Catchment Management and Poverty Alleviation (CAMP)

Final Technical Report

May 2004

UK Department for International Development/ Forestry Research Programme

ZF0150/R7937

Lead Institute:

Centre for Land Use and Water Resources Research (CLUWRR), University of Newcastle-upon-Tyne, UK

Collaborators:

Centre for Ecology and Hydrology (CEH), Wallingford, UK

CSIR-Environmentek, Republic of South Africa (RSA)

School of Bio-resources Engineering and Environmental Hydrology (BEEH), University of Kwa-Zulu Natal, RSA

Department of Anthropology, University of Durham, UK

Sokoine University of Agriculture, Tanzania

Ministry Agriculture, Grenada

Table of Contents

Final Technical Report

Appendices

Author and Principal Investigator: Professor Ian R. Calder

Project title: Catchment Management and Poverty Alleviation (CAMP)
– the role of economic instruments and compensation mechanisms in water resource and forest management.

Project number: R7937/ZF0150

Photo: Rob Hope

Copies of this report and supporting documentation are available from:

Centre for Land Use and Water Resources Research (CLUWRR),
University of Newcastle-upon-Tyne, Bedson Building,
Newcastle, NE1 7RU, UK.
Tel/fax: 00-44-(0)191-222-6563
Website: http://www.cluwrr.ncl.ac.uk/projects/camp/index.html
Email: cluwrr@ncl.ac.uk

1. Executive Summary

In water-stressed environments, the livelihoods of poor people are directly affected by their access to land and water resources. Land and water policies often do not adequately evaluate their impacts on these resources, upon which livelihoods are dependent. Particular concern exists over the inadequate consideration given to the impact of forestry operations, and in some cases the escape of alien species, on water resources.

The CAMP project compares and contrasts Integrated Water Resource Management (IWRM) and Sustainable Livelihoods (SL) approaches to land and water management within the Luvuvhu catchment, Republic of South Africa (RSA) (Figure 1). It investigates IWRM and SL issues as a means towards identifying policy instruments, which both improve the livelihoods of poor people, and protect the resource base The project employs macro-scale hydrological modelling combined with household-level SL assessment to examine the effects of alternative policy instruments relating to forestry and water allocation. The replicability of the methodologies is assessed in Grenada and Tanzania to provide additional insight into transferability of project outputs and methods.

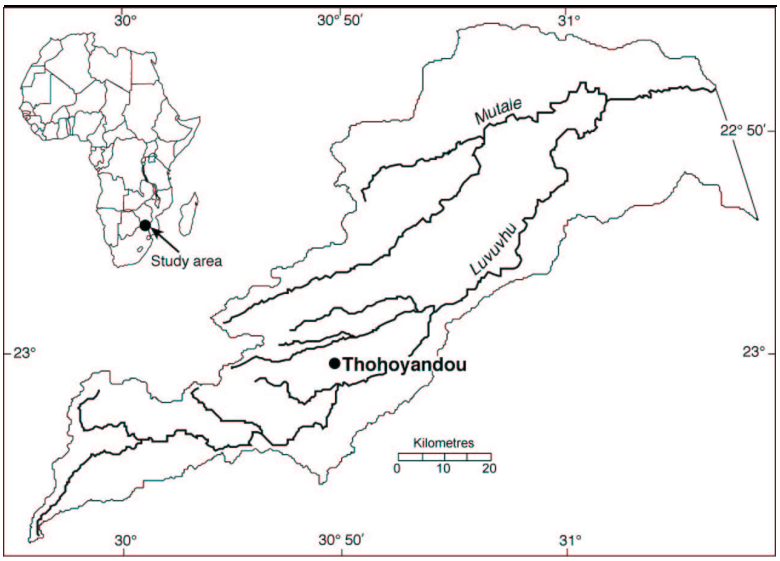

Figure 1 Luvuvhu catchment, Limpopo Province, South Africa

Research activities in the Luvuvhu catchment included agro-hydrological modelling with land use change simulations, economic evaluation of commercial land uses, and an integrated sequence of SL assessments utilising quantitative and qualitative approaches. The Grenada and Tanzanian studies followed a more parsimonious approach focussing primarily on SL studies to evaluate the impacts of land and water policies on livelihoods.

Policy relevant outputs of the CAMP project include:

- Development of a 'green water' policy instrument to contribute to the implementation of the Streamflow Reduction Activities (SFRA) policy;
- Greater understanding of livelihood responses and opportunities in relation to improved water supplies above the Human Needs Reserve and 'Schedule 1 uses';
- A socio-economic evaluation of the Working for Water programme that is contributing to a comprehensive internal review process;
- Grenadian development of an innovative land care mechanism for poor upper catchment farmers funded by reduced downstream water treatment costs;

- Grenadian government approval of an environmental fund linking downstream users (tourism, industry) of improved flow regimes (quality, quantity) to upstream management of the resource base;

- Tanzanian national water policy review and design is being influenced and informed by the insights developed within the CAMP project and with South African policy partners.

The CAMP project has contributed to the UK Department for International Development's (DFID) developmental goals on the elimination of poverty and encouragement of economic growth, which benefits the poor, in the following ways:

- Contributing to improved water policy in South Africa, and other water-stressed developing countries, that will allow water resource allocation decisions to meet social justice, economic efficiency and ecological integrity criteria;

- Evidenced-based understanding of the relationship between water and rural poverty in water-stressed areas that can inform appropriate developmental interventions;

- Developing methodologies for an Integrated Land and Water Resources Management' (ILWRM) approach for poverty reduction;

- Implementing innovative mechanisms in Grenada that reward the upper catchment poor for improved management of environmental services consumed by lower catchment communities and industry.

2. Background

National governments and national and international development agencies worldwide are striving towards improved methodologies for catchment management. These methodologies assist with the elimination of poverty, whilst meeting the objectives of IWRM which is directed to achieving sustainable use of water resources for ecological and economic systems at the catchment scale.

The pressing need is to develop policy instruments which will assist in carrying out these tasks, meeting the IWRM ideals and, in some form, combine the two methodological approaches outlined above to work towards sustainable development. It is essential that policy instruments are developed through, and supported by, a rigorous science base. The methodological approach must also take account of the trade-offs in livelihood strategies of the rural poor and economic productivity which result from the hydrological impacts of changes in forest-related land use.

No research specifically addressing how IWRM and SL methodologies could be combined for catchment management and poverty reduction had been carried out in RSA prior to the implementation of the CAMP project. However, related and concurrent research, directed to assisting with the implementation of the South African National Water Act (NWA), was carried out with DFID-SA funding under the Strategic Environmental Assessment (SEA) project in the Usutu-Mhlathuze catchment, Kwa-Zulu Natal.

The ambitious time-table for implementing the NWA, with the creation of Catchment Management Agencies (CMAs) in the 19 designated Water Management Areas over the next few years has created a wide constituency for the findings from both the CAMP and the SEA projects.

The original project memorandum (PMF) noted various Government of RSA policy documents that established a clear demand for integrating land use (particularly, commercial forestry), water resources and poverty elimination. Water policy provided the unifying context for these overlapping sectors, specifically with the context of the CMAs as implementing agencies. The capacity constraints that DWAF and other national government departments continue to face has identified, not only the need for methodologies for interpreting the impacts of land use

change on water resources, economic growth and poverty reduction, but also for making these methodologies available in a form which can be used by non-specialists.

3. Project Purpose

The purpose of the project is to improve the livelihoods of poor people by increasing access to water through improved methodologies for integrated catchment management. In water-stressed countries, access to and use of water resources is one of the major constraints to poverty elimination and economic growth.

4. Research Activities

This section is structured by country-specific research activities in South Africa, Tanzania and Grenada.

4.1 South Africa

4.1.1 Hydrology

Two hydrological modelling approaches were used in the CAMP project; the ACRU and HYLUC model. The ACRU model, was developed in South Africa, and at present has applications mostly limited to South Africa, and has been previously calibrated for South African conditions and for typical vegetation types. The HYLUC model, which was developed in the UK, has been applied in many countries of the world,

The ACRU Agrohydrological modelling system
The ACRU model is a multi-purpose and multi-level integrated physical conceptual model that can simulate streamflow, total evaporation, and land cover/management and abstraction impacts on water resources at a daily time step. The model revolves around multi-layer soil water budgeting: streamflow is generated as stormflow and baseflow dependent upon the magnitude of daily rainfall in relation to dynamic soil water budgeting. Components of the soil water budget are integrated with modules in the ACRU system to simulate other catchment components including irrigation requirements and sediment yield. Spatial variation of rainfall, soils and land cover is facilitated by operating the model in "distributed" mode, in which scenario the catchment to be modelled is sub-divided into sub-catchments. Within these sub-catchments, units of similar hydrological response based largely on land use zones, are designated to facilitate simulation of land use changes. Land cover and land use affect hydrological responses through canopy and litter interception, infiltration of rainfall into the soil and the rates of evaporation and transpiration of soil water from the soil. The principal applications of the model are in the assessment of environmental and land use related impacts for water resources planning. Many verification studies have been performed, both on internal state variables and final model output; in particular, forest water use and the impacts on streamflows have been verified at several locations in South Africa.

HYLUC
The HYLUC model has been developed from a knowledge of the underlying bio-physical processes which govern the evaporation from different land uses whilst bearing in mind the requirements of parsimony both in terms of data requirements (daily rainfall, daily potential evaporation and land cover data) and in terms of the parameters required to take account of the different evaporative responses of different vegetation types. The model is designed to be applicable both in a land use management context, in, for example, understanding the water resource impacts of afforestation or deforestation operations, where input data is usually very limited, and for research purposes. Parsimony of parameters has been achieved through application of the “Limits” concept. Central to the model is the recognition that although the original Penman approach to estimating evaporation from open water surfaces and short vegetation is generally very successful it cannot be applied, without modification, to taller vegetation where interception losses may form a significant component of the total evaporation. With this modification it has been shown that the model may be an effective tool for land use change assessment studies in different parts of the world.

Hydrological simulations of alien plant invasions

The simulation of various invasive alien plant (IAP) scenarios was performed using ACRU. The entire Luvuvhu basin was simulated after disaggregating the catchment into the various quaternary catchments (QCs). Only five quaternary catchments had existing infestations of woody invasive alien plants, so these QCs were again subdivided into 4 sub-catchments. These represented areas under 1) no infestation (i.e. existing National Land Cover vegetation), 2) sparse AIP infestation, 3) moderate AIP infestation, and 4) dense AIP infestation. The allocation of these sub-catchments to the various infestation states allowed their respective areas to be manipulated according to the results from a spread/density model. The only condition was that the overall quaternary catchment areas should remain the same. It was assumed that the densest infestations would be closest to the stream channels (riparian zones), consequently flow through the four subcatchments was routed in series from uninvaded (Current National Land Cover), through sparse and moderate infestations to the densely infested subcatchment.

4.1.2 Livelihoods

Livelihoods research was conducted in the Luvuvhu catchment between September 2001 and October 2003. Following the Sustainable Livelihoods (SL) framework, a SL assessment was made utilising a range of quantitative and qualitative methods (Figure 2).

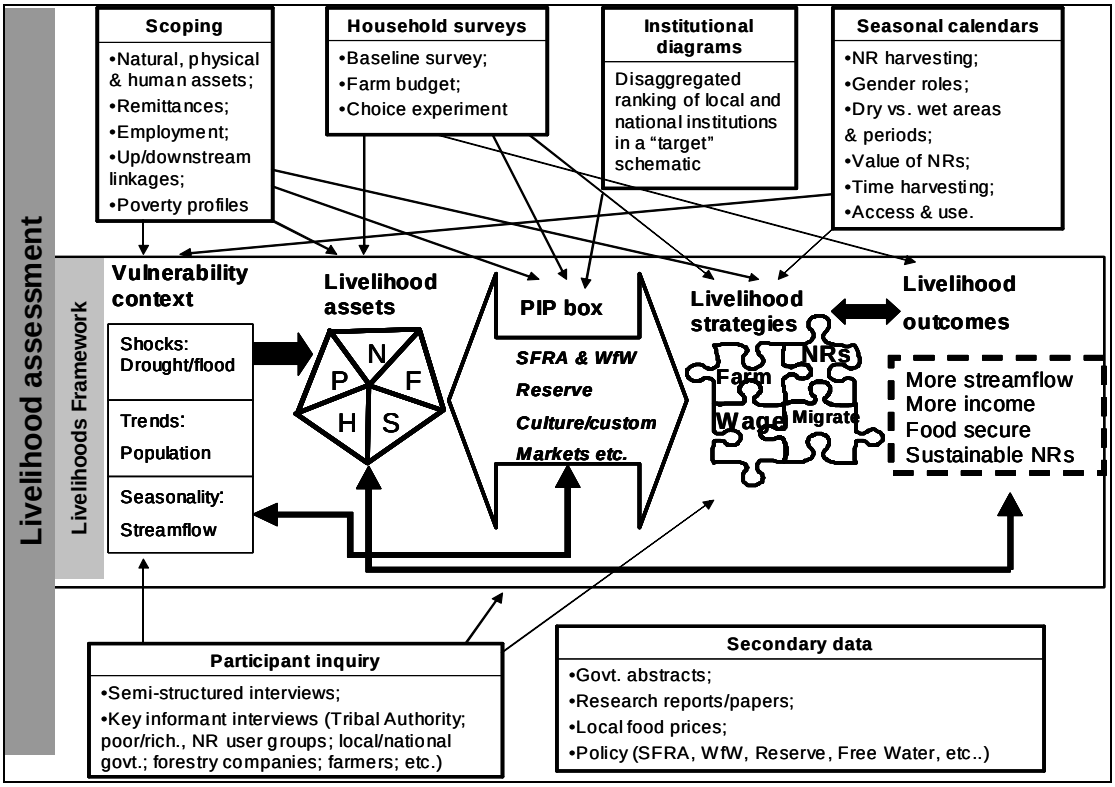

Figure 2 Livelihoods assessment schematic

SL research methods followed a sequential learning process with each study informing and building upon the former. The methods, sequence and time-frame are illustrated in Table 1.

A one day consultancy was provided by the Statistical Services Centre of the University of Reading (Dr. S. Abeyasekera) in July 2003 on the base-line survey sampling frame, replicability of findings, weighting of results and multi-variate data analysis techniques. Further research led to the application of a discrete choice experiment on domestic water trade-offs in October 2003 based on random utility theory and analysed by a multinomial logit (MNL) procedure in the NLOGIT software programme (Hope and Garrod, 2004).

4.1.3 Macro-economic analysis

Economic data has been sourced from reports and key informants in the agricultural sector in the Luvuvhu catchment, forestry consultancies, CSIR databases/records and government statistical abstracts. This data has been combined with water use estimates from the ACRU hydrological model to determine US$/$m^3$ water and man days/hectare. Economic data has been reported on commercial agriculture and commercial forestry sectors.

Table 1 RSA SL assessment sequential time-frame

Research method	Description	Date	Analytical approach	Output contribution
1.Meta-data review	Review of relevant projects, research and policy addressing livelihoods, poverty and Natural Resources.	April 2001 - Feb 2004	Desk-top research and key informant interviews with secondary stakeholders	Identify catchment communities and framework for social differentiation
2.Base-line household survey	Purposive, random household survey based on factorial design of community characteristics based on rainfall (>or<700mm), water service level and irrigation infrastructure.	Jan 2002	Catchment-level quantitative household survey eliciting basic demographic data and water-related livelihood characteristics in 8 communities (n=552)	Primary stakeholder assessment of water and livelihood links and constraints at the catchment scale.
3.PRA	Based on 2), PRA effort was focussed on the Khumbe irrigation scheme. Further PRA research was conducted in 3 other communities across the catchment gradient	Sept 2002 – Jan 2003	A range of PRA techniques were employed (seasonal calendars, time-lines, focus groups, interviews, farm walks etc.) across disaggregated livelihood groups.	Exploring further issues and questions revealed by 2) to understand institutional dynamics and policy impacts not fully captured.
4. Farm budget survey	In-depth farmer survey at the Khumbe irrigation scheme.	Oct 2003	Disaggregated farmer survey (upstream-downstream) collating seasonal data on farm strategies, inputs and livelihood outcomes.	Assessment of the role of streamflow resource benefits on livelihood strategies and outcomes over time and space.
5. Choice experiment	Choice experiment of 2 riparian communities without improved water supply in the drier eastern part of the catchment.	Oct 2003	Investigating household preferences to domestic water trade-offs to assess changes in water resources and water services for livelihoods.	Experimental exploration of livelihood decision-making in relation to future scenarios premised in water policy.

4.2 Tanzania

Research activities were conducted in the Mkoji sub-catchment in the Great Ruaha River basin. Specific activities included; livelihoods assessment in the Mkoji subcatchment; economic assessment of benefits of water in relation to the value of water use in agriculture and brick making; assessment of the transferability of CAMP RSA methodologies to Tanzanian land and water policy context.

4.3 Grenada

Stakeholder consultations were conducted with government ministries and NGOs involved in the land use and water resources sectors. Research activities were conducted in the Beausejour and Black Bay sub-catchments on the western coast. Specific activities included: livelihoods assessment; GIS mapping of the sub-catchments; current and future water use demands; improved land use practices with compensation mechanisms; development of new policy initiatives informed by the Grenadian research and the wider CAMP methodologies. Economic compensation instruments were a particular focus of this research and policy uptake.

5. Outputs

The CAMP output is directed towards the development of a methodology for improved, pro-poor, whole catchment management related to forestry activities developed by comparing and contrasting the application of IWRM and SL policy instruments in case study catchments. Three Objectively Verifiable Indicators (OVIs) were determined to achieve this output:

- An evaluation of alternative policy instruments for managing water demand of forestry related activities in RSA, according to SL and IWRM criteria;
- An evaluation of alternative policy instruments for managing water demand of forestry related activities in Grenada, according to SL and IWRM criteria;
- Recommendations for pro-poor and environmentally sustainable policy instruments and strategies, and an evaluation of these instruments and strategies by stakeholders in Tanzania;

The MOVs relating to CAMP outputs are listed in Table 2 and are included in the Appendix.

Table 2 Mapping CAMP products to the OVIs and MOVs

Objectively verifiable indicators	Means of verification	Appendix reference
An evaluation of alternative policy instruments for managing water demand of forestry related activities in RSA, according to SL and IWRM criteria.	Electronic conferences proceedings.	CAMP(2002)
	Paper describing new approach for estimating water resource impacts of forests/ alien invaders.	Calder and Dye (2001)
	Paper bringing to the attention of the UN and National Development community the development issues being addressed by this project.	Calder (2000) Calder (2001) Calder (2002) Calder (2003)
	Report describing to what extent the project process is influencing the development by DWAF/CSIR of upstream/downstream compensation mechanisms in RSA.	Fuller et al. (2003) Jewitt and Garratt (2004) Gush et al. (2004) Calder et al. (2004)
	Development of net rainfall evaluation methodology submitted by close of project.	Giacomello (2004)
	Development and application of SL assessment methodology in RSA.	Hope et al. (2003a) Hope et al. (2003b) Hope and Gowing (2003) Hope (2004) Hope and Garrod (submitted) Hope and Gowing (2004) Hope et al. (2004) Dixon (2004a) Dixon (2004b)
	Policy briefing notes for RSA, submitted by close of project.	CAMP Policy Brief RSA
An evaluation of alternative policy instruments for managing water demand of forestry related activities in Grenada, according to SL and IWRM criteria.	Policy briefing notes for Grenada submitted by close of project.	CAMP Policy Brief Grenada
Recommendations for pro-poor and environmentally sustainable policy instruments and strategies, and an evaluation of these instruments and strategies by stakeholders in Tanzania.	Policy briefing notes for Tanzania submitted by close of project.	CAMP Policy Brief Tanzania

As reported to DFID-FRP (quarterly report 02 for year 2003/4), CEH adopted a modified approach in developing the economic valuation of hydrological processes due to scale issues, data availability and the distorting influence of reticulated supplies both within the study catchments and more widely. The output is not a Net Rainfall Valuation model *per se*, but a more replicable methodology for the economic assessment of major land/water uses.

6. Contribution of Outputs

6.1 Contribution to DFID's developmental goals

The CAMP project has contributed to the UK Department for International Development's (DFID) developmental goals on the elimination of poverty and encouragement of economic growth, which benefits the poor, in the following ways:

- Contributing to improved water policy in South Africa, and other water-stressed developing countries, that will allow water resource allocation decisions to meet social justice, economic efficiency and ecological integrity criteria;

- Evidenced-based understanding of the relationship between water availability and rural poverty in water-stressed areas that can inform appropriate developmental interventions;

- Developing methodologies for an Integrated Land and Water Resources Management ' (ILWRM) approach for poverty reduction;

- Implementing innovative mechanisms in Grenada that reward the upper catchment poor for improved management of environmental services consumed by lower catchment communities and industry.

6.2 Identified promotion pathways to client institutions and beneficiaries

The key target beneficiary of the CAMP project in RSA has been DWAF. The promotion strategy for CAMP in RSA is embedded within the collaborating institutions' network pathways design and implementation, which directly and indirectly influence the policy process. A recommendation domain configuration provides a useful framework for understanding how CAMP has attempted to contribute to the dynamic and challenging phase of water policy development in RSA. The relevant government departments (Department for Land Affairs, National Department for Agriculture, Department for Environmental Affairs and Tourism) are important secondary stakeholders and have been addressed through existing networks of RSA CAMP collaborators and researchers. Figure 3 illustrates the way in which this process functions. The inner circle represents close discussion and debate with DWAF that shaped research activities to meet identified knowledge gaps or insufficient understandings. The second level involves contextualising CAMP research into other institutions current research activities, sharing information and experience, and advising on suitable research methods that may complement and/or build on these activities. The third level is a more passive process of disseminating findings and reports through local partners be that either electronically or in workshops/seminars.

The concept of '*policy shapers'* (ODI – RAPID project) post-dates CAMP by a few years but is nonetheless a key component that has identified country collaborators, who continue to develop or influence policy in their respective countries;

- In RSA, Mr. Jan Bosch, CSIR-Environmentek, continues to work closely on the development and implementation of Streamflow Reduction Activities policy within DWAF;
- In Grenada, Mr. Gordon Patterson, Dept. Forestry, is actively participating in the development of catchment management policy through collaboration with CAMP;

- In Tanzania, Dr. Nuhu Hatibu (SUA and CGIAR), is an active collaborator in the current national water policy review, which allows dissemination both of CAMP findings from Tanzania and experience gained from RSA water policy.

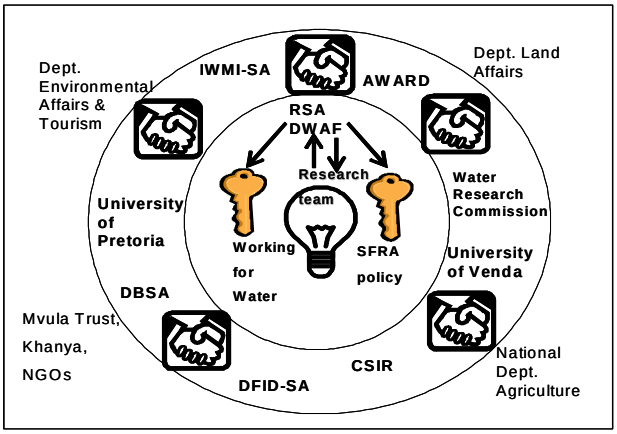

Figure 2 CAMP recommendation domains for RSA

6.3 Follow-up research to promote findings to achieve development benefit

In RSA, two key outputs have been identified that require follow-up research funding to achieve potential development benefits:

1. *Green water policy instruments*. It is now recognised that the recasting of SFRA type legislation within a "Green water framework", with the primary focus on how land use impacts on the primary process of evaporation loss from the land areas within a catchment rather than on the secondary consequences on water flow in a stream, will have a number of benefits. Testing and piloting this approach in South African catchments is required prior to full scale implementation in RSA and other countries.

2. *Water for rural development*. Significant, new developmental projects (section 6.4) are addressing associated pro-poor interventions in the water resource-social interface, which is core to DWAF's thinking and development of policy initiatives. There exists an opportunity to promote and develop the innovative methods used in CAMP for the evidence-based findings required by policy makers and the wider research community.

In Grenada, the development of innovative economic instruments that link the upstream poor with downstream commercial users of water (industry, tourism) has promoted new thinking on integrated catchment management in the Caribbean region. Opportunities to promote and disseminate these findings exist through collaboration with DFID-IIED's current 'Markets for Watershed Services' that is being undertaken in the Caribbean along with India, Indonesia and South Africa.

In Tanzania, the current national water policy review and design is being influenced and informed by the insights developed within the CAMP project. Streamflow Reduction Activity (SFRA) policy development is of particular interest and relevance to the growing water scarcity constraints that Tanzania faces. Further, DFID's identification of Tanzania for forthcoming developmental interventions provides the opportunity for the uptake of CAMP findings.

6.4 Further studies

The identified key outputs from the RSA component of CAMP have direct and significant implications and relevance for four development projects which are in initial stages of implementation in RSA and wider country partnerships;

- DFID-SA / DWAF: Water and Forestry Support Programme/Water Resource Management component, 2002-2007;

- Water Research Commission (WRC-RSA): Low flows modelling and policy aspects relating to the SFRA, Project with University of KwaZulu-Natal. (CLUWRR is a project partner in this project commissioned by WRC but does not, at present, have donor funding for a CLUWRR input);

- IWMI-SA, Challenge 'Water and Food Programme' project investigating the multiple uses of water for poverty reduction, 2003-?

- Smallholder Systems Innovations (SSI) Upgrading rainfed agriculture through Water System Innovations. UNESCO-IHE, Stockholm University, Kwa-Zulu Natal University (BEEH), IWMI-SA, Sokoine University of Agriculture, 2003-2008;

- Clean development mechanisms (CDM) toolkit: A multi national proposal to the EU program on Tropical forest and other Forests in Developing countries for evaluating CDM interventions in relation to C sequestration, economic, environmental (including water resources) and social (poverty alleviation) indicators;

CAMP has directly contributed to, or entered into dialogues with, all five projects, together with the other projects within the FRP FLOWS network with the aim of disseminating CAMP methodologies and outputs, and developing wider research networks. The ability to maintain and support these productive networks and established uptake pathways is likely to be significantly reduced as CAMP ends its project life-cycle. Further donor funding would be required to maximise the FRP FLOWS benefits to these projects.

6.5 Availability of outputs to intended users

A multiple level strategy of disseminating project outputs has been identified;

- Personal networks: including meetings, telephone calls, conferences, symposia, etc;
- CAMP workshops: maturity workshops in RSA and Grenada have made available project technical reports, publicity, flyers, posters and contact details of the CAMP team;
- CAMP website: all project reports, including databases are being posted on the website (http://www.cluwrr.ncl.ac.uk/projects/camp/index.html);
- CAMP policy briefs will be emailed or sent to a targeted group of 'policy shapers' and secondary stakeholders in all three countries;
- As part of the FLOWS cluster of DFID-FRP projects, CAMP findings will feed into research in Costa Rica and India that will continue until March 2005;

6.6 How, and by whom, will the further stages be completed/developed

CAMP has identified (section 6.4) four active development projects (and an additional one is being developed) that are currently addressing similar issues that CAMP has extensively investigated and reported upon. Established research networks, (formal and informal) between CAMP and these projects require new funding to promote the outputs from CAMP and to allow the new thinking and ideas that have been generated by CAMP to inform, contribute and be developed within these projects.

CAMP identifies **DFID-SA** and **DFID-UK** (including, **FRP**) as key actors in promoting the beneficial development and promotion of CAMP outputs into these new development projects. Without additional and targeted support, the innovative research undertaken within CAMP may not be fully able to contribute to these projects which addresses themes and issues core to CAMP. The research demand for such an extension of CAMP is recognised by key research staff involved in these four projects and policy makers in RSA.

Outputs

1. Policy Briefs

- CAMP Policy Brief, South Africa (SFRA)
- CAMP Policy Brief, South Africa (socio-economic)
- CAMP Research Summary, South Africa (socio-economic)
- CAMP Policy Brief, Tanzania
- CAMP Policy Brief, Grenada

2. South Africa country reports

Calder, I.R, Bosch, J. and Jewitt, G.P.W. (2004) Developing Green Water Policy Instruments – Considering the hydrological role of land use in water resources management? CLUWRR-University of Newcastle-upon-Tyne/CSIR-Environmentek/BEEH-University of KwaZulu-Natal.

Dixon, P-J. (2004a) Report on PRA work at Khumbe in the Luvuvhu catchment, Limpopo Province, South Africa between 18-25 September 2002. University of Durham, UK.

Dixon (2004b) Guidelines for PRAs in the Luvuvhu catchment. University of Durham, UK.

Giacomello, A. M., Jackson, N., O'Regan, D. and Sullivan, C. (2004) Economic analysis of Forestry and Commercial Agriculture in the Luvuvhu Catchment. Centre for Ecology and Hydrology, Wallingford, UK.

Gush, M., LeMaitre, D. and Jewitt, G. (2004) Simulation of impacts of invasive alien plants on water resources within the Luvuvhu catchment. CSIR-Environmentek/BEEH-University of KwaZulu-Natal.

Hope, R.A. (2004) Water, workfare and poverty: A socio-economic evaluation of the Working for Water programme in Limpopo Province, South Africa. CLUWRR, University of Newcastle-upon-Tyne, UK.

Hope, R.A. and Gowing, J.W. (2004) The contested future of irrigation in African rural livelihoods. CLUWRR, University of Newcastle-upon-Tyne, UK.

Hope, R.A., Dixon, P-J., von Maltitz, G., and Gowing, J.W. (2004) Development and application of a Sustainable Livelihoods methodology using qualitative and quantitative research methods in the Luvuvhu catchment, South Africa. CLUWRR, University of Newcastle-upon-Tyne, UK/University of Durham, UK/CSIR-Environmentek, RSA.

Jewitt, G. and Garratt, J.A. (2004) Hydrological modelling in the Luvuvhu catchment. BEEH-University of KwaZulu Natal/ CLUWRR, University of Newcastle-upon-Tyne, UK.

3. Grenada country report

Jackson, N., Giacomello, A.M., O'Regan, D., Sullivan, C. and Patterson, G. (2004) Managing Watersheds for a Better Future. Improved catchment management methodologies to achieve poverty alleviation through better access to water. Centre for Ecology and Hydrology, Wallingford, UK.

Appendix1: Stakeholder consultation;
Appendix 2: Household and farmer surveys;
Appendix 3: Economic analysis in Grenada;
Appendix 4: Submission to Cabinet;
Appendix 5: Final workshop;
Appendix 6: Policy Brief Note development;
Appendix 7: Maps and tables;
Appendix 8: Outputs.

4. Tanzania country report

Kiagho, E., Hatibu, N., Mahoo, H. and Gowing, J.W. (2004) Tanzania country report. Sokoine University of Agriculture, Morogoro, Tanzania/CLUWRR, University of Newcastle, UK.

5. CAMP workshops

5.1 CAMP workshop reports

- Inception workshop report, Punda Maria, RSA. April, 2001
- Midterm workshop report, Bronkhorstspruit, RSA. September, 2002
- Maturity workshop report, Pretoria, RSA. January, 2004

5.2 CAMP workshop presentations

5.2.1 Inception workshop (Punda Maria, RSA, April 2001)

Calder, I.R. (2001) Catchment management and Poverty Alleviation - project objectives. CLUWRR, University of Newcastle-upon-Tyne, UK.

Barr, J., Dixon, P-J., Laurie, N., and Gowing, J. (2001) Sustainable Livelihoods - analysis, modelling options and data requirements. CLUWRR, University of Newcastle-upon-Tyne, UK.

Sullivan, C. and Jackson, N. (2001) Net Rainfall Value. Centre for Ecology and Hydrology, Wallingford, UK.

Sullivan, C. and Jackson, N. (2001) Operationalising participation - an example using Multi-Criteria analysis. Centre for Ecology and Hydrology, Wallingford, UK.

Moshe, D. and McClintock, S. (2001) CAMP Project - Case study selection - South Africa. CSIR-Environmentek, Pretoria, RSA.

Mahoo, H., Hatibu, N. and Mzirai, O. (2001) Tanzanian case study. Sokoine University of Agriculture, Morogoro, Tanzania.

5.2.2 Mid-term workshop (Bronkhorstspruit, RSA, September 2002)

Jewitt, G.P., LeMaitre, D. and Gush, M.(2002) Modelling hydrological scenarios. BEEH, University of KwaZulu-Natal, RSA; CSIR-Environmentek, RSA.

Giacomello, A-M. (2002) Untitled. Centre for Ecology and Hydrology, Wallingford, UK.

Dixon, P-J., Hope, R, and von Maltitz, G. (2002) Review of liveliihoods component of CAMP. University of Durham, UK; CLUWRR, University of Newcastle-upon-Tyne, UK; CSIR-Environmentek, RSA.

Kiagho, E. and Mahoo, H. (2002) Tanzanian briefings. Sokoine University of Agriculture, Morogoro, Tanzania.

O'Regan, D. (2002) Grenada report. Centre for Ecology and Hydrology, Wallingford, UK.

5.2.3 Maturity workshop and Stakeholder workshop (Gauteng province, RSA; January, 2004)

Jewitt, G.P. (2004) The legislative and biophysical context to CAMP. BEEH, University of KwaZulu-Natal, RSA.

Gush, M., Le Maitre, D. and Jewitt, G.P. (2004) Simulation of impact of invasive alien plants on water resources within the Luvuvhu catchment. BEEH, University of KwaZulu-Natal, RSA; CSIR-Environmentek, RSA.

O'Regan, D., Sullivan, C., Jackson, N. and Giacomello, A-M. (2004) The CEH contribution to CAMP. Centre for Ecology and Hydrology, Wallingford, UK.

Hope, R., Dixon, P-J., von Maltitz, G. and Gowing, J.W. (2004) Livelihoods assessment of water policy and water resources impacts on poverty reduction. University of Durham, UK; CLUWRR, University of Newcastle-upon-Tyne, UK; CSIR-Environmentek, RSA.

Kiagho, E. (2004) The role of CAMP in Tanzania. Sokoine University of Agriculture, Morogoro, Tanzania.

Patterson, G. (2004) CAMP-Grenada. Ministry of Agriculture, Dept. Forestry, Grenada.

Calder, I.R., Bosch, J. and Jewitt, G.P. (2004) Can we improve on the SFRA methodology through focussing on Green water as well as Blue water? CLUWRR, University of Newcastle-upon-Tyne, UK; CSIR-Environmentek, RSA; BEEH, University of KwaZulu-Natal, RSA.

Hope, R., Dixon, P-J, von Maltitz, G. and Gowing, J.W. (2004) Water and Poverty. University of Durham, UK; CLUWRR, University of Newcastle-upon-Tyne, UK; CSIR-Environmentek, RSA.

5.3 CAMP Electronic conference

CAMP (2002) Proceedings of the CAMP electronic workshop, June 2002

6. Journal/refereed papers

Calder, I.R. and Dye, P. (2001) Hydrological impact of invasive alien plants. Land Uses and Water Resources Research **1** (7): 1-12. Available at: http://www.luwrr.com

Hope, R., Calder, I.R., Gowing, J.W., Laurie, N., Dixon, P-J., Sullivan, C., Jackson, N., von Maltitz, G., Bosch, J., LeMaitre, D., Dye, P., Netshiluvhi, T., Hatibu, N. and Paterson, G. (2001) Saving the trees and the poor? European Tropical Forestry Newsletter, **35**. Available at: http://www.etfrn.org/etfrn/newsletter/news35/index.html

Calder, I.R. (2002) Forests and Hydrological Services: Reconciling public and science perceptions. Land Uses and Water Resources Research **2** (2): 1-12. Available at: http://www.luwrr.com

Calder, I.R., Amezaga J., Aylward, B., Bosch, J., Fuller, L., Gallop, K., Gosain, A., Hope, R., Jewitt, G., Miranda, M., Porras. I,, and Wilson, V. (2004) Forest and Water Policies - The need to reconcile public and science perceptions. Geologica Acta **2** (2)

Hope, R.A. and Garrod, G. (submitted) Is water policy responding to rural preferences? A choice experiment evaluating household domestic water trade-offs in rural South Africa. Water Policy, Water and Politics special edition.

7. Conference papers

Calder, I.R. (2000) Land use impacts on water resources. Background paper No. 1. Land-Water linkages in Rural Watersheds. Electronic Workshop, 18th Sept. – 27th Oct, 2001. United Nations Food and Agricultural Organization, Rome, Italy.

Calder, I.R. (2001) Research issues in spatial land and water management, examples from the UK, Panama and South Africa. GIS Technologies for Sustainable Development at Local Level, 9-11 October 2001, New Delhi, India.

Calder, I.R. (2003) Forests and Water – Closing the gap between public and science perceptions. Keynote speech, Proceedings of the Stockholm International Water Symposium, August 2003. Stockholm, Sweden.

Hope, R.A., Dixon, P-J and von Maltitz, G. (2003a) The role of kitchen gardens in livelihoods and poverty reduction in Limpopo province, South Africa. In, Butterworth, J., Moriarty, P. and van Koppen, B. (eds) Beyond Domestic: cases studies on poverty and productive uses of water at the household level. Proceedings of an International Symposium on the Productive Uses of Water at the Household Level, January 2003, Muldersdrift, South Africa. IWMI/NRI/IRC: Delft, Holland. Available at: http://www.irc.nl/prodwat

Hope, R.A., Jewitt, G.P. and Gowing, J.W. (2003b) Linking the hydrological cycle and rural livelihoods: A case study in the Luvuvhu catchment, South Africa. Paper presented at the Waternet conference, Gaborone, Botswana, 15-17th October, 2003.

Hope, R.A. and Gowing, J.W. (2003) Managing water to reduce poverty: water and livelihood linkages in a rural South African context. Paper presented at the Alternative Water Forum, University of Bradford Centre for International Development, 1-2 May, 2003. Available at: http://www.brad.ac.uk/acad/bcid/GTP/altwater.html

Fuller, L., Garratt, J.A., Jewitt, G. and Calder, I.R. (2003) Water resources planning and modelling tools for the assessment of land use change in the Luvuvhu catchment, RSA. Paper presented at the Waternet conference, Gabarone, Botswana, 15-17th October, 2003.

8. MSc. Dissertations

Kiagho, E. (2003) Policy Instruments in Integrated Water Resources Management and Sustainable livelihoods in the Great Ruaha river Basin. MSc. Dissertation, unpublished. Sokoine University of Agriculture: Tanzania.

Spice, W. (2003) The Use of Geographical Information Systems to Simulate and Assess the Spatial Variation of Maize Yields in a Semi-arid Catchment. MSc. Dissertation, unpublished. University of Leeds: UK.

9. Posters/leaflets

Poster: Catchment Management and Poverty Alleviation (CLUWRR/CSIR)

Leaflet1: Forests and Water (CLUWRR)

Leaflet 2: Catchment management (CEH)

Leaflet 3: Managing Watersheds for a Better Future (CEH)