CGIAR Challenge Program on WATER & FOOD

Submission Document

Limpopo Basin Development Challenge of the CPWF

Integrated management of rainwater to improve smallholder productivity and livelihoods and reduce risk

L1 Targeting and scaling out

Originally submitted April 2010
Revised and resubmitted August 2010

PART A: SUMMARY

1. Project Data

BDC: Limpopo
Project Title: L1 Targeting and scaling out
Project Lead Organization: Stockholm Environment Institute (SEI)
Consortium partners (who receive budget): WaterNet , University of Witwatersrand, Council for Scientific and Industrial Research (South Africa)
Project Leader (name and contact details): Jennie Barron, Stockholm Environment Institute, University of York, York YO10 5DD, United Kingdom Email: jennie.barron@sei.se
Duration: 3 years
Target start date: 1 October 2010
Finish date: 30 September 2013
Maximum budget requested from CPWF (in US$): USD 700,000
Any matching funds offered (provide brief explanation): WaterNet support for MSc. fellowships and in –kind project contributions USD 104000 attached (see letter of support)

2. Project Summary

Despite hosting some of the most developed sub Saharan countries, a majority of rural smallholder farmers in the Limpopo basin still live in poverty. The challenge of low and highly variable rainfall together with inadequate technology transfers, inadequate policy and investment context all act to disable successful transitions out of poverty. The CPWF Phase I identified several opportunities to manage rainfall in more efficient and productive manners at field to basin scales. The challenge of successful targeting and scaling out is still a key research and development area to contribute towards the Limpopo development challenges (CPWF Limpopo Stakeholder Consultation, 2009) with opportunities to enable transformations of rural livelihoods at a greater scale. The project L1 ”Targeting and scaling out” aims to develop an evidence and knowledge-based tool that will map the likelihood that a given intervention will be successful in given locations. The tool would be intended for non-expert users and would be available via the World Wide Web.

The proposed L1 project will contribute to achieving the BDC challenge of improving rainwater and small reservoir management to contribute to poverty reduction and improved livelihoods resilience. It will do this by producing a framework and web-based and electronic “decision support”, (or targeting and scaling out tool) that will identify likely sites to introduce AWM interventions for smallholder farming systems. The purpose is to contribute towards improved water management and increasing food production in the basin, based on assessments of social-economic and biophysical conditions, and within the framework of basin-scale water management realities.

The project partnership comprises of the Stockholm Environment Institute (SEI) with WaterNet, University of Witwatersrand, and CSIR/South Africa and will be carried out in close collaboration with CPWF Limpopo basin projects L2, L3, L4 and L5, and with CPWF Volta V1.

PART B: PROJECT DESCRIPTION

3. BDC Goals to which the project will contribute

Despite the Limpopo basin covering some of the most developed countries of sub-Sahara Africa, the region is still highly affected by rural poverty, and not the least, inequity in distributions of resources, including water, investments and infrastructure.
The L1 project will contribute to meeting the identified CPWF Limpopo basin development challenge to improve rural livelihoods and their resilience through better management of rainwater, including management of small reservoirs through development of a decision support tool to identify potential *agricultural water management interventions* and *potential areas* for out-scaling promising *smallholder farming* systems. The targeting and scaling out tool will assist national and regional decision makers, implementers and investors (the Boundary Partners of the project) including the Southern Africa Development community (SADC) generally, the Limpopo Water Course Commission (LimCom) and specific projects such as the LoGo project by identifying areas that exhibit the greatest opportunities for the out-scaling of interventions related to particular agricultural water interventions that integrate rainwater management for smallholder farming systems, including livestock and domestic water opportunities. The Bayes-based out-scaling tool will combine data from biophysical and socio-economic GIS data layers and survey results with expert knowledge (where it is available and appropriate) within a Bayesian framework. The output of the Bayesian analysis will be a spatial map of probabilities of success, based on the available information. Where data are scarce, the level of certainty will be correspondingly low. Using this tool, implementers and policymakers can identify where interventions may have a certain likelihood of success in adoption and adaptation. Ultimately, the improved targeting tool could help interventions and investments to be more efficient in reaching successful development targets on alleviating poverty, increasing agricultural productivity, and reducing environmental impact (especially water scarcity). The project further emphasizes interventions that show inherent *water productivity* gains while having potentially neutral or positive impacts on other *ecosystems services* in landscape, to ensure that aggregated impacts of adopted interventions contribute to sustainable *development in positively resilient trajectories.* In addition, the interventions of key interest should reduce the *multiple risks* that affect smallholder-farming systems in the basin, in particular related to food sufficiency, income loss and failing crops and/or livestock production. The project will integrate social and ecological data into interdisciplinary decision support tool for public domain use. The tool and data are developed in partnership in a consultative manner with potential end-users.

The project is a consultative research project designed to be iterative. At least four meetings/workshops designed to be mutual learning events with the project team and potential end users will take place over the project period as well as several more ad hoc meetings.

4. Research questions and methodologies

The Limpopo basin development research of CPWF aims to contribute towards out-scaling and uptake of integrated rainwater management to increase smallholder farmers' livelihoods, productivity and reduce exposure to risks. Part of this research can be addressed through learning from past successful cases of integrated rainwater management at field to catchment scale in the Limpopo basin, and synthesize this knowledge to identify similar domains and potential locations that may be subject to further successful development interventions. Three

key research issues guide the project L1 “Targeting and scaling out” addressing the ‘what?’, the ‘which?’ and the ‘where’? The proposed research approach for L1 broadly follows the CPWF Volta V1 ‘Targeting and scaling out’ approach in research.

The research is undertaken as a collaborative effort between several southern research organizations and a limited number of northern ones. The proposal seeks to maximize the advantages of both with northern partners focusing on providing the integrated rainwater management, Bayesian Belief Networks (BBN), PGIS expertise, the latter two of which are absent in the other research partner organizations, and the local partners providing detailed integrated rainwater management expertise, policy analysis and engagement experience and socio-cultural participatory research expertise. The project will seek to build capacity amongst the local partners in BBNs and PGIS over the course of the work, and of course build up the knowledge base of the northern partners of the basin. The project will also seek through V5 to ensure south-south learning between the partners involved in L1 and V1.

1) What constitutes key social-economic and ecological conditions where ‘successful’ smallholder agricultural water management interventions (with particular focus on rain water management interventions for crop, livestock and domestic purposes?

To identify and learn from past and current cases of successful rainwater harvesting and small reservoir management interventions, the project starts with the identification of past successful interventions. The in-country project partners represent the key to this and will lead this component of the work. There are two key issues for the project to determine through stakeholder consultations and data analysis. The first is to determine which constitutes a “successful” initiative or case study. For example, the project must assess the relative importance of factors such as adoption rate, yield improvement, income, and environmental impacts, including water resource use and water efficiency. Second, based on these discussions and the subsequent identification of successful rainwater harvesting and small reservoir management interventions, the project will analyze, through consultation and data analysis, the characteristics considered most important in providing an indication of the likely success (or failure) of an intervention case. The project will develop a case study assessment protocol based on the five livelihood capitals (DFID1999). This approach has been used previously (Kemp-Benedict et al, 2009; Barron et al 2010) to assess multiple dimensions of impacts by agricultural water management interventions in smallholder farming systems.

2) Which past and existing successful and failed interventions can we learn from?
Once the protocol has been determined, four different sources of case information will be used. *Interpreting existing data (act 2.3, 2.4)*: examples of cases will be sought in CPWF Phase 1, including The Challenge of Integrated Water Resource Management for Improved Rural Livelihoods: Managing Risk, Mitigating Drought and Improving Water Productivity in the Water Scarce Limpopo Basin (PN17), Models for implementing multiple-use water supply systems for enhanced land and water productivity, rural livelihoods and gender equity (PN 28), and possibly Wetlands-based livelihoods in the Limpopo basin: balancing social welfare and environmental security (PN30) and Food and Water Security under Global Change: Developing Adaptive Capacity with a Focus on Rural Africa (PN53), together with other recent relevant projects in the Limpopo basin. For data layers, the project will start with existing information from CPWF Phase 1 (e.g., BFP Limpopo) and other basin scale public source relevant information. *Collecting new data (act 2.8,2.9,2.10,2.11)*: consultations meetings at national level will be held in South Africa and Zimbabwe to identify additional successful cases, which will be assessed using the

developed protocol in combination with participatory GIS methodologies in field assessment (Wang et al., 2008; Cinderby, 2010)(act. 2.7). *Incorporating other CPWF project data(act.3.3, 1.5)*: case information developed in CPWF Limpopo Phase II projects will be incorporated when data become available by projects L2, L3 and L4 in years 2 and 3. Special attention will be given in reflecting case information and basin–scale information on social and human capital as it is well shown that these factors have strong correlation with successful outcomes of AWM interventions (e.g. Noble et al., 2006; Joshi et al. 2008; Barron et al. 2010).

All collected data will be entered in a database using recommended data format relevant to L5. The database will be available in public domain via web page and through distribution of CDs (act 1.4,).

3) *Where in the Limpopo basin can similar agro-ecological and social-economic conditions be found, which may present development opportunities in terms of increasing productivity of smallholder farming systems, livelihoods and reduce risks through integrated rainwater management?*

The work will seek to build a GIS-linked Bayesian calculation tool utilising the data identified and gathered to determine where in the Limpopo basin can similar agro-ecological and social-economic conditions be found, which may present development opportunities in terms of increasing productivity of smallholder farming systems, livelihoods and reduce risks through integrated rainwater management. The Bayesian targeting and scaling tool will provide two estimates of the probability that an intervention might be successful: first, the probability of success at a particular location based on evidence of successful and unsuccessful interventions elsewhere and evidence about the proposed site; second, a probability map of where within the basin an intervention is likely to be successful, provided the necessary spatial datasets are available. The targeting and scaling tool will apply a Bayesian network model over a large spatial domain using GIS analysis. The use of Bayesian methods will enable outputs to be given confidence bounds (high, medium and low), indicating the degree of uncertainty whether an intervention will be successful. The tool will be designed for use by a non-expert audience. It will be available in the public domain and distributed over the web.

Bayesian statistical reasoning provides a coherent and effective way to combine diverse information under conditions of uncertainty. Conceptually, a Bayesian analysis starts by asking, "If you had only minimal information about a potential adopting community, what odds would you give for the success of a particular AWM intervention?" Then layers of information are added – about slope, precipitation, economic status, dominant livelihood strategies, ground cover, expert assessment of community capacity, institutional effectiveness, etc. – and the evaluation of the odds is updated. The "training" of a Bayesian belief network follows a similar logic: a preliminary set of relationships is specified and then, using available data collected from pilot sites and case studies, the model parameters (which are probabilities) are updated to reflect the observed information. In this way the proposed tool uses both a knowledge-based and evidence-based approach to targeting interventions. The Bayesian approach is unique in its capacity both to make use of diverse data sources and to capture and coherently accommodate uncertainty. The work will build on the "extrapolation domains" method that was developed in part through CPWF Phase I funding (Otero et al., 2006) and insights gained in applying Bayesian methods within the Mekong Basin Focal Project (Kirby et al., 2009; Kemp-Benedict et al., 2009). It will also draw on experience from the efforts by other researchers of applying Bayesian methods to problems of natural resources management (Cain, 2001).

The targeting and scaling tool will also be informed by the results of two national policy analysis reviews undertaken by the local partners. These reviews will seek to inform the project team on what are current development priorities in the agriculture and water, environment. The first will explore the current targets, policies and expectations on water management in agriculture, poverty alleviation in rural development and identified priority areas in Burkina Faso and in Ghana (OP4). In view of these reviews, a number of applications based on the identified successful cases will be assessed in the spatial domain with the tool to guide policymakers, potential investors, and other decision makers, in rainwater management and small reservoirs in the Volta basin.

For a limited set of interventions that will be explored in the decision support tool, a separate potential impact analysis at basin in scale water allocations will be explored using the SWAT modelling tool (act, 4.1-4.3). An attempt to ex-ante assessment on potential benefits attained for using an improved decision support system will be developed addressing issues relating to gains in positive resilience trajectories (act 3.4).

Generic approaches in L1 project

Human capacity development (activity 5.1-5.4)): The L1 'Targeting and scaling out' will have components of human capacity development throughout the project timeline. This will include the involvement of three MSc. Fellowships, and contributions to MSc. field activities of various WaterNet members in the Limpopo basin. In addition, key related research will be undertaken by the L1 project post-doc based at University of Witwatersrand, which focuses on hydrological basin scale impacts. The topics will be coordinated with the project lead researchers. Additional human capacity development will be for 1) researchers in the project to apply Participatory GIS (PGIS) methodologies for data collection ,testing the DSS extrapolation tool with potential end-users and training them as identified in the Outcome Pathway analysis, and refined at project inception.

Communications and outreach: A plan of communication of activities and outreach opportunities from the project will be developed in the project partnership during the inception meeting. This plan will be closely coordinated with L5 outreach and dissemination activities to ensure complementary activities. L1 will rely on L5 to enable and facilitate principal dialogues in dissemination with particularly targeted national and international /regional policy actors, investors (donors and private) and beneficiaries.

Project management, including M&E (activity 6.1-6.6): Project coordination and administration will be the responsibility of SEI. Partners will provide a key person responsible on behalf of their respective institutions. These people along with representatives from the boundary partners will form the project steering committee group, where discussions and decisions on project management, developments and alterations will be reached. The strong emphasis on process learning will be reflected in the L1 project participation in various cross-basin project meetings. Due to the limited travel budget, special attention will be paid to ensure that partners and individuals are adequately represented at project meetings.

Project M&E will, in addition to CPWF guidelines, follow the planning, monitoring and evaluation (PME) framework of SEI based generally on an outcome mapping approach. This seeks to ensure that during the inception phase of the project there is detailed consideration of the intended outcomes of the project for the boundary partners of the project. The project will, in accordance with the approach, identify boundary partners and their outcome challenges,

identify progress markers relative to the proposed outcomes, develop a strategy map of broad strategies and activities for each outcome, develop outcome and activity monitoring plans, and develop an evaluation plan to ensure reflection and learning.

CPWF cross-basin and within basin learning (activity 6.2,6.5): The L1 activities will be planned in close collaboration with related activities, especially those under L5, and with other basin project meetings. This will ensure that, whenever feasible, parallel meetings will be held, giving formal and informal opportunities for interaction, sharing and learning. The L1 team will actively seek to provide information to the CPWF for it to disseminate through its website. Moreover, SEI will combine, where possible, work on L1 with Volta Project V1, which is also a "targeting and scaling out" project, and which SEI is also coordinating. For example, the development time for the generic Bayesian network-based out-scaling tool is split between L1 and V1, a necessity given budget limitations and modelling development costs. Under the process a generic model will be produced which will be populated with basin specific data. In this way the costs is shared across two projects.

The dual coordination will enable cross-learning and alignment of research efforts between the two projects.

Stockholm Resilience Centre/ CPWF cross basin resource person on resilience issues: We would like to seek input from the CPWF cross-basin resource person Dr Line Gordon at an early project stage on how the tool, and associated data can be interpreted from a resilience perspective, in particular in the context of using the thinking of traps and transformations of rural smallholder livelihoods and development options (e.g. Enfors, 2009). These concepts may be useful in viewing opportunities in risk reduction and development trajectories (Activity 3.4). Dr Gordon already supervises potentially relevant work in South Africa together with University of KwaZulu Natal.

Describe here what is the problem this project is aiming to address. CPWF has suggested sample questions for each BDC project (available from https://sites.google.com/site/cpwfbdceoi). Describe how your research will address these research questions and/or additional research questions you consider important. Give a brief description of the research methodologies you will use.

The Limpopo basin development research of CPWF aims to contribute towards out-scaling and uptake of integrated rainwater management to increase smallholder farmers livelihoods, productivity and reduce exposure to risks. Part of this research can be addressed through learning from past successful cases of integrated rainwater management at field to catchment scale in the Limpopo basin, and synthesize this knowledge to identify similar domains and potential locations that may be subject to further successful development interventions. Three key research issues guide the project L1 "Targeting and scaling out" addressing the 'what?', the 'which?' and the 'where'? The proposed research approach follows the CPWF Volta V1 'Targeting and scaling out' approach in research.

1) What constitutes key social-economic and ecological conditions where 'successful' smallholder agricultural water management interventions (with particular focus on rain water management interventions for crop, livestock and domestic purposes?

To identify and learn from past and current cases of successful and failed interventions in rainwater management in smallholder farming systems, the project starts with development of a

case study assessment protocol using the five livelihood capitals (DfiD1999) (activity 2.1). This approach has been used previously (Kemp-Benedict et al, 2009; Barron et al 2010 etc.) to assess multiple dimensions of impacts by agricultural water management interventions in smallholder farming systems. Two key issues for the project will be determined through stakeholder consultations: the constituents of the case assessment protocol, and the assessment of what is a 'successful case' in terms of for example adoption rate, yield improvement, risk reduction, income, and/or environmental impacts, including water resource use. The case assessment protocol will be developed to enable generic features of what conditions can constitute a successful interventions, and how these generic features can be extracted from multiple cases.

2) Which past and existing successful and failed interventions can we learn from?

Once the protocol has been determined, three different sources of case information will be used. *Interpreting existing data (act 2.3, 2.4)*: examples of cases will be sought in CPWF Phase 1, including PN17, PN 28 and possibly PN30 and PN53, together with other recent relevant projects in the Limpopo basin. For data layers, the project will start with existing information from CPWF Phase 1 (e.g., BFP Limpopo) and other basin scale public source relevant information. *Collecting new data (act 2.8,2.9,2.10,2.11)*: a consultation meeting at national level will be held in South Africa and Zimbabwe to identify additional successful cases, which will be assessed using the developed protocol in combination with participatory GIS methodologies in field assessment (Wang et al., 2008; Cinderby, 2010)(act. 2.7). *Incorporating other CPWF project data(act.3.3, 1.5)*: case information developed in CPWF Limpopo Phase II projects will be incorporated when data become available by projects L2, L3 and L4 in years 2 and 3. Special attention will be given in reflecting case information and basin–scale information on social and human capital as it is well shown that these factors have strong correlation with successful outcomes of AWM interventions (e.g. Noble et al., 2006; Joshi et al. 2008; Barron et al. 2010).

All collected data will be entered in a database using recommended data format relevant to L5. The data base will be available in public domain via web page and through distribution of CDs (act 1.4,).

3) *Where in the Limpopo basin can similar agro-ecological and social-economic conditions be found, which may present development opportunities in terms of increasing productivity of smallholder farming systems, livelihoods and reduce risks through integrated rain water management?*

In parallel with the data collection, the model construction for the decision support tool will be developed (act.1.1-1.4)). The tool aims to provide guidance on where similar social, economic, and agro-ecological conditions prevail, assuming these factors strongly influence the rate of adoption and adaptation of the identified successful rainwater management interventions. The decision support tool will be available in public domain and distributed electronically. It will apply a Bayesian network model over a large spatial domain using GIS analysis. This work builds on the "extrapolation domains" method that was developed in part through CPWF Phase 1 funding (Otero et al., 2006). The Bayesian network model will provide estimates of the probability that an AWM intervention will succeed in two different ways. It will provide a probability of success at a particular location based on evidence of successful interventions elsewhere and evidence about the proposed site. It will also, given the factors of success of a given intervention, analyze where else within the basin the same intervention is likely to be successful (provided the necessary spatial datasets are available and/or created). The use of the Bayesian network will enable the output to be given confidence bounds (high, medium and low), indicating the degree of uncertainty whether an intervention will be successful. There will be two current policy analysis reviews carried out to guide the application of the decision support tool, in terms of what are the

current targets, policies and expectations on water management in agriculture, poverty alleviation in rural development and possibly spatial explicit priority areas in Limpopo basin (act.3.1,3.2)). These will be linked with the decisions support tool, and accessible for end-user. In view of these reviews, a number of applications based on the identified successful cases will be assessed in the spatial domain with the tool to guide decision–makers, policy and potential investors the Limpopo basin (3.5). For a limited set of interventions that will be explored in the decision support tool, a separate potential impact analysis at basin in scale water allocations will be explored using the SWAT modelling tool (act, 4.1-4.3). An attempt to ex-ante assessment on potential benefits attained for using an improved decision support system will be developed addressing issues relating to gains in positive resilience trajectories (act 3.4)

Generic approaches in L1 project

Human capacity development (activity 5.1-5.4)): The L1 'Targeting and scaling out' will have components of human capacity development throughout the project timeline. We propose involvement of 3 MSc. Fellowships, and contributions to MSc field activities funding at various WaterNet members in the Limpopo basin. In addition, a key research will be the L1 project post-doc based at University of Witwatersrand, to focus on hydrological basin scale impacts. The topics will be coordinated with the project lead researchers. Additional human capacity development will be for 1) researchers in the project to apply Participatory GIS (PGIS)methodologies for data collection ,testing the DSS extrapolation tool with potential end-users and training them as identified in the Outcome Pathway analysis, and refined at project inception.

Communications and outreach: A plan of communication of activities and outreach opportunities from the project will be developed in the project partnership during the inception meeting. This plan will be closely coordinated with L5 outreach and dissemination activities to ensure complementary activities. L1 will rely on L5 to enable and facilitate principal dialogues in dissemination with particularly targeted national and international /regional policy actors, investors (donors and private) and beneficiaries.

Project management, incl. M&E (activity 6.1-6.6): The ultimate project management will be with SEI. Each partner will provide a key person responsible that will form the core project lead group where decisions and discussions of project management, developments and alterations will be held. The strong emphasis on process learning will be reflected in the L1 project participation in various cross basin project meetings and possibly cross-basin meeting. Due to the limited travel budget, special attention will be paid to ensure that various partners and individuals are represented at various meetings. The project M&E, including reflection elements, will provide the L1 partnership with valuable insights on how to ensure relevant research for development in an effective and adaptive way. It will also be aligned with SEIs' internal M&E framework, which is currently being developed.

CPWF cross basin and within basin learning (activity 6.2,6.5): Due to the limited travel budget, special attention will be paid to ensure that various L1 partners and individuals are represented at various meetings. The L1 activities will also be planned in close collaboration with L5 activities and with other basin project meetings, so that whenever feasible, parallel meetings can be held, giving formal and informal opportunities to interaction, sharing and learning. SEI will twin the work of L1 with Volta project V1, on "targeting and out-scaling", which SEI is also coordinating. The dual coordination will enable cross-learning and alignment of research efforts between the two projects.

Stockholm Resilience Centre/ CPWF cross basin resource person on resilience issues: We would like to seek input from the CPWF cross-basin resource person Dr Line Gordon at an early project stage on how the tool, and associated data can be interpreted from a resilience perspective, in

particular in the context of using the thinking of traps and transformations of rural smallholder livelihoods and development options (e.g. Enfors, 2009). These concepts may be useful in viewing opportunities in risk reduction and development trajectories (Activity 3.4). Dr Gordon already supervises potentially relevant work in South Africa together with University of KwaZulu Natal.

5. Links to previous and ongoing work

There are already various spatial analysis/DSS tools available for identifying potential areas for agricultural water management interventions for sub-Sahara Africa conditions. Some are more locally focused, whereas others are national to sub continental (e.g. Mati et al 2006; Mbilinyi et al, 2007; Andersson et al, 2009 for more references). However, these tools are focused on biophysical aspects (agro ecological zone, climate, slope, soil, surface water distance etc) and, possibly incorporating some dimensions of human (labour availability, population density), financial (poverty/income proxies) and physical capitals (typically market access). To date, the incorporation of dimensions of social a/o human capital are not common, and factors such as institutional capacity largely absent. At the meso-scale, two PN 17 decision support tools have been developed for South African conditions. One developed by Kahinda et al (2009) is primarily aimed at assisting in the assessment of potential hydrological impacts downstream of rainwater harvesting technologies in the landscape. The other, by Magombeyi (forthcoming), which incorporates a complex dynamic hydrological model with an agronomic and a socio-economic model, seeks to improve rainwater management in the Olifants catchment of Limpopo basin. These two products will contribute to the developments of L1 research and data.

Bayesian network models have been used for natural resource management in several different contexts (Bacon *et al*., 2002; Borsuk *et al*., 2004; Cain, 2001; Henriksen et al., 2007; MERIT, 2005; Newton *et al*., 2006; Sadoddin, 2005). The CPWF Phase I had its own examples (Otero *et al*., 2006 and Kemp-Benedict *et al*., 2007). Furthermore, the research team extensively explored the use of Bayesian networks for analyzing water and livelihoods in Phase I of CPWF (Kemp-Benedict et al., 2009). The project will benefit from the experience from these different sources. The methodology proposed for the project seeks to build on the experiences, knowledge and data of much of this work as well as that of AWM initiatives generally, particularly that of the CPWF progress as far as possible. However, the expansion of the model to include social, human and also institutional variables is innovative; furthermore, the need to include variables identified by specific successful intervention cases require a new model to be created. Experience of developing such Bayesian models currently resides with SEI but the capacity building elements of the programme will seek to begin to develop capacity to interrogate and construct such models over the course of the project.

CPWF Phase I projects are also envisaged to inform, and provide, the multidisciplinary data for successful rainwater management and small reservoirs intervention cases that are the focus of the CPWF Phase II L1. Various cases of promising interventions documented and assessed, in particular in PN17, various rainwater management interventions were studied at field to landscape scale. Additional cases may be related to PN 28, which had strong focus on multiple use systems at household and community level, and PN 30, which focused on developments of wetlands from sustainable perspectives.

CPWF Limpopo BFP: The CPWF Phase 1 Basin Focal Project (BFP) is in process of developing a basin-scale database with public domain interface. We expect this database to provide a starting point for the decision support tool.

Stockholm Resilience Centre/ CPWF cross-basin resource person on resilience issues. The project will also seek input from the CPWF cross-basin resource person Dr Line Gordon at an early project stage on how the tool, and associated data can be interpreted from a resilience perspective, in particular in the context of using the thinking of traps and transformations of rural smallholder livelihoods and development options (e.g. Enfors , 2009). These concepts may be useful in viewing opportunities in risk reduction and development trajectories. Dr Gordon already supervises potentially relevant work in South Africa together with University of KwaZulu Natal.

6. Links to other BDC projects

Research outputs	**Dependencies on other BDC projects to produce it**	**Use of research output by other BDC projects**	**Risks and assumptions**
Pilot research site characterization	Input of site coordinates and possibly site characterization by L2, L3, L4	Knowledge on representativeness of selected pilot research sites	Assumptions
Characterization of selected rainwater management intervention systems being studied to feed into database	Assessment using L1 protocol in systems researched by L2, L3, L4	Protocol developed and consulted with L2, L3, L4	Risk: Protocol requirements being too demanding for L2, L3, L4data collection; cases studied in L2, L3, L4not suitable for L1 criteria
Creating spatial information layers on social a/o human capital	Consultation /information from L4 Possibly L5 : “innovation history”		Risk: identifying existing data, proxies at relevant resolution
Reaching target beneficiaries /end-users at basin and national level	L5 to assist with national and international dialogue activities and contacts	Delivery of L1 database of cases and DSS tool tested and available for use	Assumptions: that some key outputs and meetings are facilitated by L5
Access and permission to use different data layers without additional costs	L5 for negotiating data access and use for all project partners		Assumptions: L5 will take on organizing project knowledge management agreement between partners
Hosting of end product (tool and database)	L5 for assisting in identifying a host and providing framework for data management		Assumption: FANRPAN will be interested and willing to host V1 end-products
Potential impact analysis on basin scale hydrology	Delivery of DSS and database on cases in time for comprehensive assessment		Assumption : relevant data available at no cost

7. Suggested sites

The sites of L1 will depend on the consultation on the identification of success stories from Phase I and the activities of partners and others in the Limpopo Basin. The identification will be achieved through the development of a protocol and subsequent consultation meetings with national/sub national experts in agricultural development at project start. Sites selected by other CPWF Volta projects will be assessed, once they have been identified, for representativeness of basin conditions. Specific agricultural water management interventions studied a/o promoted by L2, L3 and L4 may be assessed similarly to other cases in L1, and added to the database, if appropriate. The project aims to have good and equitable representation among all the four basin countries within the framework of budgets and time constraints given. We also intend to ensure that case(s) with livestock dimensions are included in the analysis.
A review of the CP Phase I may guide identification of sites relevant for characterization of possible 'success cases'.

8. Project Outcome Pathways

(See L1 Project Workbook)

9. Activities and Implementation Plan

(See L1 Project Workbook, Gantt chart worksheet).

10. Communications

Types of output material expected to be generated

The L1 outputs are expected to cover various types of media and formats. A key output is the tool itself with a user-interface to enable user-friendly application of the model and the incorporated database of successful interventions as described above. The tool, interface and case database will be available in public domain on web sites of CPWF and partners in L1. It will also be distributed as CDs at various events and for mailing. We expect the tool and its application to be presented in submitted scientific papers a/o presentation for academic audience.

Similarly, the database of success cases and associated lessons learned will be submitted for peer-review publication purposes. Research on potential hydrological impacts will be presented in research papers and in policy briefs, manuals, users guides and instructions on methodologies will be documented in project reports and made available in public domain. There will be two policy analysis of relevant policy context for South Africa and for Zimbabwe, produced at an early stage of the L1 project. All training material will be made available in modules for off-the –shelf use in public domain.
Through project human development efforts and training events, we expect to raise awareness and use of L1 outputs to targeted potential.

The project is designed to ensure engagement and communication with the boundary partners of the project from the outset. The involvement of the boundary partners on the project steering committee provides a regular and active communications means to ensure the project remains relevant to the needs of the proposed users. Similarly, the proposed capacity building exercises with boundary partners provide a means to communicate information on the project.

The project will also expect the tool and its application to be presented in submitted scientific papers and presented at relevant events over the last 12 months of the project. These would include submission to relevant components of the Stockholm World Water Week and Africa Water Week. This element of the work will be informed by the activities of L5, which will establish an events calendar for the projects. Similarly, the database of success cases and associated lessons learned will be submitted for peer-review publication purposes.

Communications of outputs:
A communication plan will be developed in the partnership at the inception workshop. This plan aims to contain key events, and activities relevant for awareness raising and dissemination of project outputs to various potential stakeholder, end users and beneficiaries. The L1 will also engage closely with L5. As L1 partner WaterNet is partner also in L5, we will ensure coordination of these activities also with other Limpopo basin projects. In addition, it is expected that L5 will facilitate key relevant contacts and network for outreach and dissemination activities, in particularly national and regional/international policy makers, donors and investors that potentially may be end-users of the L1 outputs.

Through human development investments in L1 such as targeted training events in part funded by investments made by WaterNet, the project will raise awareness and use of L1 outputs to targeted potential end-users and clients.

Through distribution of tools and data through web pages, electronic copies and as handouts at various venues, we expect to distribute the developed decisions support tool to various potential end-users targeted in L1.

PART C: CONSORTIUM DETAILS, INDICATIVE BUDGET AND REFERENCES

11. Consortium Details

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The **Stockholm Environment Institute** (SEI) goal is to bring about change for sustainable development by bridging science and policy through integrated analyses that supports decision makers. SEI develops and synthesis new knowledge by scientific evidence-based approaches, including pilot research project in strategic areas of development and environmental sustainability. In the area of water management for agriculture, specific focus is on how to attain development targets, including poverty and hunger goals, through wise and productive use of water, land and ecosystems services. The integrated analyses are carried out in various applied pilot research and policy –relevant partnerships from global to local scale. SEI commonly coordinates, facilitates and participates on various global and local research for development projects, and has the capacity to carry these multiple partnership collaborations in various countries and contexts.

SEI was involved in several aspects of the CPWF Phase I, in the Mekong, Volta, in the SSI project w and by developing the CN 17 project of Limpopo. In addition SEI is currently involved in several projects of research relating to agriculture, development, water management and climate adaptation in various SADC countries.

In the CPWF Phase II, SEI undertakes activities in the L1 (and V1) by invitation, as a partner in CPWF Nile basin N4 and in the CPWF Andes, specifically addressing water resource management and allocation issues. The SEI Africa office in Dar es Salaam, Tanzania will play a key coordinating role for the L1 project coordination and implementation with L1 partners.

WaterNet: is a SADC-affiliated wide network of research and implementation water management organizations in Limpopo basin and elsewhere in southern African. It is hosted by University of Zimbabwe but work throughout the region with various academic and policy relevant organizations and institutes in issues of IWRM. In L1 WaterNet will assist in incorporating and hosting human capacity elements among its relevant Limpopo partners, contribute to communications /outreach at relevant venues in region and also take up project findings for incorporation into regional postgraduate education and professional training programmes. Through its network the L1 will be able to engage with various WaterNet partners in the L1 activities, in particularly regarding identification and assessment of successful AWM cases in various locations of the basin. WaterNet will link the project to ongoing and proposed research projects on IWRM, natural resources management and early warning systems in the Limpopo and other southern African Basins. WaterNet has offered to leverage USD 104 000 in support for the L1 activities.

University of Witwatersrand, School of Civil and Environmental Engineering: The University of Wits /School of Civil and Env. Eng. hosts a wealth of experience of hydrologic, crop and socio-economic modelling, and on-field farmer research carried out in CPWF phase I in B72A quaternary catchment of the Olifants catchment of the Limpopo basin, and as well as the wealth of experience gathered from collaboration with other partners under the umbrella of WaterNet. In the L1 University of Wits will bring its modelling, DSS experiences of previous work and GIS capacity to the partnership. With strong academic research anchoring in the Limpopo CPWF Phase I, especially PN17, the L1 will build on these experiences in the partnership. Wits University will play a key role in the assessment of potential impacts on basin water resources due to possible successful out-scaling of specific interventions.

Council for Scientific & Industrial Research (CSIR) is the national research body of South Africa. Its mandate is to carry out applied and frontline research fro development and support of SA public and private good. It operates in various local, national and international partnerships. The role of CSIR in the L1 project is to provide expertise on social and institutional dimension on agricultural development context, incl. policy analysis. The partnership with CSIR will also provide good linkages for outreach and communication, especially in South Africa.

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