Don’t let the rain run off

RIU

Validated RNRRS Output.

New approaches to rainwater harvesting (RWH) are improving life in Tanzania’s semi-arid areas. Previously, lack of awareness by planners and farmers meant RWH was not used much. A holistic system integrates interventions ranging from in situ RWH (soil and water conservation), to supplementary irrigation using water harvested from macro-catchments. The basic principle is to start by preventing runoff and promoting infiltration of the rain falling directly on the field. Another approach combines RWH with road and railway drainage infrastructure to contain flash floods while at the same time increasing water availability for agriculture and livestock. In Tanzania, use is widespread in the districts originally targeted by the project and spreading. In Rwanda, projects have been launched in several areas.

Project Ref: **NRSP12:**
Topic: **4. Better Water Harvesting, Catchment Management & Environments**
Lead Organisation: **ASARECA, Uganda**
Source: **Natural Resources Systems Programme**

Document Contents:

Research into Use
NR International
Park House
Bradbourne Lane
Aylesford
Kent
ME20 6SN
UK

Geographical regions included:

Ethiopia, Nigeria, Rwanda, Tanzania,

Target Audiences for this content:

Crop farmers, Livestock farmers, Fishers, Forest-dependent poor,

Description

NRSP12

A. Description of the Research Output(s)

1. Working title of output or cluster of outputs

Rainwater harvesting for up-grading and stabilizing rainfed agriculture in semi-arid areas

2. Name of relevant RNRRS Programme(s)

The Natural Resources Systems Programme (NRSP)

3. Relevant R numbers and institutional partners

R 7888

The Project Team

(a) Soil-Water Management Research Group - Sokoine University of Agriculture (Nuhu Hatibu, Henry F. Mahoo, Evelyne A. Lazaro, Filbert B. Rwehumbiza, Ephraem M. Senkondo, Siza Tumbo, Omari B. Mzirai, Kossa Rajabu, Abeid K. Msangi, and Adolph R. Ludovick)

(b) Lake Zone Agriculture Research and Development Institute (LZARDI-Ukiriguru) (Geoffrey G.J. Kajiru)

(c) Northern Zone Agriculture Research and Development Institute (NZARDI – Seliani) (Charles Lyamchai, Peter Xavery, Jeremiah Sembosi, Mwikare Mshana

(d) Centre for Land Use and Water Resources Research, University of Newcastle upon Tyne – UK (John W. Gowing)

4. RNRRS output or cluster of outputs *(max. 400 words)*.

The four outputs described here were produced in 2000/01 and were designed to address the problem of **Slow Rate of Adoption of RWH** to up-grade and stabilize rainfed agriculture in semi-arid areas**.** This problem was caused mainly by a failure to recognize feasibility of RWH, which itself was a result of (i) Low awareness by stakeholders of what RWH is and what farmers are already doing, (ii) Inadequate knowledge on RWH techniques especially by planners and farmers' support agents, and (iii) Shortage of comprehensive strategies to influence sectoral policy.

i) Tail-to-Mouth [1] Approach to RWH

A **holistic system of RWH** which integrates interventions that range from ***in-situ*** **RWH** (normally known as soil and water conservation), to supplementary irrigation using water harvested from macro-catchments. The basic principle is to start by preventing runoff and promoting infiltration of the rain falling directly on the crop field before any consideration to supply the field with extra water – treating the "tail". This practice ensures that investments in RWH and supplementary irrigation start by managing the field for optimum capture and

utilization of direct rainfall.

ii) A method/approach for Integrating RWH with Drainage Systems of Road and Railway Infrastructure

The output is a "proof-of-concept" that **drainage structures** of roads and railways facilitate the concentration of runoff and hence increase the potential for RWH. It is a win-win approach because in the semi-arid areas there is serious failure or poor performance of road-drainage systems caused by the problem of 'flash floods' where the rainwater quickly runs off leaving behind a shortage of water. There is therefore a high potential for **combining RWH with road drainage structures** to contain the effects of 'flash floods' while increasing water availability for domestic, livestock and irrigation needs.

iii) Communication, Knowledge Sharing and Learning Products

The output is a collection of products for awareness-raising, joint learning and planning of rainwater harvesting. These included:

- A special issue of the Tanzania Journal of Agricultural Sciences (**TAJAS**) devoted to RWH;
- One planning guide **handbook on RWH [2]** and another on smallholder irrigation [3];
- Seven booklets popularizing different aspects of RWH in both Kiswahili and English; and
- Three 15-minute **videos for awareness-raising** on RWH.

They were designed to target stakeholders such as individual households, community, local change agents, and policy makers and planners at both local and national governments.

[360 words]

5. What is the type of output(s) being described here?

(Please tick one or more of the following options)

Product	*Technology*	*Service*	*Process or Methodology*	*Policy*	*Other Please specify*
	x	*x*	*x*	*x*	

6. What is the main commodity (ies) upon which the output(s) focussed?

A wide variety of commodities were tested with these outputs, including cereals (sorghum, maize, and rice), vegetables and livestock. Therefore, there is no limitation of the commodities to which the outputs can be applied as the central theme is an increased provision of soil-water available for plant growth in the semi-arid areas.

7. What production system(s) does/could the output(s) focus upon?

Semi-Arid	*High potential*	*Hillsides*	*Forest-Agriculture*	*Peri-urban*	*Land water*	*Tropical moist forest*	*Cross-cutting*
x		*x*					

8. What farming system(s) does the output(s) focus upon?

Smallholder rainfed humid	*Irrigated*	*Wetland rice based*	*Smallholder rainfed highland*	*Smallholder rainfed dry/cold*	*Dualistic*	*Coastal artisanal fishing*
				x		

9. How could value be added to the output? ***(max. 300 words)***

Improved availability of water for plant growth in the semi-arid areas is but just one solution that needs to be integrated with other productivity-enhancing interventions in a systems approach that includes integrated watershed management, off-farm income generation, better analysis of climate variability, market linkages, and risk insurance mechanisms. Therefore, value will be added if the proposed outputs will be clustered with outputs of:

- R8452/R8215 – Increasing food security and improving livelihoods through the promotion of integrated pest and soil management in lowland maize systems;
- R8182/R8418 – Participatory market chain analysis;
- R8274/8275/8498 – Farmers access to markets;
- **R8088** – Improved pro-poor strategies for scaling-up the integrated management of rainwater in semi-arid areas and **R8116 –** Improving management of CPRs in RWH systems.
- R7304 – Improved management of CPRs;
- R7830 – Participatory irrigation management and participatory technology development;
- Various projects (e.g. R7434, R8269) on variety development and seed management; and
- Some projects (e.g. R7010, R6621) on livestock management.
- R8064 - Raising Irrigation Productivity and Releasing Water for Intersectoral Needs (RIPARWIN), especially the participatory dialogue and decision support tool, called River Basin Game (RBG).

The non-RNRRS outputs recommended for consideration are:

- Smallholder system innovations in integrated watershed management [SSI] being implemented in Tanzania and South Africa. The main output is an advanced knowledge for improved eco-hydrological management at watershed and basin scale with particular focus on system interactions in smallholder rainfed farming systems upgraded with RWH;
- Outputs from the Comprehensive Assessment (CA) of Water Management in Agriculture [4];
- Outputs from India on integrated watershed management, such as the national manual of watershed management, and the Hariyali [5] guidelines dealing with cost norms for various works in different regions to assist budgeting, funding and execution.

[1] This approach was first described by the Tradition Irrigation Improvement Programme (TIP) assisted by SNV of the Netherlands
[2] Hatibu N. and H.F. Mahoo [eds] (2000). Rainwater Harvesting for Natural Resources Management: A planning guide for Tanzania. Technical handbook No. 22, ISBN 9966-896-52-x, RELMA, Nairobi.
[3] Guidelines for participatory improvements to farmer initiated and managed smallholder irrigation schemes in Tanzania, Ministry of Agriculture and Cooperatives, 2004, Dar es Salaam.
[4] www.**iwmi**.cgiar.org/**Assessment**/
[5] **The "Hariyali Guideline" is a product of many years of lessons from implementation of IWM in India and was approved by the GoI in 2005 (**http://dolr.nic.in/HariyaliGuidelines.htm**)**

[288 words]

Validation

B. Validation of the Research Output(s)

10. How were the output(s) validated and who validated them? ***(max. 500 words)***

The outputs have been validated through studies targeting both the intermediate organisations and user groups. Two were carried just before the project and provided a baseline. These studies included:

- Assessment of the acceptability and sustainability of RWH for paddy and maize production under semi-arid conditions of Dodoma District in Central Tanzania (2000)
- Cost-benefit analysis of RWH techniques for maize and onion production in Same and Mwanga districts (1999)

Three more were conducted after the project ended, as follows:

- Preliminary Economic Analysis of Rainwater Harvesting Systems [6];
- Farmers' Assessment of the RWH Techniques Njombe District in Southern Tanzania [7]; and
- Detailed Economics Studies [8]

The outputs have also been validated by proxy through practical use. Examples include inclusion into national strategies, District Agricultural Development Strategies, and projects in Tanzania. Many Intermediary organisations like SAIPRO, MIFPIRO, VECO and TIP, and projects such as PADEP and PIDP have invested resources to replicate and put these products into use. Local Government Authorities are using the products to improve content of extension messages as well as capacity building for extension officers. This also included the transfer of outputs to Ethiopia, Rwanda and Nigeria. These countries sent delegations to visit and assess implementation of the outputs in Tanzania, followed by adaptation of the outputs to own countries. The Rwandan Government has hired two senior experts, one from Tanzania (a member of SWMRG) and one from India to facilitate work of Integrated Participatory Watershed Management including RWH systems.

Validation of communication and learning products was implemented while the products were being developed and used, as follows:

(a) **Stage 1**: Participatory assessment of needs for information, learning and training, through consultation meetings with stakeholders across all levels of the uptake pathway.
(b) **Stage 2:** Participatory design of materials for awareness raising, learning and training through a workshop attended by over 40 participants cutting across institutions, gender and other social groups.
(c) **Stage 3**: Testing, evaluation and approval of draft versions of materials by stakeholders.
(d) **Stage 4**: Technical review by users, including IWMI who identified that the awareness raising booklets would be useful in South Africa where there were initiatives to assist small holders in areas in a country with limited experience on smallholder farming.

The validation processes reported above involved smallholder farmers across gender (women, men and the youth). All relevant social groups were reached by the capacity building activities and they provided validation

feedback. The validation process showed that Improved management of rainwater enabled farmers to cultivate high value cereals (maize and paddy) in areas which are traditionally considered for production of drought tolerant (sorghum and millets) leading to an increase in maize yield by 2.5 t/ha, an increase in GM of $220/ha; an increase in return to labour of $5/person day, and a benefit to cost ratio of 1.55. In one area farmers are storing harvested water in small ponds and scheduling the water applications to grow onions. The result is a high gross margin of US$2,750/ha and a return to labour of over US$13/person day.
[505 words]

11. Where and when have the output(s) been validated? *(max 300 words)*

Four countries have been involved in the validation, namely Tanzania (mainly semi-arid production system), Rwanda (hillsides production system), Ethiopia (semi-arid) and Nigeria (High potential). The farming system of focus was generally smallholder rainfed in all cases. Specific locations in Tanzania included:

i) The semi-arid areas of Central Tanzania particularly Dodoma, Singida, Shinyanga and Mwanza regions, covered by the Participatory Irrigation Development Project (PIDP)(2001-06) which is a development project funded with loan funds from IFAD and implementing the principles of output 1 and 2. Members of R7888 project contributed as consultants to the design of the project as well as in capacity building.

ii) In Same and Mwanga Districts where four NGOs (MIFIPRO, SAIPRO, TIP and VECO) have been promoting RWH since 2002 following interactions with the R7888 projects.

iii) In Njombe district, in the Southern Highlands from 2003 -2005.

In Rwanda the main target locations are the Bugesera and Umutara provinces where all social groups from farmers, their support agents, local leaders as well as national politicians are involved. The timing of the validation 2003-05 and the RWH systems were well taken up by the farmers. The farmers' association at Murama is now assisting other such organisations to take up RWH activities in surrounding areas. In Ethiopia the validation was carried out in 2001 through farmers' visits to Tanzania followed by technical design missions to Nazareth supported by RELMA. In Nigeria the validations were carried out under another project commissioned by NRSP in 2004/05.

[6] Senkondo, E.M, A.S.K. Msangi, P. Xavery, E.A.Lazaro and N. Hatibu (2001). *Economic Analysis of Rainwater Harvesting Systems in Selected Semi-arid areas of Tanzania*. Poster Presentation at the 10th International Conference on Rainwater Catchment Systems, Mannheim Germany, 10 – 14 September 2001
[7] Kapinga, P. H., N. Hatibu, H. F. Mahoo, F. B. Rwehumbiza and M. M. Mkuchu (2003). *Assessment of Rainwater Harvesting Techniques for Domestic Uses and Crop Production in the Semi-arid areas of Njombe District*.
[8] N. Hatibu, K. Mutabazi, E. M. Senkondo and A. S. K. Msangi (2006). Economics of rainwater harvesting for crop enterprises in semi-arid areas of East Africa. *Agricultural Water Management*, 80 (2006): 74-86.

[244 words]

Current Situation

C. Current situation

12. ***How and by whom*** *are the outputs currently being used? Please give a brief description* ***(max. 250 words****).*

These Outputs are being used at a national and regional level primarily by bodies responsible for agrochemical management to influence policy, promote and implement plans of action for better agro-chemical management and to influence the public and farmers towards good agricultural practices.

The Regional Plan of Action has been supported with funds from the United Nations Environment Programme (UNEP) Chemicals to implement two workshops with the involvement of CARICOM Secretariat. This enabled the group to explore collaboration to implement the Multilateral Environment Agreement. CGPC has been empowered to recommend further policy changes on behalf of the rural poor with whom they work closely. The lessons learnt are being employed by CGPC to seek CARICOM's approval to initiate regional registration. At the last meeting, CGPC continued to implement and promote the strategy and included in its recommendations a new submission to CARICOM Annex I.

The Caribbean Agricultural Research Development Institute (CARDI) has used the outputs in papers presented across the Caribbean to disseminate information on the status and effects of the use of agro-chemicals to regional audiences (Annex II)

Nationally, the Strategy has been employed to guide agrochemical management, and the toolkit used for developing national plans of action. Promotional materials have been used to sensitise people from the general public and consumers, farmers, companies producing and selling agro-chemicals, donor community to managers and policy makers in government.

The Certification of Agricultural Produce project of the Jamaica Agricultural Society and the Bureau of Standards have used the EUREPGAP Standards to develop a national standard on good agricultural practice.

The Strategy’s recommendation for public health monitoring is being implemented by the Caribbean Poison Information Network and the hospital surveillance unit with the involvement of pharmacists, ministry of education, toxicologists, medical professionals and the PCA.

Pesticide companies have been involved with the PCA in programmes to restrict sales of certain toxic agrochemicals

13. ***Where*** *are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used* ***(max. 250 words).***

Regionally throughout the Caribbean by the CGPC, CARICOM Secretariat and by regional bodies such as the Caribbean Environmental Health Institute (CEHI) and CARDI.

Nationally all CGPC member countries have adopted at least one of the recommendations of the strategy, and through the involvement of CARICOM the influence of CGPC has increased (see Q 14). National and regional videos and posters were used during pesticides awareness weeks in 2005 and 2006 within CGPC countries.

Extensive use of the Outputs has occurred in: Jamaica and Belize which have implemented several

recommendations of the strategy (e.g. cost recovery, public health monitoring, national database); Jamaica and St. Lucia are implementing inter ministerial plans of action and utilising promotional material; Montserrat has harmonised its legislation with Organisation of Eastern Caribbean States; St Kitts and Nevis has reviewed draft legislation and introduced sustainable financing. Dominica has undertaken a public awareness raising campaign; initiated environmental monitoring together with the Environment Division, and work is in progress to determine pesticide residues on selected produce to include fruits and vegetables, breast milk (human and cow) and meat samples. Antigua has also drafted a new Pesticides and Toxic Chemicals Control Act, trained inspectors and advised distributors on the operation requirements for their premises. Elements of the strategy have also been applied in St Vincent and the Grenadines and Trinidad and Tobago.

14. What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading ***(max 250 words).***

Following completion and adoption of the strategy in 2003, and endorsement at CARICOM in 2005, lobbying of national governments continued and all CGPC members have adopted at least one of the recommendations of the strategy within a year of completion of the project. At the last CGPC meeting PIP expressed willingness to provide assistance for a legal review and drafting of legislation to support harmonised registration which has already started with the Organisation of Eastern Caribbean States and extended to Barbados. The toolkit has been used to develop National Plans of Action for POPs. CARICOM endorsement of the Strategy has strengthened the CGPC resulting in increased membership since 2005.

Nationally, implementation of the strategy has spread from two countries in 2003 to eight (St. Kitts and Nevis, Trinidad and Tobago, Suriname, Dominica, Antigua, Belise, Jamaica and St. Lucia) in 2006. Jamaica implemented four inter-ministerial national plans of action almost immediately. In St Lucia policy endorsement of the strategy resulted in the proposal for appointment of a full time registrar and staff for the PCB, and in St Kitts, addressing the sustainable financing element of the strategy, import licence fees were introduced. Other CARICOM countries like Dominica and Belize became parties to the Rotterdam Convention and initiated public health monitoring. Belize also employs full time staff, cost recovery, and trains pesticides users. *Antigua has done public health and* environmental monitoring work primarily in the area of POPs

Data collection on poisonings has increased and hot spots where poisoning is highest are being targeted for intervention.

15. In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key factors of success? ***(max 350 words).***

The development and ownership of the Strategy by members of the regional CGPC has been central to the success of its implementation. Sharing of information among CGPC members at annual meetings has contributed to capacity building. The development of a regional plan of action by CGPC has provided a framework to take forward the Strategy and attract donor funds. While CGPC represented only 65% of the CARICOM, the regional platform that brings ministerial attention to the recommendations of the strategy ensures that agrochemical policies are coordinated and there is support for its adoption. CARICOM support was achieved in 2005 (see 10). Support and promotion by recognised regional bodies like CARDI and IICA have also been influential.

External funding from UNEP Chemicals has enabled capacity building workshops to develop project proposals for implementing the strategy. Two consultation workshops to develop national plans of action for ratifying and implementing Rotterdam Convention were held in Trinidad and Tobago and Jamaica September 2005 and May 2006 respectively. Suriname, Barbados, Jamaica and Trinidad and Tobago participated. Familiarity with the toolkit made it possible to complete these NPA's.

Implementation of the strategy at the national level requires an integrated approach amongst existing Ministerial structures. This has required the development of new structures implemented through inter-ministerial national plans of action. UNEP Chemicals also encourages synergies among multinational environment agreements and has supported NPAs on chemicals management involving inter-ministerial coordination. Under that initiative a website for integrated chemicals management was developed (www.chemicalsafety.gov.jm)

Sensitisation of farmers, consumers and the general public has been important in achieving success. In this respect lessons learned from the NRSP projects on the development and implementation of Communication Plans have been important. Communications specialists have been important in developing and disseminating messages. Although a range of media have been employed, but face to face meetings and focus working groups have been particularly.

At a national level uptake of the strategy has been most successful in those locations where a dedicated full time staff exists. The level of training of people in the relevant agro-chemical bodies in the Caribbean is generally high but in those locations where no dedicated full time staff exists, competing duties limit uptake.

Current Promotion

D. Current Promotion/Uptake Pathways

16. Where is promotion currently taking place? - *(max 200 words))*

Aspects of this question have already been covered above with respect to the two countries, Tanzania and Rwanda where there is active promotion. By inclusion of these products in policy and programme documents in Tanzania, promotion is taking place by utilization of the concepts inherent in the outputs. Main promoters are relevant programmes at national, district and NGOs levels. The scale of current promotion can be measured by the number districts where there is active use of some or all outputs. Out of about 60 districts in Tanzania which are categorized to have semi-arid climate, 13 (Maswa, Same, Mwanga, Mbeya, Njombe, Hai, Rombo, Handeni, Singida, Kwimba, Shinyanga, Bariadi and Misungwi) have specific programmes dealing with RWH through which some of the outputs are being promoted.

In Rwanda Rwanda promotion is mainly by ISAR and it is taking place at high rate. As an RWH is being included in the plans for integrated management of watersheds across many sites that have been established within a period of 12 months. These watersheds are located in in Gitarama, Cyabayaga, Gasharo, Ruhengeri, Kibungo didtricts

[173 words]

17. What are the current barriers preventing or slowing the adoption of the output(s)? - ***(max 200 words)***

There are two categories of barriers slowing down the adoption of the outputs in particular, and RWH in general. The first category concerns knowledge, attitudes, and practices (KAP) of the key stakeholders along the uptake pathway. The second problem is related to resources economics and governance. With respect to KAP, and despite the many years of work on RWH, there are still gaps to fill in Tanzania on each aspect.

i) On knowledge, there is still a problem that agricultural water management (AWM) is still taken to mean irrigation as defined by Civil Engineers, who continue to dominate the relevant departments in government and NGOs. So although accepted at policy level, RWH is not being implemented adequately because of a major shortage of experts who are broad minded about AWM.

ii) On attitudes, a good measure of success has been achieved as testified by the change of policy with increased support for RWH. However, attitudes are still fixed on large irrigation schemes for national pride.

iii) With practices, the problem on **integrating RWH with infrastructure drainage**, as the infrastructure, agriculture, and water departments are continuing with old practices and design manuals which do not facilitate integration.

With respect to resource economics and governance the barriers include:

i) Inadequate understanding of how and when runoff is a resource, how much is available, and this availability is affected by different plans for land, agriculture, infrastructure, water resources, and environmental management.

ii) Poor understanding of the economics of RWH as well as poor market incentives.

iii) Runoff is a common pool resource, and governance to ensure equitable inclusion of poor target groups in its use and benefits, remains a challenge.

[277 words]

18. What changes are needed to remove/reduce these barriers to adoption? - *(max 200 words))*

Further work is required to develop a community of practices for RWH in target countries. The CoP should involve a trans-sector network linking key actors in sectors such as land, water, infrastructure, agriculture, environment and agricultural markets. All the outreach by R7888 described previously has been too much focused on the agricultural sector. More importantly there is need for action to build a broad based platform that will foster innovation, joint planning and adaptive management of runoff resources.

To achieve the above there is a need to expand the awareness raising, professional development and joint learning programme to reach a critical mass of actors in each of the important sectors. There is a need for a vigorous campaign to influence the educational and professional training systems to mainstream training in RWH as well as AWM in its broad sense so that the new crop of scientists and other professionals will be well versed in integrated AWM approaches. This will require re-tailoring of the existing communication, knowledge sharing and learning products. Further to these we need to promote platforms that allow for continuous and inclusive dialogue and planning.

There is an urgent need for procedures for evaluating the runoff resource status and assessing the potential for implementing successful and profitable RWH interventions for a given area. This procedure would use remotely sensed data, and participatory GIS (to include data on rainfall, land and soils characteristics, civil works on drainage, and economic, social and environmental issues). This should put emphasis on the economics of RWH under different enterprises and conditions of market access. The ultimate aim should be to ensure that local resource users/managers make better choices.

[275 words]

19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people? - *(max 300 words)*

The bottom line in the adoption of production-enhancing outputs is that they must lead to **increased income and reduction of risk**. This requires technical soundness of the output itself, knowledge and understanding by users of the output and its limitations, good support in terms of policy, technical and financial services, and an economic environment that ensures access of products to markets.

Farmers and their support agents are very much motivated by strong learning alliances which deliberately bring together researchers, government planners, and policy makers to share in the technical risks associated with adoption of new technologies and practices. Such alliances should support the whole process from identification, design, implementation and evaluation of performance of new outputs. This way the researchers and other technical partners **under-write the technical risks**.

All the critical players in the uptake pathway should be well targeted and facilitated to play their roles. In many cases policy is the most critical entry point followed by adequate institutional support at all levels. This requires a robust plan for ensuring that all institutions and organizations with key roles in supporting the uptake, are knowledgeable and supportive of the research output being promoted. Where the output influences policies and strategies, then potential for adoption is tremendously increased.

The economic environment is perhaps in the final analysis the most important factor as it determines whether adoption will lead to profitability and income generation for the end-users. Therefore, trade and markets play a key role in driving wide-scale adoption and use of productivity-enhancing outputs. This can not be achieved without strong collaboration of sectors as well as private-public partnerships.

[267 words]

Impacts On Poverty

E. Impacts on Poverty to Date

20. Where have impact studies on poverty in relation to this output or cluster of outputs taken place?

i) The detailed economics studies [11], conducted under project R8116 were perhaps the only direct studies targeting the impact of the outputs of R7888.
ii) The others are impacts studies for one major rainwater harvesting project in Tanzania – the PIDP [12] which have used some of the outputs.

21. How have the poor benefited from the application and/or adoption of the output(s)? - *(max. 500 words)*

We must state here that empirical evidence that clearly attribute the use of these outputs to poverty reduction impacts is weak. However, the detailed economic studies showed that there were impressive returns to land and labour as a result of adopting RWH. The overall per hectare returns to land from paddy increased progressively from micro-catchment RWH (US $ 701.1), macro-catchment RWH (US$ 746.4) and macro-catchment RWH with road drainage (US$ 879.7) before declining to US$ 779.7 in the case of micro/macro-catchment with storage pond. The returns to labour were 8.7, 9.3, 11.0 and 9.7 US$ per person-day for micro, macro, macro linked to road drainage and micro/macro with storage pond respectively during an above-average season. The impressive performance under RWH integrated with drainage systems suggests that these outputs are contributing to poverty reduction. For example returns to land were more than doubled under RWH.

The following positive impacts on livelihoods have been recorded since 2001:

i) **On human capita**l – the outputs have lead to increased knowledge on RWH for stakeholders all the way from policy makers to farmers. Although a critical mass has not been attained, but the national expertise on RWH has been vastly improved. More importantly, a momentum has been created for further and continuous building of human capital.

ii) **On social capita**l – by its nature implementation of RWH leads to the building of strong watershed networks improving social capital. The specific impact on social capital has been the increase of number of savings and credit groups as well as water users association. Most have helped to empower women and youths to take part and influence decisions on water allocation, use and management in the target areas.

iii) On natural capital – Adoption of RWH has improved the extent to which land is conserved against erosion through the construction of *in-situ* and *majaluba* systems. This has certainly improved the quality of natural capital. For example in Maswa District alone, an extra 13,961 ha are estimated to have been treated this way since 2001. RWH has also increased the availability of water for different uses. However, in this case it has sometimes led to reduction of water availability downstream leading to conflicts over water. For example during the River Basin Game Workshop conducted in September 2005 in Makanya sub-catchment, Same District, participants observed that increased use of RWH technologies in the up-stream and mid-stream villages (Vudee, Chome, Mwembe, Bangalala, Tae etc.) has led to reduced water availability in the downstream village of Makanya. They thus proposed the establishment of a sub-catchment committee to oversee water allocation throughout the sub-catchment.

iv) On physical capital – There has been a direct increase in structures for control and storage of runoff. For example, there are over 50 privately-owned charco dams in Makanya village, Same District. Some water tanks have also been constructed by livestock keepers in Makanya village to provide water for domestic uses. Under the support of IFAD/PIDP 52 schemes to harvest water for supplementary irrigation were constructed

in Shinyanga, Mwanza, Dodoma, Singida and Manyara regions increasing benefits to more smallholder farmers. This led to expansion of area under RWH by 13,961 ha in the five regions, hence increasing production and ultimately improving food security. Other benefits include the construction of improved houses, buy bicycles, radio sets and agricultural implements and equipments such as oxen drawn ploughs, treadle pumps and wheel barrows. For example, assessment done in four villages in Tanzania attributed 100% increase in the number of houses improved from thatched room to corrugated iron roofs, to adoption of RWH. In Rwanda during 2005, seven small holder ponds were constructed in a small watershed. The water made available by these RWH systems was used for various uses e.g. drinking water for animals, irrigation of vegetable crops, sorghum, construction of bricks, household use. Prior to these RWH the farmers had to walk 2 km for getting water from a spring.

v) On financial capital - Adoption of RWH technologies has led to reduced risks of crop failure and yield reductions thereby increasing agricultural productivity, food security and household incomes. Formation of 14 Savings and Credit Cooperative Societies (SACCOS) in the RWH schemes in Central, Lake and Rift Valley zones under PIDP support is an indication of increased income from increased productivity. Increased incomes have enabled people to pay school fees for their children, access better health facilities.

Despite these recorded successes from the monitoring reports, a more systematic impact assessment for the project is already initiated after completion of the project to document relative benefits by different farmer categories.

[11] N. Hatibu, K. Mutabazi, E. M. Senkondo and A. S. K. Msangi (2006). Economics of rainwater harvesting for crop enterprises in semi-arid areas of East Africa. *Agricultural Water Management*, 80 (2006): 74-86.
[12] United Nations Office for Project Services (UNOPS) (2005). Participatory Irrigation Development Project (PIDP). Project Supervision Summary. United Nations Office for Project Services - Eastern and Southern Africa Regional Office (ESA-RO), Nairobi, Kenya.

[759 words]

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? - ***(max 300 words)***

The outputs proposed are designed to influence policies, strategies and practices for optimal and profitable use of available rain water in areas with scarce water resources.
The main outcomes are to conserve water and dispose runoff water safely leading to reduction erosion, soil nutrient losses and flooding of downstream areas. Of course the use of these outputs may lead to substantial change in the runoff patterns and water stored in the profile, but this will be mainly lead to reduction of losses.

The enhanced productivity of food crop enterprises will improve income earning capacity of the small holder

farmer which may lead to greater diversification of the systems, with positive impact on the environmental in general. Improved productivity may also lead to easing of the pressure on land and thereby result in reduction of the conversion of land for agriculture from other uses.

[216 words]

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? - *(max 100 words)*

Adverse environmental impacts related to the use of the outputs include:

- Excessive use of water by upstream farmers through RWH could lead to reduced availability of water to downstream farmers and livestock keepers.
- Reduced flooding of lowland areas may affect farmers who depend on floods to grow paddy.
- Drying of rivers and streams in downstream reaches as a result of over-abstraction or over-exploitation of water through RWH, may lead to serious negative effects on natural ecosystems.
- Dissolved nutrients and pesticide residues may pollute the ground water.

There is therefore a need for watershed scale planning and implementation in a way that is acceptable to upstream and downstream users to prevent the occurrence of conflicts in water sharing/access.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? - (*max 200 words****)***

Dry land farming systems are challenging and are depended upon by some of the poorest and most vulnerable communities. They manage and largely rely upon rain-fed agriculture and pastoral systems for their livelihoods and are the custodians of the natural resource base upon which such enterprises depend. The outputs proposed here are designed to directly deal with the variability of rainfall amounts and distribution, which is a major outcome of climate change. Therefore, this outputs where used lead to an increase of the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters such as droughts and floods and increase their resilience to climatic shocks.

Annex

Introduction

In rainfed agriculture ...
local rainfall, which fall directly on given field is the predominant source of water for growing crops, trees or pasture on that field. Without the direct rainwater no plant growth and crop yields are possible and irrigation if used is only supplemental.

Rainfed agriculture is the dominant form of agriculture in the world and in the temperate regions it generates very high yields. This is also true in tropical regions, particularly in the sub-humid and humid zones, where agricultural yields in commercial rainfed agriculture exceed 5-6 t/ha. However, in the dry sub-humid and semi-arid regions yields remain very low, between 0.5 – 2 t/ha. In sub-Saharan Africa (SSA) where more than 95% of agriculture is rainfed, average grain yields are only about 1 t/ha. There are many causes for the low performance of rainfed agriculture in semi-arid areas but the most critical is the variability in the availability of soil-moisture for crop use. It is well known that in typical farms in the semi-arid areas, especially when only the hand hoe is used for tillage, only a small fraction of the rain falling on the field reaches and remains in the soil long enough to be useful to crops while up to 70 percent can be lost as un-productive evapo-transpiration and runoff. So it is often argued that poor crop yields and crop failures are not so much the result of low rainfall but of too much wastage of valuable rainwater. Interestingly, no one doubts the critical importance of rainfall but few recognizes the importance of runoff. It is often seen as the cause of soil erosion and so as a hazard rather than a useful resource.

In rainfed agriculture ...
local rainfall, which fall directly on given field is the predominant source of water for growing crops, trees or pasture on that field. Without the direct rainwater no plant growth and crop yields are possible and irrigation if used is only supplemental.

Therefore, Project R7888 was designed to assess whether better management of rainwater can help to improve soil-moisture status and thus reduce the negative consequences of droughts and dry spells in semi-arid regions? Given the importance of managing runoff, the project focused on the harvesting of runoff to make more of the rainwater available for use by crops. With respect to this, the second question tackled by R7888 was, will rainwater harvesting lead to significant increases in crop yields and farm incomes?

Project's purpose was to *improve productivity of water in rainfed agriculture through accelerated uptake and intensive use of rainwater harvesting*. The project worked on three fronts, (i) consolidating the technical knowledge of rainwater harvesting while demonstrating the benefits of this approach to farming, (ii) awareness raising to improve the parception of policy makers with respect to the role of rainwater harvesting, and (iii) providing farmers' support agents with the technical knowledge and the skills they need to put better management of rainwater into practice. These were achieved through the promotion of findings from past research to stakeholders at different levels, from farmers to policy makers. The aim was to increase support for rainwater harvesting, in policy, strategies and programs, so that various stakeholders would take positive steps in the promotion and adoption of RWH systems, especially for agricultural production. These steps would involve the inclusion of RWH in the strategies, programs and funding by the government, district councils and NGOs.

Therefore, communication and knowledge sharing was accorded the highest attention, reaching out to policy makers, farmers' support agents, and farmers themselves. A special issue of the Tanzania Journal of Agricultural Sciences devoted to rainwater harvesting was produced, a planning guide handbook on rainwater harvesting was published and circulated widely beyond Tanzania into the whole of eastern Africa, and training programmes for the extension staff and NGOs who work directly with farmer groups, were designed and implemented. These communication, knowledge sharing and learning products are the major outputs of project R7888 that RIU can scale-up especially to promote rainwater harvesting for agriculture at regional level, as described in this proforma.

However, it must be stated up front that R7888 was built on many years of work on rainwater harvesting in Tanzania which was stated in 1991. This means that the outputs articulated and packaged by R7888 actually came from nearly 10 years of work which had gone on previously under other projects supported by IDRC and DFID. Furthermore, R7888 led to another set of major projects some stil on-going. Therefore, this proforma should be read together with those already submitted for R8116 and R8088.

List of Abbreviations

ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASDP	Agricultural Sector Development Programme of Tanzania
ASDS	Agricultural Sector Development Strategy of Tanzania
ASPS	Agricultural Sector Program Support
ATI	Agricultural Training Institutes
AWM	Agricultural Water Management
CA	Comprehensive Assessment of Water Management for Agriculture
COCOBA	Community Conservation Banks
CPRs	Common Pool Resources
DANIDA	Danish International Development Agency
DFID	UK Department for International Development
DGIS	Netherlands Development Agency
ESA	Eastern and Southern Africa
FAO	Food and Agriculture Organization of the United Nations
IFAD	International Fund for Agricultural Development
ISAR	Institut des Sciences Agronomiques du Rwanda
IWMI	International Water Management Institute
LGA	Local Government Authority
LZARDI	Lake Zone Agricultural Research and Development Institute-Ukiriguru
MDG	Millennium Development Goal
MIFIPRO	Mwanga Integrated Farming Improvement PROgramme
NGO	Non-Governmental Organization
NRSP	The Natural Resources Systems Programme
NSGRP	National Strategy for Growth and Reduction of Poverty
NZARDI	Northern Zone Agricultural Research and Development Institute-Selian
PADEP	Participatory Agricultural Development and Empowerment Project
PANTIL	Program for Agricultural and Natural Resources Transformation for Improved Livelihood
PDRCIU	Projet de Développement Rural Communautaire et intégrée d'Umutara
PIDP	Participatory Irrigation Development Project – An irrigation project based on RWH systems
RELMA	Regional Land Management Unit of ICRAF
RIPARWIN	Raising Irrigation Productivity and Releasing Water for Intersectoral Needs
RWH	Rainwater Harvesting
SACCOS	Savings and Credit Cooperative Society
SAIPRO	Same Agricultural Improvement PROgramme
SEARNET	Southern and Eastern African Rainwater Network
Sida	Swedish International Development Agency

SSA	Sub-Saharan Africa
TAJAS	Tanzania Journal of Agricultural Sciences
TIP	Traditional Irrigation and Environmental Development Organization
URT	United Republic of Tanzania
US	United States of America
VECO	Vedesailannen Country Office - An International NGO
WPLL	Western Pare Lowlands within the Mwanga and Same districts