Project Title

Wetlands-based livelihoods in the Limpopo basin: balancing social welfare and environmental security

Brief Title

Wetlands, social welfare and environmental security.

Executive Summary

For many years the need to avert water shortages has resulted in farmers turning to wetlands for crop production. The wetlands are attractive units for their rich soils and year round soil moisture, which is favorable to crops during both the dry season and drought years. But wetlands also have many functions that are beneficial to the environment and humans, and if used unwisely these benefits will be destroyed. This study proposes to use trade-off analyses to study the mix of agricultural (crop and livestock) and fisheries water use strategies in *dambos* and riverine swamps at two sites in the Limpopo River basin, and the trade-offs among them as a tool to guide planning for wetland use and conservation. It will develop guidelines and tools to assist decision-making regarding the use of these wetlands to ensure that livelihoods continue to be supported in a way that does not compromise environmental security. The focus of the study is facilitating sustainable wetland management and development. The proposal is based on the basic hypothesis that wetlands can be managed in a sustainable manner, and that a balance between protection and agricultural production can be achieved, ensuring optimal use of wetlands. It will investigate wetlands in upper and lower catchments of the Limpopo basin**.**

The project addresses crop water productivity in wetlands, agriculture in upper catchments, aquatic ecosystems, and integrated basin water management system. It will be implemented over forty-two months. The expected research outputs are:

- An inventory of the different methods of wetland water management for agriculture and to support livelihoods at two sites in the Limpopo basin.
- A framework for a social welfare indicator based on food security and income goals of farmers.
- Empirical knowledge of the natural resource base's potential to produce agricultural products and ecological goods and services at two sites in the Limpopo basin.
- Analytical framework for analyzing trade-offs between food production/security and environmental security developed and applied and comparative analysis of social welfare benefits accruing from various options for wetland water use for agriculture, and the trade-offs among them, including trade-offs among different intensities of each use.
- Recommendations and guidelines, based on trade-offs analysis, for allocating uses to dambos and riverine swamps for extension agents, traditional decisionmakers, and wetland users; and policy recommendations on agricultural wetland use regulation.
- Enhanced capacity of wetland users, researchers, and other stakeholders.

Institutions participating

- Name of institution: International Water Management Institute (IWMI)
- Postal address: P. bag X 813, Silverton 0127, South Africa
- Email: iwmi@cgiar.org
- Type of institution: CGIAR (Future Harvest) Center

- Name of Institution: University of Zimbabwe, Department of Geology (UZ-GEOL)
- Postal Address: P. O. Box MP 167, Mt Pleasant, Harare
- Email: lupankwa@hotmail.com
- Type of institution: NARES
- Key Collaborators: Dr. Lupankwa

- Name of Institution: University of Zimbabwe, Department of soil Science and Agricultural Engineering, Institute of Environmental Studies (UZ-SSIES)
- Postal Address: P. O. Box MP 167, Mt Pleasant, Harare
- Email: kmotsi@agric.uz.ac.zw / chuma@africaonline.co.zw
- Type of institution: NARES
- Key Collaborators: Mr. Kudakwashe Motsi and Mr. Edward Chuma

- Name of institution: University Eduardo Mondhlane (UEM)
- Postal address: Faculty of Engineering, Av. de Mozambique Km 1.5, CP257, Maputo, Mozambique
- Email: juizo@hotmail.com
- Type of institution: NARES
- Key Collaborator: Mr. Dinis Juizo

Project leader

- Name: Dr. M. C. Masiyandima
- Professional Discipline: Hydrology and Soil and Water Engineering
- Institution: International Water Management Institute
- Title: Researcher

Principal investigators - (PIs)

1. Name: Dr. Matthew McCartney
   Professional Discipline: Hydrology
   Institution: International Water Management Institute
   Title: Senior Researcher

2. Name: Dr. Mlindelwa Lupankwa
   Professional Discipline: Hydrology and Remote Sensing
   Institution: University of Zimbabwe
   Title: Lecturer

3. Name: Dr. Marcus Wishart
   Professional Discipline: Environment and Social Water Resources
   Institution: University Eduardo Mondhlane

	Title:	Researcher
4.	Name:	Dr. Sylvie Morardet
	Professional Discipline:	Economics
	Institution:	International Water Management Institute
	Title:	Senior Researcher
5.	Name:	Mr. Edward Chuma
	Professional Discipline:	Soil Science, Participation
	Institution:	University of Zimbabwe (Department of Soil Science / Institute of Environmental Studies)
	Title:	Researcher

Other Investigators

6.	Name:	Mr. Dinis Juizo
	Professional Discipline:	Hydrology
	Institution:	University Eduardo Mondhlane
	Title:	Lecturer
7.	Name:	Dr. Barbara van Koppen
	Professional Discipline:	Sociology
	Institution:	International Water Management Institute
	Title:	Senior Researcher
8.	Name:	Mr. Kudakwashe Motsi
	Professional Discipline:	Irrigation and Water Management
	Institution:	University of Zimbabwe (Department of Soil Science and Agricultural Engineering)
	Title:	Lecturer
9.	Name:	Dr. Prasad S. Thenkabail
	Professional Discipline:	Remote Sensing
	Institution:	International Water Management Institute
	Title:	Senior Researcher
10.	Name:	Dr. Gift Manase
	Professional Discipline:	Resource Economics
	Institution:	Institute of Sanitation and Water Development
	Title:	Economist
11.	Name:	Dr. Dominique Rollin
	Professional Discipline:	Agronomy
	Institution:	International Water Management Institute
	Title:	Senior Researcher

Budget requested from CP (in US$)

$865,100.00

Budget offered as matching funds (in US$)

$215,217.00 (possibly over $1.1 million)

IWMI expects a GEF funded project on 'Sustainable Management of Wetlands in Southern Africa: A Livelihoods and Ecosystems Approach' to come online by the end of 2004 through UNEP. This project will be of the order of $950,000.00, bringing the matching funds to over $1.1 million.

Total budget (in US$)

$1,080,316.00

Duration of project

3.5 years

Coverage of basins

Limpopo basin

Coverage of themes

Crop Water Productivity Improvement (Theme 1)	10 %
Multiple Use of Upper Catchments (Theme 2)	30 %
Aquatic Ecosystems and Fisheries (Theme 3)	30 %
Integrated Basin Water Management Systems (Theme 4)	30 %
Global and National Food and Water System (Theme 5)	0 %

Background and justification

Wetlands in the Limpopo River Basin (LRB) are important aquatic systems. Their most visible characteristic is the abundance of water in them particularly in the dry season, when compared to the surrounding catchment area. They are an important resource in this basin that is characterised by climatic extremes. The wetlands in the LRB are predominantly *dambos* (seasonally or permanently saturated areas, also referred to as pans), pans, and riverine wetlands. Dambos and pans are associated with some of the upper catchments in the basin, with significant occurrence in the upper Olifants catchment in South Africa; the Mwenezi, Shashe, Tuli, Umzingwane, and Bubi catchments in Zimbabwe; and the tributaries of the Changane catchment in Mozambique. Riverine swamps are confined to the main stem of the Limpopo and Changane tributary and the lower reaches of the Limpopo River in Mozambique. Of the nearly 58,000

hectares of wetlands in the Upper Olifants tributary, 11% are pans (Marneweck and Batchelor, 2002).

In Zimbabwe and Mozambique it is mainly communal populations who live around the dambos and make use of these highly productive resources. In the upper Olifants catchment in South Africa several pans occur on commercial farms, and are used for livestock grazing and cropping. In Zimbabwe and Mozambique, many poor people depending on agriculture for their living utilize wetlands to mitigate problems of low crop yields associated with droughts across the region, and the low rainfall that is characteristic of the basin. The wetlands support livelihoods through agriculture for both food production and income. Dry season crop production and livestock production are some of the uses of dambos and riverine wetlands in Mozambique (Gomes et al., 1998). In drought years wetlands often have sufficient moisture to sustain crop production, mitigating the potential impacts of drought on food availability. Irrigation in the wetlands provides the means to intensify food production, and alleviates constrains resulting from short drought spells or mid-season droughts. If properly managed, wetlands are an asset to the rural communities who depend on them.

Wetlands support a host of other important environmental functions, including flood control. They are complex and ecologically sensitive environments that are intrinsically linked to the catchments in which they occur. Altering the wetland environment through cultivation, for example, has potential impacts across the wetland and the associated downstrean areas. As such, agricultural production in wetlands has traditionally been considered an antithesis to the conservation of wetlands. The perception is that crop production in wetlands causes degradation of the wetlands, and results in loss of benefits. But agriculture has taken place in some of these wetlands for many years, and farmers, regardless of conservation efforts and restrictions, and driven by escalating unemployment and increasingly unreliable rainfall, continue practicing varying levels of agriculture in marshes and swamps. Long-lasting efforts towards sustainable management and conservation of wetlands cannot focus on conservation alone; it requires that farmers are taken on board.

There is a large gap in the understanding of the effects of land uses in the wetlands on hydrological processes in the catchments. The agricultural interventions whose costs and benefits are largely unknown make the wetlands, especially the dambos and pans in the upper catchments quite vulnerable. Moreover, the impacts of activities in dambos and pans located in the upper catchments on downstream users (water supply and quality, flood control, flora and fauna, etc.) are still not well understood. While history has shown that wetland ecosystems have the potential to support reasonable livelihoods, continued unplanned conversion of wetlands to cropland will result in environmental degradation and severely compromise the other benefits derived from them. In recent times, perhaps as a result of the realization that restrictions and conservation efforts have not had the expected impact, traditional conservation-oriented thinking has shifted. Globally, 45% of the more than 17,000 major sites devoted to biodiversity conservation have at least 30% of their area utilized for agriculture (Scherr and McNeely, 2002). Solutions to ensure protection of these environments and productivity for people need a multi-pronged approach focusing on conserving the wetlands while maintaining the livelihood benefits to local people.

Over the last decade numerous studies have addressed sustainable utilization of wetland issues but have not addressed the issue of how much wetland area should remain unconverted, and the different levels of intensity of use that do not adversely affect the ecosystem services.

Trade-off analysis, which can be used to support such decision making processes in agricultural production systems (Antle et al., 2002), will be used to address this. This study proposes to use trade-off analysis to study the mix of agricultural water use strategies (crop, livestock production, and fisheries) in *dambos* and riverine swamps and wetlands, and the trade-offs among them, and will focus on facilitating sustainable wetland management and development. It will develop guidelines and tools that assist in making decisions regarding the use of these wetlands to ensure that livelihoods continue to be supported in a way that does not compromise environmental security. The proposal is based on the hypothesis that wetlands can be managed in a sustainable manner, and that a balance between protection and agricultural production can be achieved, ensuring optimal use of wetlands. It will investigate wetlands in upper and lower catchments as well as the links with downstream areas.

Conceptually the proposed analytical framework could be applied to aquatic resources and other non-tangible wetland benefits. In this project, however, it will be limited to crops, livestock, and fisheries. Application to other benefits will be implemented under a project commissioned by the GEF, currently under preparation by IWMI and other partners. The project will form synergies with other initiatives in the Limpopo basin, such as the GEF-supported Desert Margins Program that has a wetlands component in Zimbabwe, and will also build on knowledge been generated by initiatives such as the IUCN project on 'establishing ecosystem management in the Limpopo River Basin'. We will also work closely with another CPWF Project on 'Managing Risk, Mitigating Drought and Improving Water Productivity in the Water Scarce Limpopo Basin' that is led by Waternet.

Goal

The project goal is to contribute to enhancing food security and improving the livelihoods of wetland-dependent communities by increasing productivity of water and optimizing and maintaining wetland ecosystem services. The project addresses issues of use of wetlands for crop water productivity in wetlands, agriculture in upper catchments, aquatic ecosystems, and integrated basin water management system. It will generate knowledge on trade-offs among several wetland uses.

Specific objectives

The project goal will be achieved through developing and applying a trade-offs based framework for making decisions about allocations of wetland resources to specific uses, including agriculture. The project research team and development facilitators (extension officers, NGOs) will identify, together with wetland users, the various agricultural uses of wetlands, especially cropping patterns, and evaluate their respective water use levels and demands on wetland water, and the resultant impacts on the wetland. The project will determine the trade-offs among different agricultural uses of wetland water, and the trade-offs between each of the agricultural water uses and environmental use. Where there are negative impacts, evaluation of the benefits lost due to decreased level of use and the subsequent benefits to environmental security will be evaluated. Together with male and female farmers, guidelines on acceptable levels of wetland water use for agriculture will be proposed, and encouraged as best practice.

Specifically the project aims to:

1. Develop and apply a trade-offs based framework for making decisions about allocations of wetland resources to specific uses, including agriculture.
2. Determine the trade-offs among different agricultural uses of wetland water and the trade-offs between each of the agricultural water uses and environmental use; develop guidelines on acceptable levels of wetland water use for agriculture; and encourage this as best practice.
3. Identify as part of the trade-off analysis *who* benefits, e.g., poor women and men farmers, herders, fisher folk; local business people; etc.
4. Enhance capacity of wetland users, researchers, extension officers, natural resource managers, and policy makers.

Activities and methodology

During the first year, activities to establish the project will be carried out. These will include:

1. *Situation assessment and assessment of local knowledge, perceptions, and expectations (specific objective 1)*

During this phase study catchments, sites, and stakeholders will be identified. The sites will be selected based on the (1) representativeness of wetland type, e.g., headwater pan, (2) availability of biodiversity data in particular mainly wetland flora, (3) some use of the wetland for agriculture, and (4) accessibility of the site.

Second, stakeholder workshops will be held during the second quarter of the first year to (1) consult with users to ascertain uses of the wetlands, benefits that are derived from wetlands and to whom they accrue, water management practices, etc., (2) assess the nature and extent of the competition for water between livelihoods and environment, and links to food insecurity and poverty, (3) analyze policies and legal frameworks that affect the way in which wetlands are utilized, and (4) establish wetlands users' perceptions regarding erosion, loss of plant and animal species, reduced downstream flows, and drying up of wetlands. These workshops will enable researchers to assess local knowledge, perceptions and expectations in the study catchments to gather site-specific local knowledge. These consultations will also be used to develop a framework together with stakeholders, for a gender disaggregated social welfare indicator based on food security and income goals of farmers.

The detailed activities are:

Activity 1.1: Inaugural project team meeting.
Activity 1.2: Inception meetings / discussions in each country (to get buy-in from local leaders, key decision makers, etc).
Activity 1.3: Evaluation / preliminary site selection of potential sites, reconnaissance visit to the proposed site.
Activity 1.4: Two stakeholder workshops, one at each site.
Activity 1.5: Detailed work plan for each site.
Activity 1.6: Situation assessment synthesis, including preliminary land use mapping using RS / GIS.
Activity 1.7: Formulation of framework for social welfare indicator, ecological framework, and tradeoff framework.
Activity 1.8: Identification of student research topics and initiate recruitment.

Activity 1.9: Consolidation of items 1.4 – 1.8 into project work plan for submission to CP Secretariat.

2. *Socio-economic and agronomic survey; empirical hydrological, ecological studies (specific objective 1):*

Exhaustive inventories of wetland water use for agriculture and fisheries will be carried out at each of the two sites to establish all the different types of wetland water use for agriculture and livelihoods, and possible alternative uses of wetland water use for agriculture that achieve the social welfare goals set by wetland users.

The hydrological and ecological studies will enable assessments of the natural resource base and potential production of agricultural products (fisheries, crops, livestock, etc.) and ecological goods and services. Hydrometric monitoring equipment will be installed and biophysical and limited ecological parameters (indicator plants) monitored. Ecological parameters (as specified in the ecological monitoring framework designed in 1.7) will be monitored to enable analyses of the response of the plants to the different hydrological regimes imposed by various agricultural water management techniques. A conceptual model for the processes and impacts will be developed.

Historical changes in land use will be analyzed to determine how the cultivated area in wetlands and use of water for crop production has evolved over time and impacted on the hydrology of the wetland. This will be done by using remote sensing techniques, analyzing past satellite images of the catchment site and comparing them to the present state. Advances in mapping wetlands using Landsat and SPOT images have been made in earlier work in West Africa (Thenkabail et al., 2000). This project will build on the knowledge gained there. Working from the hypothesis that wetlands and their land cover characterization can be mapped in detail and at high levels of accuracies using the newer generation of satellite sensor data, the main focus of this component will be to determine the impact of land use on *dambo* hydrology. Landsat and IKONOS data will be used to establish the land cover characteristics of the wetlands. This component of the study will also enable past trade-offs between cultivation and environmental security to be evaluated.

The detailed activities are:

Activity 2.1: Wider Stakeholder consultation; design and implement socio-economic and agronomic survey to establish water management interventions in wetlands, other wetland uses, benefits derived, and social welfare and income goals.
Activity 2.2: Installation of hydrometric monitoring network and hydrometric monitoring
Activity 2.3: Design and implementation of ecological monitoring framework.
Activity 2.4: Data quality control.
Activity 2.5: Land use assessment using remote sensing.
Activity 2.6: Modeling and synthesis.

3. *Tradeoff analysis (specific objective 1).*

During the third and fourth quarters of the first year the tradeoff analytical framework based on the conceptual framework in Annex 8 will be developed and tested. The framework will be

based on conceptualization of the relationships among environmental security, crop production, and the extent of wetland resource required. It is hypothesized that low technology production systems require more land, and utilize more water than high technology systems to achieve the same level of food production. With improved water management technology, smaller wetland areas consuming less water should be able to meet required food production targets. Relationships among social welfare, environmental security, crop production, and wetland area, and indicators for these parameters wil be determined. Environmental security will be taken as the minimum water requirement to meet the wetland's biodiversity needs and to maintain flow requirements. Social welfare will be measured using a gender-disaggregated food security indicator and the users' expectations of income from wetland agriculture.

For the field sites, the empirical relationships between (1) wetland resource use for crop production (cultivated area and wetland water use and productivity), (2) social welfare indicator and crop production, (3) social welfare indicator (resulting from crop production) and environmental security indicator, and (4) environmental security indicator and extent of wetland resource use will be developed. The relationships that represent the threshold for environmental security and wetland resource use (also environmental water requirement for the wetland) will be developed.

From the first quarter of the second year the trade-offs framework will be tested and applied to establish (a) trade-offs between the existing land uses in the catchments and (b) for each use, to determine the trade-offs associated with different levels of intensity of use (e.g., if maintaining the required level of environmental security entails lowering the productivity of a particular use, what is the associated trade-off?)

Activity 3.1: Development, testing and validation of trade-offs framework.
Activity 3.2: Revision of data collection as necessary.
Activity 3.3: Application of framework to the two case studies.

4. *Analysis of farmer land/water management strategies for agricultural uses that achieve required social welfare targets (specific objectives 2 and 3).*
Existing farmer innovations will be monitored and evaluated.

Activity 4.1: Selection of field sites and evaluation of existing interventions and monitoring interventions and obtaining feed back from farmers and other wetland users.

5. *Evaluating strategies (specific objectives 2 and 3):*
Activity 4 links management methods to the potential of the wetlands identified in Activity 3. Activity 5 will evaluate these land and water management strategies using trade-offs analysis. It constitutes the application phase, to determine the trade-offs among the different uses of wetlands. Specifically we will:

- Evaluate the trade-offs between cultivation and ecological uses using historical data to establish the trade-offs of the past.
- Evaluate ecological impacts of the land and water management strategies in Activity 4. Empirical hydrologic and flora data collected during the project will be analyzed to assess trade-offs among different levels of agricultural use, alternative land uses and land/water/crop management strategies and wetland flora.
- Socio-economic studies will determine the benefits and impacts at different tradeoff levels

on household incomes, gender, nutrition, and equity, etc.

- Synthesize findings (impacts, trade-offs, best practices) and prepare reports and guidelines targeted at various user groups (policy makers', wetland users/managers, farmers, etc.). These will be disseminated during the various workshops.

The activities are:
Activity 5.1: Assessment of water management methods and technologies, and evaluation of impact.
Activity 5.2: Socio-economic studies for impacts; evaluation of the ecological impacts; and synthesis of impacts, tradeoffs, best practice; preparation of guidelines
Activity 5.3: Assessment of scaling up interventions through spatial modeling of RS / GIS data.
Activity 5.4: Midterm evaluation, and end of project evaluation
Activity 5.5: Synthesis of findings, including workshop.

6. *Capacity building (specific objective 4)*

All aspects of the study will have a capacity building component. Wetland users will be exposed to improved and new methodologies of water management. A direct result of the tradeoff analysis is that users will be armed with the tools for making rational choices between the possible uses of wetlands.

At least four postgraduate students will be recruited to work on the various components of the project for their field research.

The outputs of this research, in particular policy recommendations will contribute to enhancing the capacity of policy makers and decision makers involved with natural resources management.

The specific capacity building activities are:

Activity 6.1: Supervision of postgraduate students

7. Dissemination (specific objective 4)

The results of the trade-off analysis will be used to compile best practice guidelines. These will be shared with the relevant government departments for further dissemination through national programs. A workshop for wetland users will be held at each site to disseminate findings directly to the communities.

Activity 7.1: Preparation of recommendations and guidelines.

Activity 7.2: Dissemination workshops for communities

Roles of project researchers and institutions

1. Dr. Masiyandima	Project leader, hydrology, trade-offs framework

2. Dr. McCartney	Hydrology
3. Dr. Barbara van Koppen	Livelihoods and gender analysis
4. Dr. Prasad Thenkabail	Remote sensing
5. Mr. Dinis Juizo	Hydrology
6. Dr. Mlindelwa Lupankwa	Remote sensing
7. Dr. Sylvie Morardet	Trade-offs analysis methodology
8. Dr. Gift Manase	Economic valuations of benefits derived from wetlands and the cost of wetlands degradation.
9. Mr. Kudakwashe Motsi	Hydrology and agricultural water management
10. Mr. Edward. Chuma	Monitoring and evaluation
11. Dr. Dominique Rollin	Agronomy

Outputs

1. An inventory of the different methods of wetland water management for agriculture to support livelihoods and a framework for a gender-disaggregated social welfare index based on food security and income goals of farmers.
2. Empirical knowledge of the natural resource base's potential to produce agricultural products and ecological goods and services.
3. Framework for analyzing trade-offs between food production/security and environmental security developed and applied; and comparative analysis of social welfare benefits accruing from various options for wetland water use for agriculture and the trade-offs among them, including trade-offs among different intensities of each use.
4. Knowledge of technical management inputs to attain different levels of crop production in wetlands and the associated trade-offs.
5. Recommendations and guidelines for allocating uses to *dambos* and riverine swamps for extension agents, traditional decisionmakers, and wetland users; and policy recommendations on agricultural wetland use regulation.
6. Enhanced capacity of wetland users.

Beneficiaries and impact

The ultimate beneficiaries will be wetland users, especially farmers. The men and women who currently use wetlands sustainably will benefit from new knowledge that builds upon the insights and skills they already have. Others will be able to adopt more sustainable practices. The project results when implemented will enable communities to use designated wetlands for agricultural purposes following practices guided by scientific findings and indigenous knowledge that are compliant with national wetlands policies.

This research will benefit other wetlands users by formulating methods to enable rational

choices about wetland uses. The scale of direct and indirect benefits, including enhanced nutritional status of the poor and vulnerable, will be substantial. This project is expected to result in (1) improved and sustainable use of wetland resources for food production, (2) sustainable livelihoods, and (3) increased environmental security. As a result, wetland benefits will be available for the long term to those depending on wetland resources.

The project will enhance scientific knowledge on the intricate linkages between land use and wetlands functioning. Capacity building benefits farmers, extension personnel, development agency personnel, students and researchers, and policy makers.

The study will make available vital information on which to base decisions regarding land and water use and sharing resources in the Limpopo basin. This will benefit the basin states, in particular Zimbabwe, Mozambique, and South Africa. It will also benefit the new Limpopo Basin Commission. The knowledge that will be generated from the project will be applied on the ground through other projects such as the proposed GEF project on 'Sustainable Management of Inland Wetlands in Southern Africa: A Livelihoods and Ecosystem Approach' currently being prepared by IWMI, FAO, IUCN-ROSA, and other partners. This project is proposed for implementation in eight SADC countries starting late 2004. Application of knowledge generated from this proposed project will therefore have wider regional impacts.

In Mozambique, the study will contribute to NGO initiatives on Community Based Natural Resource Management in the Changane wetlands by proving a tool that will help communities to make rational choices in management of the wetland resources.

Assumptions and risks

Assumptions:

- There will be at least one site in each country with sufficient baseline data, especially for flora and fauna, to allow reasonable analysis.
- Wetland users will be willing to participate and allow the researchers to monitor their interventions in wetlands.
- The data generated can be utilized to test the tradeoff analysis framework, and develop guidelines as proposed.

Risks:

- Hydrometric monitoring in remote areas is vulnerable to destruction of equipment by both animals and people.
- The economic crisis in Zimbabwe.

Monitoring and evaluation plan

The project will include problem appraisal, option analysis, proof-of-concept, and small-scale evaluation. It will depend on results of small-scale implementation for large-scale adaptation. Large-scale adaptation is not a component of this project.

The lead institution, IWMI, will be responsible for monitoring and evaluation. IWMI's Quality Management System (QMS) offers a formalized structure for planning, monitoring,

documenting, and evaluating projects. The QMS system uses standardized reporting, internal audit, and review procedures.

The target groups for monitoring and evaluation will be the project team, the users, the donor, and other interested groups. A combination of methods will be used, including structured interviews, qualitative methods (participatory evaluations and beneficiary assessments), and the use of indicators that will enable the project team to carry out before-and-after analyses. Time-bound project outputs and milestones will also be used for monitoring progress. A mile stone plan will be developed at the project inception. Activity and output indicators (logical framework in Annex 6) will be used to track activities and outputs. Qualitative monitoring will be based on field visit reports, workshop reports, and feedback from workshop attendees, quarterly progress reports, and minutes of research team meetings. Feedback from workshop attendees will be obtained using a short questionnaire.

Specific activities requiring evaluation from target user groups are those under (1) situation assessment and assessment of local knowledge, perceptions and expectations, (3) testing and developing land/water management strategies for agricultural uses that achieve social welfare targets, and (4) evaluation of strategies. Opinions of wetland users will be solicited to establish perceptions about this research, relevance of the research, expectations, the effectiveness and impact of alternative water management strategies. A short questionnaire designed to take less than five minutes will be used after each phase of the project.

Project evaluation will include a midterm review by a panel of independent reviewers, review of project implementation and completion reports, performance audit reports, and an evaluation at the end of the project to assess achievement of the project objectives and impacts. The midterm evaluation will be done during the third year. Its aims will be to ensure that the project implementation is on target, and also to make recommendations for changes where necessary.

Dissemination strategy

The target audience for the output of the research is quite diverse. It includes wetland users and farmers, extension personnel, natural resource managers, researchers, and policymakers. As such, a multi-pronged dissemination approach using different media and targeting the various audiences will be followed. Dissemination of findings will take place throughout the duration of the project and beyond.

Case studies and best practices will be documented in working papers and wetlands policy briefs, and disseminated widely to other researchers, and through Waternet may be included in regional university curricula. Brochures with easy to understand information will be shared with farmers, other wetland users, and agencies working with farmer groups. Where necessary the material will be translated into local languages. A handbook of guidelines for wetland use will be written for NGOs, community workers and extension professionals. Farmers and extension personnel involved in developing and testing technologies will disseminate guidelines and other best practice information to other farmers in similar environments but not involved in the study, ensuring wider uptake.

To inform and influence the thinking on agricultural use of wetlands, research findings targeted at research and academic communities will be published in refereed journals. Two of the participating institutions are universities. Principal investigators from these institutions will

be responsible for disseminating findings within the academic circles.

A farmers' and wetland users' workshop to disseminate practical guidelines for interventions and best practices at both sites. Findings will be published in the form of policy briefs targeted at natural resources managers and policy makers. These will be circulated widely. Additional dissemination of results will achieved through presentations of research findings at regional workshops and other related for a.

The results will be communicated to a regional and global audience through IWMI's website, mailing lists, and other media. IWMI will disseminate research results through its communication and knowledge sharing activity to target audiences and stakeholders worldwide. IWMI has created information channels aimed at informing and influencing different groups of people that can make a difference in reducing poverty. Results of this project that have clear recommendations for action to improve policies to reduce poverty will be included in the Water Policy Briefing series, sent 8-10 times yearly to some 5000 development and research decision makers and educators worldwide. The series reaches an even larger group of people through direct downloads from the Water Policy Briefing website (www.iwmi.org/waterpolicybriefing). Some 200,000 copies of research publications are downloaded from the IWMI website per year. IWMI's strategy is to create information services that deliver practical information to a variety of development and research audiences.

Finally the results will also be cross-posted on the World Conservation Union Regional Office for Southern Africa's (IUCN-ROSA) SADC wetlands conservation website.

Resources needed

At around $250,000 per year, this project would by itself give excellent value for money because of its innovative methodology and potential for huge positive impacts on poverty, livelihoods and the environment. But this modest investment will leverage other resources. Participating organizations will provide in-kind contributions of about $215,000. The project will influence other major investments being made in the region implemented through SADC.

Funds are required to cover staff time, costs of supporting students, travel, communications and logistics, and equipment for measuring water and other variables in the pilot areas.

Annexes

1. Abbreviated CVs
2. Gantt chart
3. Trade-off Analysis Framework