulated for potential replication in similar contexts of the developing world.

Keywords: participatory approach; integrated basin planning; Living with Floods; Limpopo River

1. Introduction and Objectives

The identification of suitable strategies for river basin planning is the object of continuous scientific, political and institutional discussions and research [1]. Since river basins are biogeophysical units with high degree of functional integrity, they can serve as widely applicable, non-ephemeral, operational landscape units for planning and management [2]. An integrated river basin management approach is essential for land and water use planning due to the complexity of land and water interactions [3]. However, integrated basin development is complex [4] and implies the application of a holistic and multi-disciplinary approach [2,5,6]. Ideally, the latter should aim at maximizing a combination of economic, social and environmental benefits [7]. For this purpose, solid technical, institutional, political, and economic capacity is needed at the different decision-making levels [8,9].

The experience suggests there is continuing urgent need for expanding the range of management measures considered as part of the planning process, which require formidable institutional and analytical efforts [1]. Such requirements are rarely found, especially in developing countries. This is mainly due to rigid institutional structures unable to interact effectively with other sectors and to engage in a real dialogue with local communities, lack of technical capacity, weak economic conditions, and poor political will. Dealing with transboundary rivers is even more difficult [10,11]. Frequently, countries located at the upstream reaches of international basins take river management decisions (e.g., dam construction) that seriously affect countries downstream [12], eventually worsening the impacts from drought or floods.

In addition, there is a difficult equilibrium to be reached between the river's inherent dynamism and the stability requirements for socio-economic development [13], especially in the river's lower stretches. During flood events, dramatic fluvial changes in pattern and location take place, due to continuous erosion, transport and sedimentation processes [14-16]. Although there is still no relevant documented scientific literature, the Limpopo River is no exception to such natural dynamic behavior over time. Changes in land use and land cover determined mainly by anthropogenic interventions (such as deforestation, for example) have much influence on runoff response after a rainfall event, and exacerbate flooding and erosion processes. Slocombe [17], after decades of investigations, affirms that there is still a need to provide a transdisciplinary framework that links biophysical and socio-economic research and practice in a region or ecosystem through holistic, ecological and participatory methodology.

This paper analyses the implementation of participatory methods for basin planning in developing countries where, in general, data is scarce and capacity is weak at both institutional and community levels. Analysis and results obtained through the project "*Sustainable Land Use Planning for Integrated Land and Water Management for Disaster Preparedness and Vulnerability Reduction in the Limpopo River Basin*", are presented and discussed. This initiative, which was funded by the Global Environment Facility with approximately one million US dollars, was implemented between 2004 and

2007, and counted on the participation of all four riparian countries, namely Botswana, Mozambique, South Africa, and Zimbabwe. It was managed by the United Nations Human Settlements Programme (UN-HABITAT) in collaboration with the United Nations Environment Programme (UNEP). Its objective was to develop and implement participatory land use tools and plans for sustainable land management in the basin to reduce the impact of floods on land, ecosystems and human settlements. Two main results were expected, mainstreaming bottom-up approach: (i) an integrated land use management plan of the basin prepared, and (ii) capacity and tools for participatory land use planning and disaster preparedness enhanced.

In terms of the paper's structure, after presenting the methodology and defining the research question, the main characteristics of the Limpopo River basin are described, leading to a comprehensive definition of the problem under research. The applied participatory method during project implementation is then presented in detail, starting from the local level up to the basin dimension, putting emphasis on how interactions can take place between these two scales of intervention. This process resulted in drafting the Limpopo Basin Strategic Plan which focuses on reducing vulnerability to floods and drought. As a concrete experience derived from this basin planning tool, participatory approach and collaborative work with the Mozambican government authorities, the *"Living with Floods"* initiative is presented, which is still being implemented today. It represents a flood adaptation measure which, when applied in combination with a sound resettlement strategy, can effectively reduce the vulnerability of the communities living in the lower parts of the river basin. Finally, a discussion is developed regarding the application of the participatory method for basin planning and conclusions are drawn.

2. Methodology and Research Questions

This paper is based on a critical reflection of more than three years of work (between 2004 and 2007) in four riparian countries, which was undertaken by a multidisciplinary team of professionals, and subsequent activities implemented especially in the lower stretches of the Limpopo River (between 2008 and today). Studies, workshops, consultations, trainings, fieldwork, and implementation of physical works, among other activities, were carried out at the local, national and basin levels in the context of the above-referred project. This allowed inquiring and making linkages from the local to the basin scale and vice-versa.

A qualitative research approach is adopted in this paper, which is an inquiry process of understanding based on different methodological traditions of research that explore social or human-related issues. Assertions are based on scientific literature review complemented with information collected throughout the work developed in the Limpopo basin, which are then put in perspective based on the knowledge and experience of the authors of the paper. The main focus is on participatory approach for a more integrated basin planning at the local, national and sub-regional scales. At the local level the stakeholders were the target population of selected rural settlements, central and local authorities, the academic or technical sector, the civil society and the private sector, while at the national and sub-regional levels the approach involved mainly inter-sectoral and inter-country coordination respectively, as well as legal and policy framework analysis. Lessons learned and best practices are derived, which contribute to knowledge on alternative basin planning methodologies with special focus on sustainable development and vulnerability reduction to

natural disasters.

At present, dynamic models working through complex algorithms are commonly applied to simulate hydrological processes and sometimes even anthropogenic interventions at the basin scale. However, there are limiting aspects to be considered when applying modeling in developing countries, in particular: (i) data uncertainty and poor data input availability, making it difficult to generate spatially distributed scenarios [18]; and (ii) high costs involved in determining large numbers of specific indicators [19]. Data collection and monitoring is particularly challenging in these countries in which, not only resources are limited, but also historical information (which is very important to make consolidated projections) is often not available.

“Where data is a problem, approaches should be flexible and adaptive” [20]. The authors believe that applying participatory planning represents a concrete answer to data scarcity, complex environmental conditions and weak institutional capacity. Several examples of successful initiatives from around the world which applied participatory approach at the community level towards a more integrated management of water resources are reported in scientific literature [21-24]. This approach derives from the Participatory Rural Appraisal (PRA) which, according to Absalom *et al.* [25], is meant “to enable rural people to share, enhance and analyze their knowledge of life and conditions, to plan and to act”. Brace [26] broadens the definition of PRA as a holistic approach focusing on the complex people-environment relationship. Interestingly, Chambers [27] indicates that the PRA has evolved fast, and continues to evolve so differently that no final definition is adequate. In the same paper, Chambers explains that participation devolves power to the poor and encourages professionals to make changes to their personal, professional and institutional values and practices.

Why adopt a participatory approach? First of all, it is generally accepted that public participation ensures sustainability [28-30]. Some authors even consider it as essential for obtaining successful project results [31,32]. According to Freire [33,34], one of the pioneers of the participatory approach, the poor and exploited people can and should be able to conduct their own analysis of their reality, and take action to change it. From this perspective, developing countries offer particularly fertile conditions for applying this method [35], as it also promotes a more democratic decision-making process.

From the above, the main research question arises: how can participatory approach lead to more integrated (land and water) basin planning in the case of a transboundary watercourse, and which disaster risk reduction strategies can be derived?

3. Main Characteristics of the Limpopo River Basin and Problem Definition

Physical settings: The Limpopo River basin is located in the South-Eastern region of the African continent and is shared among four countries. From upstream to downstream, the river first follows the boundary between Botswana and South Africa, then between Zimbabwe and South Africa and finally it reaches the Indian Ocean by crossing southern Mozambique (see Figure 1). These particular geo-political settings complicate the inter-country management of the river. Since it follows the boundaries between three countries, different management options are applied in both sides of the same river stretch. Furthermore, as stated earlier, any basin management decision taken by the three upstream countries will affect Mozambique, which is located downstream. In general, dry land cover conditions are predominant in the basin, while irrigated and wetland ecosystems occupy 0.9% and 2.8% respectively of its area. Over the last 60 years most of the original forest cover was lost due to

deforestation activities, reducing from over 50% to less than 1% of the basin area; this process was accompanied by a regular expansion of agricultural land use to more than half of the basin area [36,37]. Such observations have profound land degradation implications due to increased runoff, erosion and sedimentation processes, eventually worsening flood and drought impacts. The relief characteristics of the basin are shown in Figure 2.

Figure 1. Geographical settings of the Limpopo River basin and population data.



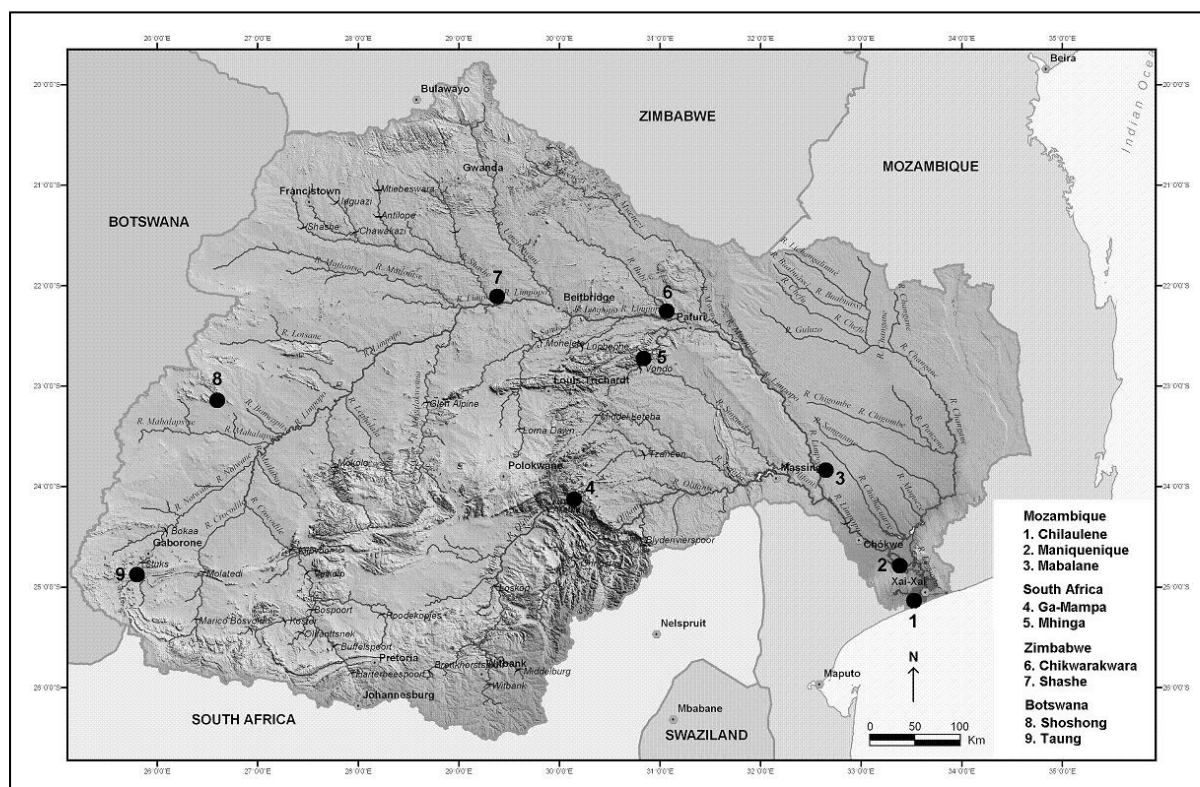
Figure 1. *Cont.*

Country	Total area of riparian country (km ²)	Country area within basin (km ²)	% of the total basin area	Country population in 2005 (million)	Country population in the basin* (million)	% of the country population
Botswana	581,730	80,118	19	1.8	1.1	60
Mozambique	801,590	84,981	21	20.5	1.6	8
South Africa	1,221,040	185,298	45	48.1	11	23
Zimbabwe	390,760	62,541	15	12.5	1.1	9
Total		412,938	100	71.6	14.8	100

Sources: Map adapted from [38]; area data extracted from [36]; population data extracted from [39].

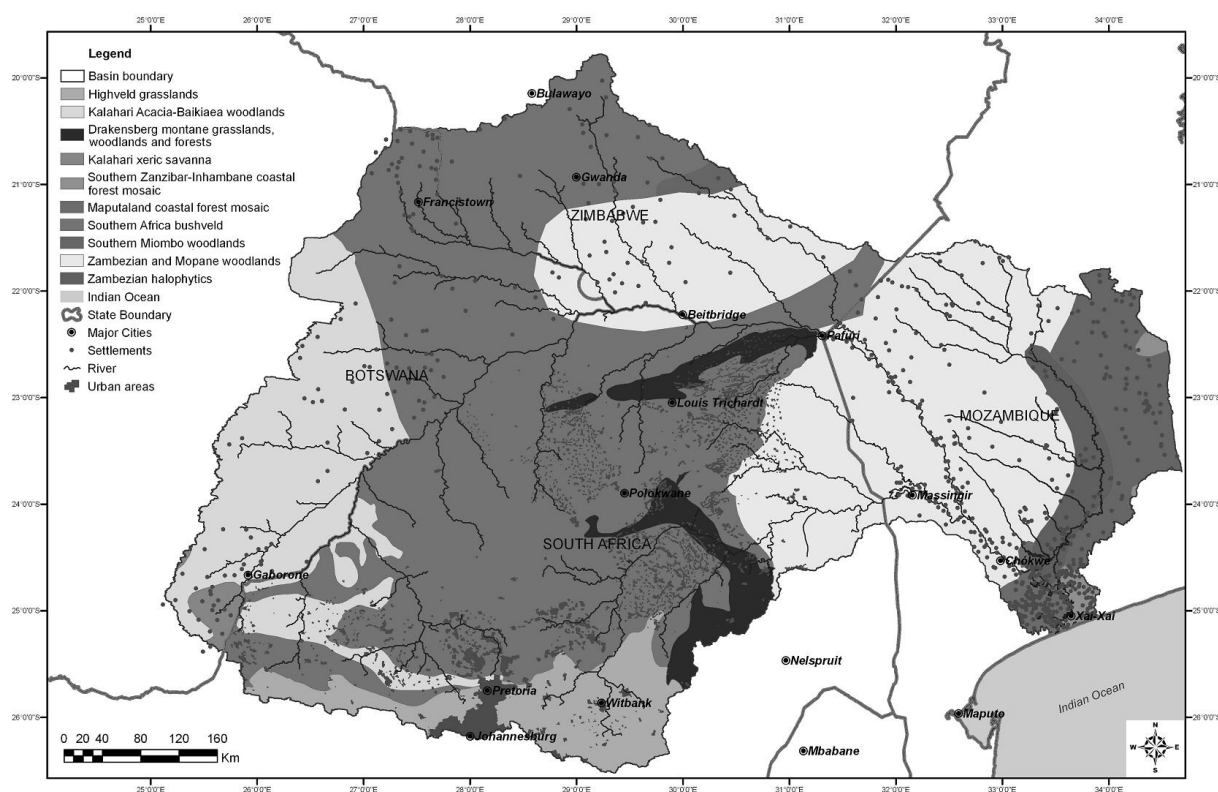
* NB: Projections made by the authors based on the updated country population in 2005.

Figure 2. Relief characteristics of the Limpopo River basin and location of the nine project study areas.



Adapted from [40].

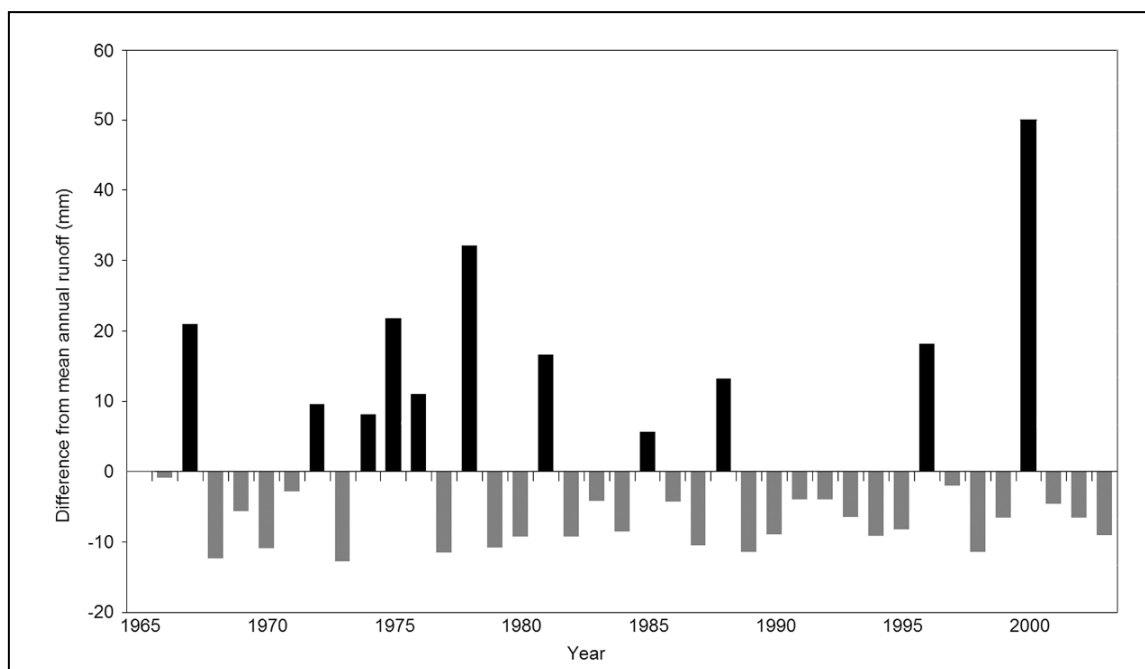
Human settlements: The basin has an estimated population of 14.8 million inhabitants distributed in approximately 5,200 human settlements. It is the second most populated in Southern Africa after the Orange River basin [41], and includes approximately 60 percent of Botswana's total population (see data presented in Figure 1). Generally, human settlements tend to concentrate close to the stream banks due to the overall arid conditions of the basin, and they are much denser in Mozambique and South Africa as compared to Botswana and Zimbabwe (see Figure 3). During the last three decades, a demographic densification process occurred in the Botswana and South Africa sections of the basin, in the delta area and along the main river channel in Mozambique, as well as in the upper reaches of the basin in Zimbabwe [41]. Such a trend can be explained by considering the natural growth of the population coupled with the rural migration to the main urban centers within the basin. However a significant decline in population until 2050 is forecast due to the impacts of HIV/AIDS [36].

Figure 3. Human settlements and ecosystems in the Limpopo basin.

Source [40].

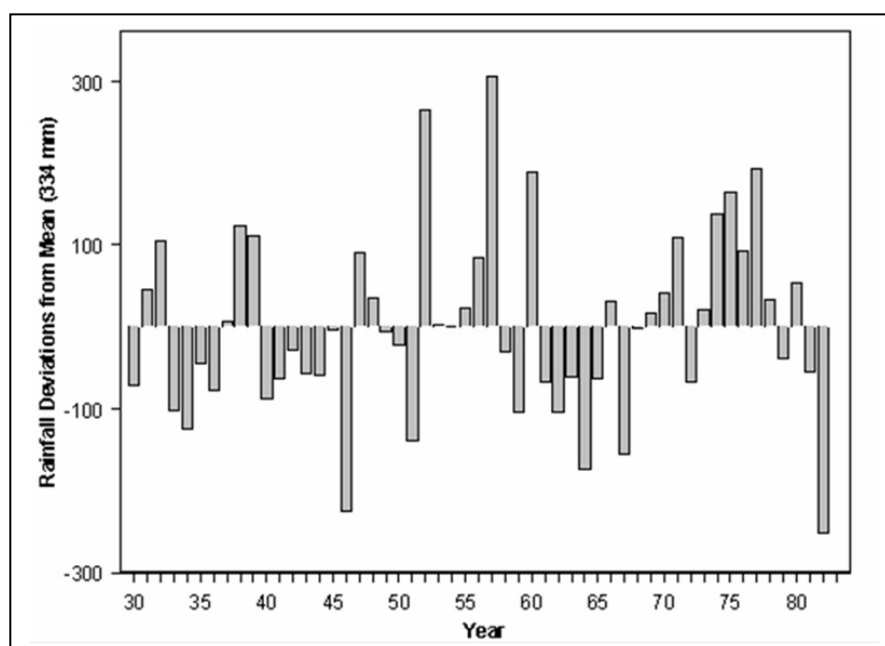
Hydrology, floods and drought: In the last 40 years the Limpopo River has shown a highly variable hydrological regime, especially in its lower course, with drought periods of two to seven years that are abruptly interrupted by flood years (see Figure 4). A considerable spatial and temporal variation in the rainfall regime in the basin is observed, as much of the rainfall occurs in a limited number of rain events [41]. An example of the temporal variability of rainfall is illustrated in Figure 5. During the last decade, drought effects in the lower river stretches have been exacerbated by increased water withdrawals from a large number of reservoirs located upstream. On the other hand, greater floods occur when peak flows of the Limpopo River and its main affluent, the Olifants River, coincide downstream from their confluence, as happened in 2000 [36]. On that occasion, more than 700 deaths were registered, including two million people affected and massive destruction of property and infrastructure [42]. While studying the hydrological response of the Sabie River catchment—a Limpopo sub-basin located in South Africa—Smithers *et al.* [43] estimated that the return period of such flood events ranged from 50 years to more than 200 years. Generally the main cause of floods in this sub-region relates to the occurrence of cyclones, which is more likely during the months January to March, provoking excessive rainfall. This was the case for the 2000 flood event triggered by Cyclone Eline. The flooding problem is exacerbated by the increased runoff as a consequence of the above-mentioned land cover and land use changes.

Figure 4. Difference from the mean annual runoff recorded at Combomune, Gaza Province, Mozambique, from 1966 to 2003, showing the irregular hydrological regime of the lower Limpopo River.



Source [44].

Figure 5. Difference from the mean annual rainfall recorded at Beitbridge, Matabeleland South Province, Zimbabwe, located on the Limpopo River at the border with South Africa, from 1931 to 1984.



Source [41].

Economic characteristics: The basin countries exhibit considerable macro-economic differences, with Botswana and South Africa possessing stronger economies than Zimbabwe and Mozambique [36]. With

the exception of Zimbabwe, which entered a well-known crisis in the late 1990s, all countries have registered a positive economic growth in the last 10 years: the average annual Gross Development Product (GDP) growth has been 4 percent for Botswana and South Africa, 6 percent for Mozambique and −6.5 percent for Zimbabwe. When compared to Mozambique, the agricultural value added per worker (a measure of productivity) is twice in Zimbabwe, four times in Botswana, and 27 times in South Africa [36]. However, while approximately three quarters of the total employed workforce is engaged in the agriculture sector in Mozambique, the other three riparian countries tend to concentrate more on industry and services.

To contribute to a better problem definition, the following aspects were analyzed thanks to the information extracted from different baseline studies carried out during project implementation [45–51]:

Land use planning: In all four countries decisional processes are top-down and centralised, particularly when large infrastructure development projects are concerned. Overall, governments' capacity to engage in broad participatory planning and decision-making processes is limited. Community participation is sought only within the context of small-scale actions involving Civil Society Organisations (CSOs). However, there are on-going political efforts for reinforcing local capacities. The decentralisation process is slow, especially in Mozambique, but early results are encouraging. This country is experiencing an important municipalization process since 1997, as well as a recent establishment of provincial assemblies. Communities generally do not have access to formal planning data and tools.

Land use management: In general, there is a weak enforcement of laws and policies due to the inherent complexity of land issues. This complexity is due to a combination of historical reasons, such as the colonisation and recent decolonisation process, land conflicts between the formal and customary systems with consequent difficulty in securing tenure, and high speculation mechanisms due to private investments' interest in land for mining, agricultural or industrial purposes. Institutional frameworks for land management vary for each riparian country at the central level (different ministries are mandated to regulate the land sector) while the land allocation and registration responsibility is commonly delegated to local authorities. The latter face serious difficulties in applying the land policies and regulations (which were approved rather recently due to a late independence and democratisation process), especially when interacting with traditional powers which are still following customary procedures, as it occurs in rural areas. In general, communities' poverty, lack of awareness and unsuitable land conservation practices lead to increased vulnerability to natural disasters such as floods and drought. These practices, which provoke land degradation and deforestation, are related with subsistence agriculture practiced with poor means, traditional techniques for housing construction (e.g., making of mud and fired bricks), production of charcoal, lack of proper drainage systems in settlement areas, obsolete irrigation schemes, among other aspects.

Disaster management: Relevant legislation is still missing in Mozambique and Botswana, is difficult to enforce in Zimbabwe due to its formulation, and is more advanced in South Africa. Despite the awareness in this sub-region of the high vulnerability to natural calamities, disaster risk reduction aspects are not yet sufficiently integrated into sectoral policies or legal tools. Efforts to improve this situation are being made in recent years, especially in policy and strategy development. Local disaster management committees are established but not sufficiently empowered nor equipped. The flow of early warning information to vulnerable communities still needs improvement.

Legal, policy and institutional settings at basin level: The Limpopo River Basin Permanent Technical Committee (LBPTC) was established by the four riparian countries in 1986 for providing technical advice to the respective governments concerning basin management issues. The LBPTC is comprised of four representatives of each country (typically from the water sector) with a rotational chairmanship. Due to political tensions among neighboring countries until 1994 (official end of the apartheid regime in South Africa), the LBPTC became effective only in 1995. After the ratification of the Southern Africa Development Community (SADC) Revised Protocol on Shared Watercourses, a slow process started to establish the Limpopo Watercourse Commission (LIMCOM), with more regulatory powers and a secretariat in Mozambique, which is currently being concluded. Despite the strong water management focus of both LBPTC and LIMCOM, there is growing interest for integrating disaster management and land-related aspects. In fact, the recently approved Regional Water Policy [52] advocates for integrated regional disaster management, appropriate land use planning, settlement policies, and climate change strategies. However, up to now, no major pilot initiatives tried to implement this policy. Finally, while the establishment of sub-regional institutions demonstrates the riparian states' commitment to transboundary river management, deliberations at basin level are still considered of secondary importance to national governments. Apart from South Africa, riparian states lack financial and technical means for setting up effective basin management mechanisms.

Inter-country cooperation: A network of gauging stations for sharing real-time information on water flows was established at basin level thanks to the SADC Hydrological Cycle Observing System (HYCOS) project. Unfortunately, this equipment could not be properly maintained, probably because local communities were not sufficiently involved in the planning and management process, which resulted in many stations being vandalised. In general, coordination between the different basin countries is weak; for instance, up-to-date technology and knowledge of South Africa is not yet benefiting the other countries, and flood forecasting and early warning at basin level suffers from the absence of standardised procedures.

From the above, there is a clear need for improving planning and management capacities at the basin, national and local levels. For this purpose, policies and tools have to be put in place and capacities reinforced.

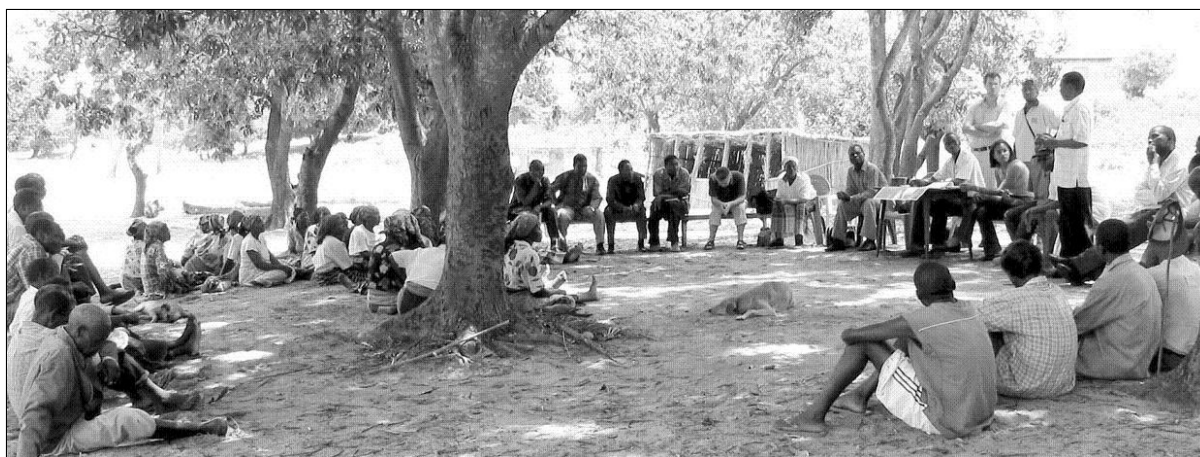
At the sub-regional level, policies and institutional mechanisms for basin management exist but present several gaps. Despite the recognition of the importance of enlarging the current water management focus to integrate land and disaster issues, effective mechanisms for that purpose have not been found yet. In particular, inter-country coordination is weak. Therefore it is urgent to develop sub-regional initiatives looking at the basin as a single natural system, despite administrative boundaries, promote an exchange of experiences and increase technical cooperation among riparian countries.

4. Application of the Participatory Approach: Starting at the Local Level

The main methodology adopted during the Limpopo project was a participatory bottom-up approach bringing together different stakeholders in the planning process to: (i) reduce the "distance" between decision-makers and the local population; (ii) maximize the use of local knowledge and resources, hence empowering local communities; and (iii) positively influence decision-making at higher (national and even sub-regional) levels.

Figure 6 shows a typical participatory planning consultation conducted in Mozambique, in which all stakeholders (target community, central government officials, local authorities, technical experts, CSOs, and private sector) are present at the same time and in the same location. The participation rate to these events has been typically between 40 and 60 people. The decision making process implies transparent negotiations until consensus is reached and mutual commitments are made among the participants publicly. In this way, the decisions taken are easier to be monitored by the local population and the different stakeholders, and are most of the times enforced.

Figure 6. Participatory meeting in Chilaulene, Gaza Province, Mozambique.



(Photographer: Carlos Trindade, 2005).

Table 1 summarizes the methodological steps of the participatory planning approach that were applied in nine rural settlements located within the Limpopo basin (see Figure 2), in close collaboration with the national authorities. Such exercises resulted in the preparation of nine local participatory plans at the village level [53-56]. Three main phases can be identified:

Table 1. Different steps of the participatory planning methodology applied in the Limpopo basin.

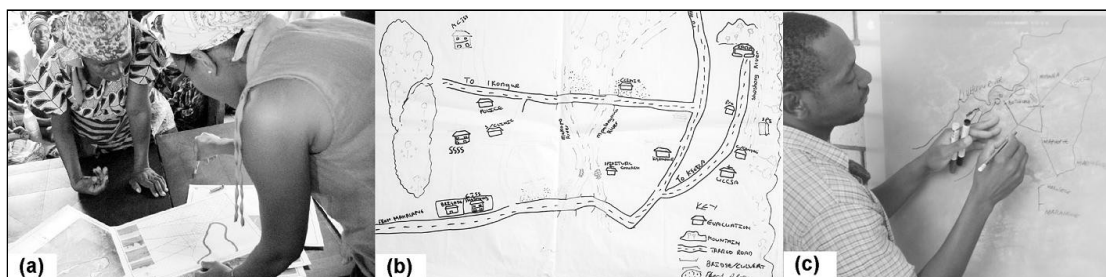
Participatory Planning Stages	Specific Activities
Step 1 Characterizing the study area	<ul style="list-style-type: none"> ▪ The technical team presents a map, aerial photographs and/or satellite image of the study area to the target community, local authorities, government officials, NGOs, and private sector; ▪ In collaboration with the community, determine the geographic location of the main features of the area.
Step 2 Mapping the existing situation	<ul style="list-style-type: none"> ▪ Based on the information provided by the resident population, draw a land use map of the area; ▪ Determine the location of the main infrastructure and basic services; ▪ Complement by fieldwork activities as needed.
Step 3 Defining the main problems	<ul style="list-style-type: none"> ▪ According to the inputs of the participants, draft a list of the existing problems in the area; ▪ Try as much as possible to locate the problems in the map; ▪ Discuss the problems openly and prioritize them.

Table 1. Cont.

Participatory Planning Stages	Specific Activities
Step 4 Identifying possible solutions	<ul style="list-style-type: none"> ▪ The community, assisted by the local authorities and the technical team, proposes its own solutions to the listed problems; ▪ These solutions are discussed in relation to their feasibility and according to the available resources; ▪ Consequently, priority interventions are agreed in consensus; ▪ Develop the implementation strategy in consultation with all participants, and determine the community's contribution.
Step 5 Elaborating the action plan	<ul style="list-style-type: none"> ▪ The technical team organizes the collected information in the form of a proposed action plan; ▪ The proposal is presented to the community and local authorities for a joint assessment, formulation of suggestions and corrections, and final approval; ▪ The whole planning process is supervised by government officials, to ensure its consistency with national and local plans, strategies and/or policies; ▪ The approved plan is adequately integrated in the local, district and provincial development plans by the competent authorities.
Step 6 Implementing priority interventions	<ul style="list-style-type: none"> ▪ Define the responsibilities of each stakeholder for the implementation phase; ▪ Jointly, assess the training and capacity building needs at the local level; ▪ Prepare all required technical drawings and detailed projects for undertaking the selected interventions; ▪ Establish partnerships at the institutional level to ensure proper coordination, including with the private sector; ▪ Involve the community in the whole implementation process and as subsidized manpower.

Adapted from [57].

Mapping and characterization of the study area (Steps 1 and 2): Different aspects characterizing the study areas are mapped, such as flood risk, human settlements (especially basic and social infrastructure and services), land use as well as relevant topographic, geomorphological and environmental features. *Mapping is a key component of the whole participatory planning method* since, as emphasized by Rambaldi *et al.* [58], it is “a fundamental way of displaying spatial human cognition and for communicating on issues related to territory”. Different mapping techniques can be used: features drawn directly on top of aerial photographs or pre-prepared maps, satellite images or community hand-drawn maps (see Figure 7). Importantly, maps are printed in a large format to allow all participants recognizing familiar features of the areas and actively participating in the planning process. This is especially important for availing illiterate people with a concrete tool for providing their inputs. Thanks to this technique, the use of local knowledge is maximized and the planning process accelerated, as fieldwork is carried out only to confirm the information collected during the stakeholders' consultations and complement it as needed.

Figure 7. Different mapping techniques: (a) Mozambique; (b) Botswana; (c) South Africa.

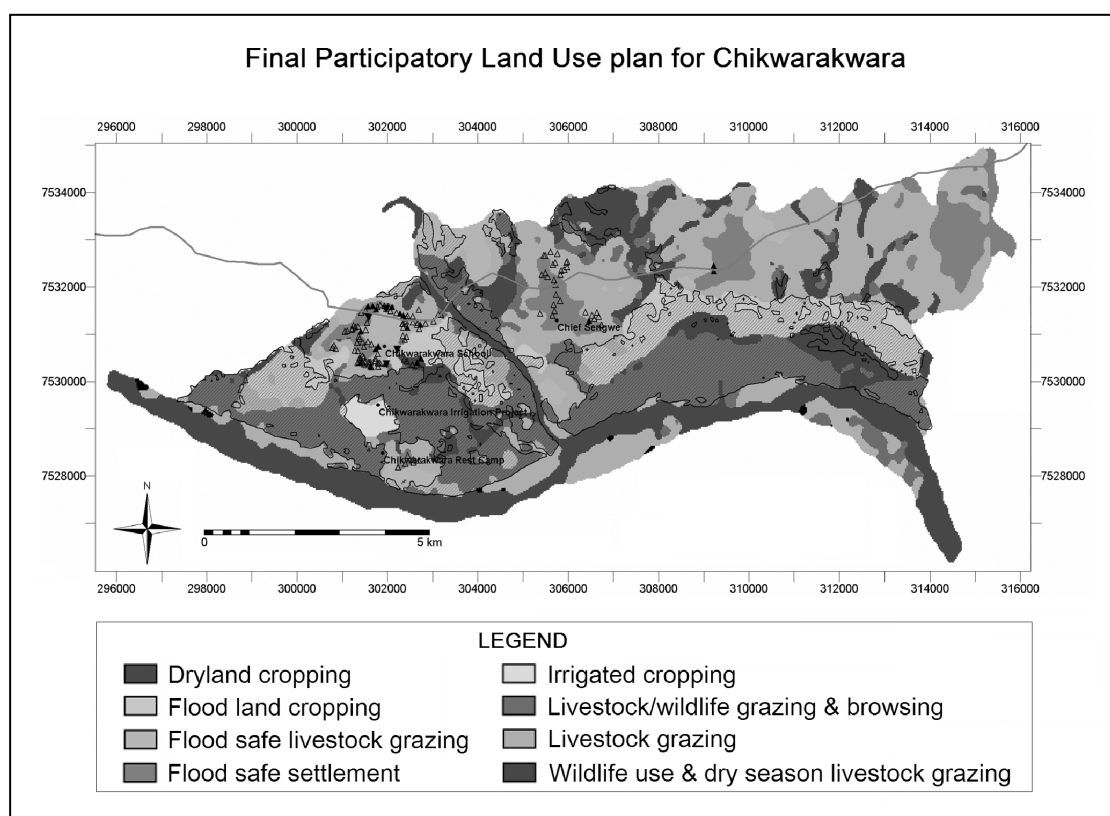
(Photographers: (a) Fernando Ferreiro, (b) Tiego Mpho, (c) Herman Timmermans).

Problem discussion and identification of solutions (Steps 3 and 4): Maps are used as basis for discussion, negotiation and conflict management and resolution (see also [59]). In particular, problems affecting the areas are discussed in plenary, classified according to a decreasing order of importance and systematically located in the maps. Hence, the cartographic output serves as support during the whole exercise, and information in it is constantly updated by interacting with the participants. For example, questions are asked to the participants regarding the areas that are flooded when it rains and the main drainage lines. It is generally the same population living in the study area (selected rural village or urban neighborhood), and who has learned to recognize the features in the map, who can indicate with great precision how such phenomenon occurs spatially and which are the affected locations. The map is then updated accordingly on the spot by the technical team mediating the process. In Zimbabwe, problems were also identified through individual interviews at the household level, giving slightly different results than the plenary sessions with community leaders. This shows that, ideally, the same issues should be analyzed from different angles in order to obtain more accurate planning information. Once problems are classified, the resident population is requested to come up with alternative solutions. In coordination with authorities, the technical experts help to assess the feasibility of each solution in plenary according to available financial, human and material resources, in a transparent manner. Discussions are then moderated around project identification and modalities of implementation. As recommended by Chambers [27] in the first PRA pillar: “outsiders should facilitate and not dominate”.

Drafting local plans and implementation of priority interventions (Steps 5 and 6): The presence of authorities from provincial or central levels contributes to frame working the plan within a larger scale, thus avoiding that locally-biased decisions are taken without due consideration of the micro-region settings and dynamics in which the study area is inserted. This allows also fulfilling the requirements defined in provincial or national plans, strategies and/or policies (see also [60]). Final maps are prepared in a Geographic Information System (GIS) environment to be included in the drafted local plans, which are then submitted to the consideration of the participants for validation (see an example of final maps in Figure 8). The validation exercise occurs once the technical team has worked out a draft of the local action plan based on the data collected in the first planning session. For such purpose, a second participatory planning session is organized, preferably with the same participants, to get confirmation that what was discussed in the previous session has been properly reflected in the drafted plan, and to identify necessary amendments or corrections to be made. In particular, Corbett *et al.* [61] assert that Participatory GIS (PGIS) can: (i) enhance capacity in generating, managing and communicating spatial information; (ii) stimulate innovation; (iii) encourage positive social change.

PGIS is geared towards community empowerment; it is a flexible practice which adapts to different socio-cultural and biophysical environments, by combining “expert” skills with local knowledge [62]. Importantly, based on the negotiated solutions during the previous phase, priority interventions are defined, which will constitute the immediate and direct consequence of the planning process. The organization that goes into carrying out these interventions works as a catalyst, as it encourages participants to contribute actively to decision-making, hence reinforcing the sense of ownership of the process as well as their commitment to achieve what was planned. Implementing tangible activities also reduces the risk of raising the communities’ frustration, as it generally occurs when the whole process is perceived as a mere data collection exercise ending up only with a printed document. For implementing the plan a local committee is elected, in a gender-balanced manner, which should enjoy the trust of the population. The committee is generally constituted by community leaders and serves as intermediary body between the resident population and the local authorities. An agreement is signed between these two entities for defining the roles and responsibilities of the different stakeholders in carrying out the plan’s implementation. Ideally a community centre is established where regular meetings are held for organizing and monitoring the execution of the planned activities. During implementation, all relevant (including budgetary) information is shared publicly and issues are discussed in a step by step fashion until a consensus is reached on the way forward. Experience shows that such community involvement approach is effective for solving conflicts deriving from individual interests which clash with community and/or public interests (e.g., an individual house abusively built along a natural drainage line is demolished for the benefit of the whole community, and rebuilt in a proper location with the support of the neighbors).

Figure 8. Local Participatory Plan for Chikwarakwara area, Matabeleland South, Zimbabwe.



Source [53].

Interestingly, even though the same methodological steps were followed, different types of local plans were produced in each riparian country. This means that *the proposed participatory approach is flexible* and can easily be adapted to local conditions and expertise of the team of facilitators. Additionally, *strengthening local capacities is key for carrying out participatory planning successfully*. For this purpose, it is necessary to develop tools and guidelines that are easily understandable by target communities and local authorities. At the same time, experience shows that *more decentralized decision-making mechanisms can be established* by ensuring the participation of representatives from central government in the local planning process.

5. Scaling up to the Basin Dimension

According to Lundqvist *et al.* [63], the water divide constitutes a natural physical boundary for examining the interdependence between land and water; meanwhile these issues are generally treated separately. The same authors observe that, commonly, river basin organizations (such as LIMCOM) are only water-oriented. This situation leads to a “reductionist” idea of the complexity of water management issues at basin level, as pointed out by Falkenmark [64]. Integration of water and land involves changes in attitude and institutional building [63]. To overcome this situation in the Limpopo basin, efforts were made for establishing *inter-sectoral committees at the national level*. Dialogue was promoted between the different sectors by planning concrete activities to be carried out at the local level.

Locally implemented activities were brought up for discussion at the sub-regional level through a series of workshops in which all four countries participated [65]. Language barriers between the riparian countries were overcome by organizing simultaneous translation, and also thanks to Mozambican participants making efforts to speak in English. During these meetings, riparian governments learned about the benefits of the adopted participatory approach. Different key ministries were present during these sub-regional events, representing the following sectors: water, land and environment, meteorology, and disaster management. This allowed reducing the distance between the local reality and decision-making at basin level as well as establishing a crucial inter-sectoral confrontation based on concrete actions carried out at ground level. The discussions were then used to draft a Limpopo Basin Strategic Plan (LBSP) focusing on vulnerability reduction to floods and drought, which are two interrelated types of natural disasters most commonly affecting the basin (see outline of the LBSP in Table 2). The plan also integrated the information derived from the different studies, reports, activities and products obtained during the project’s implementation. In this manner the planning-decisional cycle was completed: information and planning decisions collected from the local and national levels were brought up to the sub-regional level, where they were analyzed and strategic decisions were consequently taken in terms of basin management.

In general, additional time would have been needed to reach more elaborated and endorsed results in the context of the Limpopo project and, in particular, to obtain more effective inter-sectoral and inter-country coordination mechanisms for better basin planning and management. Getting the four riparian countries and all concerned stakeholders at the different levels fully on board has required considerable efforts. Once a strong interest was shown to the initiative by the respective governments after three years of implementation (2004–2007) the project was finished and all available (and limited) funds completely spent. Unfortunately no adequate follow-up could be ensured at the basin level as pledged funds for continuing the initiative were finally not confirmed by the Global

Environment Facility, despite the support of the countries. Hence the drafted LBSP could not be adequately discussed nor implemented, although its proposed activities are still valid today.

Table 2. Proposed activities of the Limpopo Basin Strategic Plan for the first four years of implementation.

Themes	a. At the basin level	b. At the national level	c. At the local level
Theme A Legal and policy framework	A.a.1. Establishment of formal coordination mechanisms for flood and drought forecasting and early warning. A.a.2. Elaboration of a SADC policy on natural disaster management which promotes inter-sectoral approach and integrated land and water management.	A.b.1. For those countries where it is still needed, complete the formulation and/or approve legal instruments on disaster management. A.b.2. Design and implement a national dissemination program of disaster management policies.	A.c.1. Encourage local discussions on existing regulations for a more efficient involvement of local authorities and communities in disaster management operations. A.c.2. Deliver local capacity building to enable effective implementation of disaster management policies.
Theme B Institutional set-up	B.a.1. Strengthen LBPTC and LIMCOM to include expertise and procedures for disaster management and land use planning. B.a.2. Streamline institutions dealing with disaster management among the different riparian countries for improving inter-country coordination and flow of information.	B.b.1. Reinforce national institutions responsible for disaster management. B.b.2. Clarify roles and responsibilities of line ministries by promoting inter-sectoral dialogue. B.b.3. Identify institutional strategies for increasing and simplifying access to funds for disaster management.	B.c.1. Build local capacities to implement disaster management operations at ground level. B.c.2. Improve flow of disaster management information at the different local levels by clarifying roles and responsibilities.
Theme C Disaster Preparedness	C.a.1. Set-up inter-country early warning mechanisms for floods and droughts. C.a.2. Run inter-country simulations, evaluate the local response and prepare a sub-regional training consequently.	C.b.1. Set-up mechanisms for sending SMS warning messages directly to community leaders. C.b.2. Deliver training on flood and drought forecasting, monitoring, and early warning at the central level.	C.c.1. Improve/upgrade network stations and establish community-based management mechanisms. C.c.2. Create floods and droughts preparedness capacity at community level.
Theme D Sustainable ecosystem utilization	C.a.3. Reinforce the implementation of current transfrontier park initiatives, in particular by promoting community participation and sustainable use of natural resources.	C.b.3. Prepare an integrated land and water management plan for disaster preparedness and vulnerability reduction, including: risk zoning, suitable areas for irrigation and dam management schemes, rural-urban linkages to be developed, practices for reducing land degradation, <i>etc.</i>	D.c.1. Carry out participatory planning at community level to prepare Activity D.b.1 and design local coping solutions to floods and droughts. C.c.3. Promote community-based wildlife management initiatives to improve the livelihood of vulnerable population.

Table 2. Cont.

Themes	a. At the basin level	b. At the national level	c. At the local level
Theme E Flood and/or drought safe infrastructure development		<p>E.b.1. Based on Activity D.b.1, identify suitable areas for developing safe havens or elevated platforms provided with basic water and sanitation facilities, to be used both during floods or droughts.</p> <p>E.b.2. Design and deliver capacity building to promote adequate building techniques and solutions for increasing resistance to floods, including rainwater harvesting systems.</p> <p>E.b.3. Promote investments for constructing or rehabilitating small irrigation and dam management schemes, as per plan drafted in Activity D.b.1.</p>	<p>E.c.1. Based on local solutions designed under Activity D.c.1 and on the locations identified in Activity E.b.1, construct elevated platforms (e.g. markets) and social services (schools, health posts, warehouses for storing food and basic goods, <i>etc.</i>) equipped with flood-proof water and sanitation facilities, and including rainwater harvesting systems; these solutions will work as safe havens during floods and as important social/basic facilities during droughts.</p>

Adapted from [41].

6. Living with Floods in Mozambique

Despite these difficulties, activities could have more continuity in Mozambique, which is also the country located downstream in the most vulnerable position to flood disaster. Some provisions made by the drafted LBSP could be implemented there since 2008, as consequence of the participatory planning approach applied in few locations and an intense work with the national authorities. With a much larger floodplain, the Limpopo River is more dynamic in Mozambique and, hence, more complex to manage compared to upstream countries, especially in terms of human-fluvial spatial requirements and relationships.

It is worth highlighting that after the 2000 floods, the Mozambican government carried out major resettlement operations of people living in low areas to higher grounds, following a policy which has been enforced since independence in 1975. Unfortunately, experience shows that if no initial investment is made in the short term for providing basic and social services, and no social integration and sustainable livelihood mechanisms are in place, the resettlement areas will soon become unsustainable locations to live in [66,67]. As a result a high percentage of the displaced population returns to the areas at risk, perpetuating a vicious cycle of vulnerability. The main reason for such behavior is related with the extreme poverty of the population and its dependency on subsistence agricultural schemes applied in the floodplains, which are very fertile [68]. This aspect was also confirmed by a recent study carried out in the lower Zambezi River after the 2007 and 2008 floods which shows that the resettled population, although accepting to live in houses (subsidized by the

Government) located in higher grounds, is returning to the low areas on a daily, weekly or seasonal basis depending on the distance from their crops [69].

Therefore, for people living in large floodplain areas characterized by a flat topography and whose relocation would mean to be moved too far away from their crops, resettlement is not a viable solution. In these cases, adaptive solutions need to be explored, such as *“Living with Floods”*. This is particularly feasible for low-lying areas prone to moderate flooding, having reached a maximum height of one meter during historic exceptional floods. Such approach has been promoted by UN-HABITAT in Mozambique since 2003, in close partnership with the Government [70]. A similar strategy was adopted long ago in Bangladesh where the destructive impact of flooding is reduced by the adjustments that peasants inhabiting the floodplain regions have historically made, adapting their agricultural practices, cropping patterns and settlements to the annual deluge [71]. In fact, building expensive flood-control structures is often an unaffordable option for poor countries which are highly vulnerable to this kind of natural disaster, especially when large and dynamic rivers are concerned. According to William [72], the goal of flood management is to reduce the hazard to lives and properties by the most cost-effective measures, recognizing that not all flood-risks can be eliminated. The same author further explains that this can be accomplished through proper land use planning, flood proofing, flood warning, and financial incentives, and that elevated structures are a valid alternative to flood control.

Along this line of thought, the selected priority interventions during the preparation of the local participatory plan for Maniquenique village, Gaza Province (see area 2 in the map of Figure 2), was the construction of an elevated school. Such structure was designed to function as a safe-haven in case of floods (see Figure 9), with a wooden floor built half a meter higher than the level reached by the floodwaters in 2000 [73]. The one-slope roof is reinforced so that it can be used as higher refuge-platform in case of a dramatic event. Moreover, it works as a rainwater harvesting system linked to a water tank with a capacity of 30 m³, allowing the community to access safe drinking water at all times, especially during a flood. The building design is adapted to the local reality and to climatic features of the area, being resistant also to cyclones. Man-power was recruited locally and trained on-the-job during the construction phase. Such demonstration activity, which is currently being replicated in the lower Zambezi River at a bigger scale, is meant to influence the building codes of public facilities such as schools and health centers of settlements located in areas potentially vulnerable to moderate flooding. The elevated school of Maniquenique was used in November 2010 by the national authorities as part of the flood simulation exercise.

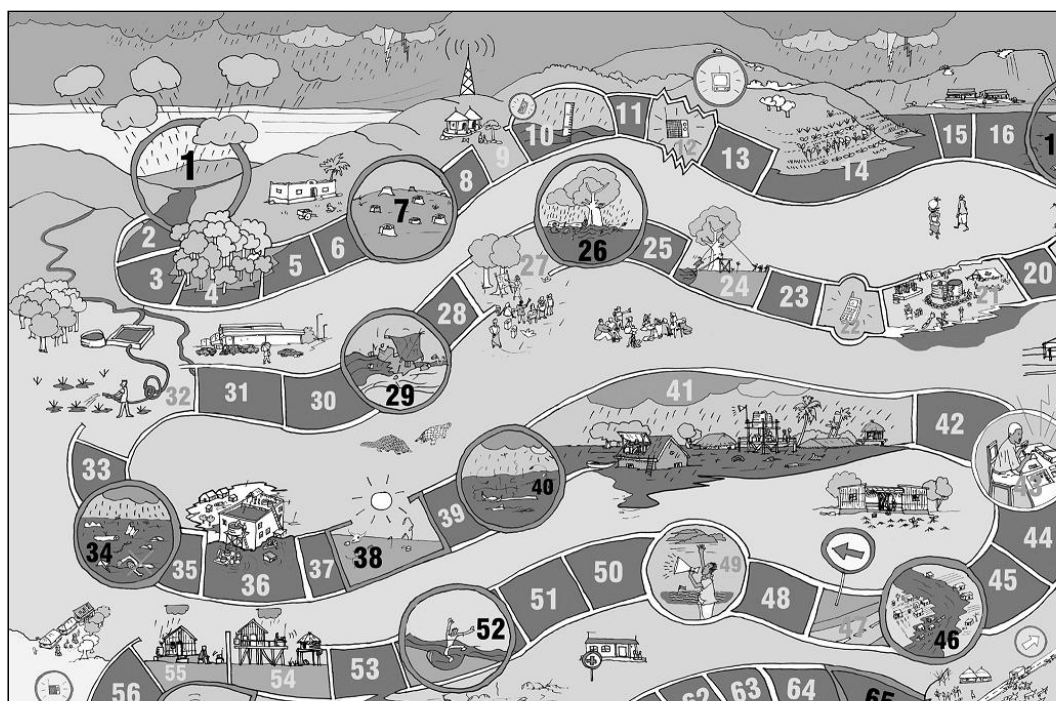
Figure 9. Elevated school of Maniquenique, Gaza Province, Mozambique.



(Photographer: Fernando Ferreiro, 2008).

Complementing such pilot intervention, awareness raising activities for vulnerability reduction to floods, drought and cyclones are also being carried out. One of most important didactic tools to reach the communities and increase their adaptive capacity is the River Game, which provides an overview of the most important recommendations regarding flood preparedness, contingency, early warning, land use management, drought mitigation, among other aspects. It includes a board game depicting the winding course of the Limpopo River from the mountains to the sea, which is divided into segments which contain simple instructions corresponding to the throw of a dice (see Figure 10). This learning by playing concept is currently having a great impact at community level and among partners across borders.

Figure 10. The River Game.



Source [74].

Based on these activities a strategy for vulnerability reduction and sustainable development targeting areas prone to moderate flooding was designed and is currently being discussed and analyzed by different government institutions in Mozambique. The strategy combines both the resettlement and the “*Living with Floods*” approaches according to the following three main lines of intervention, trying to maximize sustainability:

- Establishment of serviced resettlement areas in higher/safe grounds not too far from the productive/low areas. These areas will serve as centers for attracting resources, investments and people, setting up vocational training facilities, running commercial activities and providing services to the surrounding population within a radius of 10 to 20 km, which should include the productive/low areas and attract/serve approximately 40,000–50,000 people.
- Installation of elevated support platforms in the fertile lowlands susceptible to moderate flooding, which can serve as social facilities or resource centers in normal times and as safe-havens or evacuation centers during flood times. These platforms need to be well-connected to the resettlement areas, within a logical, interlinked and functional spatial planning framework.
- Set up a permanent institutional capacity development process at the different local (district and village) levels concerning governance, local management and service delivery for disaster risk reduction and for increasing agricultural productivity.

To start implementing this strategy and ensure the feasibility of investments, a comprehensive territorial assessment needs to be undertaken in the first place, looking into the flood vulnerability characteristics at district level, so that resettlement areas and elevated platforms can be properly planned and located. Regional planning concepts will be applied, in particular looking to the inter-connectivity with the main settlements.

7. Discussion and Conclusion

Based on the findings presented above, the major bottlenecks for obtaining a more integrated planning and effective management of the Limpopo River basin (which are typical in the context of the developing world) can be summarized as follows: (i) weak inter-sectoral and inter-country coordination; (ii) top-down decision-making mechanisms and lack of community empowerment; (iii) overall lack of capacity, especially at the local level, leading to a weak policy enforcement; (iv) high vulnerability of riparian communities to natural disasters which are provoked by climate change and variability; and (v) excessive pressure on natural resources leading to deforestation and land degradation, worsening the impact of floods and drought.

In this paper, participatory approach was presented as a potential method to overcome some of the above challenges. The authors argued that planning decisions need to be made after a careful analysis of the situation on the ground, by mainstreaming community involvement. However, such approach presented the following shortcomings during the implementation of the Limpopo project:

- It took time and effort to convince decision-makers at central level that participatory planning could work as an effective tool for better defining regulatory policy instruments at the basin level. In fact such methods refer to a given geographical area (in the case of the project: nine rural villages) in a given period of time. To be representative of the complex and changing reality of the basin, more locations would need to be selected.

- Overall, it was also time-consuming to identify pilot sites and mobilize expert teams to run the participatory planning sessions at the local level (in average three months and two sessions per site, mostly located in remote areas, were needed).
- An additional challenge was represented by the particular skills needed by these teams for conducting the sessions, such as the language to be adopted for enabling proper understanding of all participants, delicate situations to mediate which can result in tensions and conflicts between the local stakeholders, among other aspects.
- Finally, the financial means for carrying out pilot activities based on the adopted decisions were generally limited (an average of 15,000 US dollars per study area).

Despite these difficulties, the results obtained from the participatory planning activities produced reliable “snapshots” of the situation on-the-ground which were useful for understanding on-going processes as well as potential developments of the areas under study. The authors believe that if replicated according to a pre-defined sampling scheme, this approach allows “capturing” the complexity of a river basin. Hence, local plans resulting from a bottom-up decisional process can positively influence policy-makers at national and basin levels, as they represent a sort of “ground truth”.

An added-value of the participatory planning method applied in the Limpopo project was its mapping dimension, which allowed maximizing the use of local knowledge. Thanks to the detailed spatial information contained in the aerial photos or satellite images (in which even single houses can be detected), even illiterate participants from the targeted community are able to provide valuable contributions, based on their experience and deep knowledge of the study area. This increases time and cost-effectiveness in data collection about the study area [70].

The local participatory plans in particular facilitated the identification of gaps to be filled in and linkages to be strengthened between the different sectors of intervention. Examples in scientific literature provide evidence that, through use of a participatory approach, plans integrating land, water and disaster management aspects can be produced locally [21-24]. During the Limpopo project, the presentation of these local plans in sub-regional fora in which the different sectors concerned were represented has stimulated the discussions and highlighted the need for a more integrated approach, not only limited to land and water management aspects, but also including economic development and disaster management in the planning process. It is worth mentioning that after this initiative in the Limpopo, the LBPTC requested a Joint Limpopo River Basin Study of the four riparian countries, whom scoping phase was completed in 2010 [75]. Once again, the latter mainly focuses on water management aspects, ignoring the needed inter-sectoral approach needed for dealing with basin planning and management appropriately, as highlighted in this paper. There is still a long way to go before such coordinated approach is foreseen and applied, and resources are made available for such purpose.

Once strategic guidelines are determined at the basin level (such as the attempt made during the Limpopo project to draft a basin strategic plan), they need to be tested locally and then assessed for further replication. In this way the assessment, planning and decision-making cycle is completed, linking the different levels in a self-regulatory manner. This can be done through continuous needs assessments, local planning, testing of policy decisions in each cycle, hence determining the consequent adjustments to be made for the next cycle. A concrete example of such multi-level adaptive management is the “*Living with Floods*” experience in Mozambique. Following the provisions and

recommendations of the LBSP, a flood adaptation pilot activity was identified at the local level through participatory approach and complemented with awareness raising activities. This activity has then stimulated the formulation of a vulnerability reduction strategy for areas prone to moderate flooding, which now needs to be approved at the central level and tested locally in other locations, so that it can be validated and upgraded to a policy and legislation.

According to the authors, considering its complexity, a basin plan should be constituted by broad strategic orientations based on a synthetic analysis for a sample of local situations, and positively influence the formulation of improved national and regional strategies and policies. If it contains too much detail, the basin plan would be impossible to implement. Therefore, basin planning and management ideally resembles policy-making, providing strategic development guidelines and allowing some flexibility and adaptive management while applied at the local level.

It is clear that an initiative in the Limpopo River basin such as the one described in this paper, in which different countries are involved and who are struggling for controlling the same water resources, would need more time than just three years as well as more resources to significantly contribute in achieving improved basin planning and management. The implementation of the “*Living with Floods*” strategy in Mozambique since 2006 to today is the demonstration that adequate time and resources are needed to induce effective institutional and political changes for up scaling such an approach which initially did not fit the main policy advocated by the government: resettlement of the population at risk to higher grounds.

Through this paper, the potential use of the participatory approach for more integrated basin planning becomes clearer. As stated by Buller [76] and Newson [6]: “popular action is progressing the concepts of integrated river basin management”. This approach is seen by the authors as particularly valuable in developing countries where data are scarce, as it can be carried out with minimum resources. Importantly, it avoids falling into a top-down logic and allows acknowledging local population’s opinions in decisions made at the national and sub-regional levels. It also strengthens the local capacities and facilitates inter-sectoral integration and coordination.

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