NATURAL RESOURCES SYSTEMS PROGRAMME
FINAL TECHNICAL REPORT[1]

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Project Title

PARCHED-THIRST v2.1 Help Office and Upgrading to v2.2

Project Leader

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Organisation

Soil-Water Management Research Group
Sokoine University of Agriculture

NRSP Production System

Semi-Arid

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Abbreviations and Acronyms

AE	Agricultural Engineering
AICAD	African Institute for Capacity Development
APSIM	Agricultural Production Systems Simulator
ARI	Agricultural Research Institute
ASARECA	Association of Strengthening Agricultural Research in Eastern and Central Africa
ATI	Agricultural Training Institute
BACAS	Bureau for Agricultural Consultancy and Advisory Service
BASIC	Beginners All-Purpose Symbolic Instruction Code
CLUWRR	Center for Land Use and Water Resources Research
csv	comma separate values
DADP	District Agricultural Development Plan
DAELP	Department of Agricultural Engineering and Land Planning
DFID	Department for International Development
DMC	Drought Monitoring Center
DSSAT	Decision Support System for Agricultural Technologies Transfer
ECA	East and Central Africa
GIS	Geographic Information System
GMWD	Generators of Missing Weather Data
GO	Governmental Organization
GUI	Graphical User Interface
HTML	The Hypertext Markup Language
IMTR	Institute of Meteorology Training and Research
KUL	Katholieke Universiteit Leuven
MAFS	Ministry of Agriculture and Food Security
MIFIPRO	Mixed Farming Improvement Project
NGO	Non-Governmental Organization
NRSP	Natural Resources Systems Programme
ODBC	Open Data Base Connectivity
PT	PARCHED –THIRST
RELMA	Regional Land Management
RPA	Runoff Producing Area
RRA	Runoff Receiving Area
RWH	Rainwater Harvesting
SAIPRO	Same Agricultural Improvement Project
SCS	Soil Conservation Service
SEARNET	Southern and Eastern Africa Rainwater Harvesting Network
SIAC	Statistics in Agricultural Climatology
SS	Soil Science
SUA	Sokoine University of Agriculture
SWMnet	Soil-Water management Research network
SWMRG	Soil-Water Management Research Group
TMA	Tanzania Meteorological Agency
USDA	United State Department of Agriculture
WARFSA	Water Research Fund for Southern Africa
WMO	World Meteorological Organization
WPLL	Western Pare Lowlands

1 Executive Summary

The purpose of the project was to improve integrated management of rainwater resources, by providing a robust tool for planning and managing rainwater harvesting systems. The project was to achieve this by facilitating the availability, use and improvement of the PARCHED-THIRST software v2.1. The project was further aimed to improve awareness on the potential of the software, to provide advice and help to target users as well as to uptake and promote the use of the PT software. The project collected feedback from users and used it to improve PT version 2.1 to 2.2, 2.3 and 2.4 to make the package as user-friendly as possible. The project increased awareness and capacity in the use of the software to a wider range of clients. Specific clients targeted were District Agricultural and Extension officers (Kilosa, Morogoro and Same) and NGOs (e.g. MIFIPRO Trust Fund and SAIPRO in Mwanga and Same), Tanzania Meteorological Agency (TMA) and Ministry of Agriculture and Food Security (MAFS), Academic staff at Sokoine University of Agriculture (SUA), agricultural tutors from Ilonga and Uyole Agricultural Training Institutes (ATI) and Researchers from Ilonga and Uyole Agricultural Research Institutes (ARI). The project also established a PT Help Office at SUA, which provides help, support and advisory services on PT software.

Several activities were undertaken in order to deliver the project outputs. These included provision of the software to potential users and constant solicitation of feedback from them (at national and sub-regional levels), making the package available on the website at SUA; and promotion of PT software at SUA through workshops and seminars. The uptake promotion enabled District Agricultural and Extension Officers from Kilosa, Morogoro and Same and staff from TMA and MAFS to develop case studies using PT software, which could assist them to advise farmers and to make more informed decisions. Furthermore, staffs from SUA, ATIs and ARIs (Ilonga and Uyole) were involved in the development of a set of virtual laboratory experiments to assist in teaching undergraduate and postgraduate courses. Other activities were modification and validation of the software and development of training materials for short courses. The PT Help Office was later linked with the Computer Center where it is now housed.

SUA senior authorities have been convinced in housing the PT software under the Directorate of Computer Center, which has the mandate to develop and promote scientific software for agricultural applications. The project has also built capacity in the use of PT software to two Districts of Same and Mwanga by providing training, software and hardware. Same District and MIFIPRO have started to use the software in real-life application and develop strategies toward use of the software, respectively. Furthermore, PT software related activities were added into District Agricultural Development Plans (DADPs) in Same and Mwanga Districts with the goal of providing training to other extension officers and use the software in identifying potential areas for rainwater harvesting systems. The Tanzania Meteorological Agency has also built capacity in the use of the PT software. Currently, the Agency is working towards integrating crop performance analysis using PT software into their weather bulletins.

Most of the OVIs at output level were attained and the project was able to contribute towards the improvement of productivity of water and management through the introduction of PT software as a planning and research tool. Through this new knowledge, the project has improved the capacity of District, National and University level staff in providing support to farmers through agricultural extension.

2 Background

This project was funded by DFID/NRSP and dealt with establishment of a PT software Help office at Sokoine University of Agriculture, Tanzania; upgrading of the software to become more user-friendly and facilitating its availability to potential users. The research project was built upon earlier projects funded by DFID/NRSP all of which were concerned with the development and promotion of rainwater harvesting in semi-arid Tanzania. These included the development and validation of a computer software (PARCHED-THIRST, V1.0), which was intended to assist planners, and development agencies, in the design and management of rainwater harvesting (RWH) systems. The Project R7888, confirmed the role of rainwater harvesting in improving the livelihoods of people living in the target areas, and project R7949, supported the development of a user-friendly version of PT (V2.1), including the transfer of the source codes from the University of Newcastle (UK) to Sokoine University of Agriculture (SUA).

3 Project Purpose

The purpose of the project was to improve integrated management of rainwater resources, by providing a robust tool for planning and managing rainwater harvesting systems. The project achieved this by facilitating the availability and use of the PARCHED THIRST v2.1 by potential users. It improved awareness on the potential of the software as well as providing advice and help to target users. The project collected feedback from users and on the basis of the feedback improved and upgraded the software and produced version 2.4 to meet the needs of a wide cross-section of users. Furthermore, the project established a sustainable PT Help office at SUA to support use of the software in the long-term. The project was built from the findings of R7888, which showed that RWH for crop production is a common practice by poor farmers in the semi-arid areas of Tanzania. However, there were inadequate means and tools for optimizing planning and benefits from this technology. The purpose of this project was to contribute in filling this knowledge gap by facilitating a wider use of the PT software as a decision support tool. As a result, various stakeholders would use the software as a planning and design tool in land and water resources management in particular the promotion and adoption of RWH systems, research and training.

4 Outputs

4.1 Results and Findings

The main outputs from this project were: (i) to obtain feedback from clients on PT v2.1, (ii) to produce improved version of PT software, (iii) to implement strategies that would ensure sustainability of PT software and (iv) to implement uptake promotion of the use of PT software at national and district level.

4.1.1 Feedback and evaluation by clients

The initial feedback from clients and external evaluators were obtained and compiled. Most of the feedback were used to improve PT v2.1 to versions v2.2, v2.3 and v2.4. Detailed feedback is contained in Annex A. Major concerns from clients included:

- *Dialogue windows being wider than the size of the computer screen;*
- *The software sometimes crushed during data input manipulation without informing the user on the problem encountered;*
- *The online help needed to be linked to each dialogue boxes to provide appropriate help more quickly;*
- *More crops should be incorporated into the software to give users wide selection of crops;*
- *Training was highly required at various levels mostly at District levels;*
- *The climatic generator needed to include physical variables in addition to statistics of climatic variables that are used;*
- *There was a need to define more growth stages from emergency to tasseling;*
- *The tutorial instructions were not easy to follow, and there was a need to be streamlined;*
- *There was a need to avail detailed literature to assess formulation of the various modules in the software;*
- *There was a need to provide options for incorporating new scientific findings.*

These feedback were used to upgrade PT version 2.1 up to version 2.4 and in the identification of the type of services the PT Help office required to provide.

4.1.2 Improvement of the software

Feedback and identified problems from users were used to improve the software. The software was improved from version 2.1 to 2.2 and then further to versions 2.3 and 2.4. Some of the problems that were addressed included:

- *Frequent crushing of the software: The frequent crushing of the software was handled by including error handlers and runtime functions. Areas that needed these interventions were identified using Aivosto Project Analyzer Software.*
- *Output interface: The output interface was improved by designing a form which shows summary of the outputs in graphical form and the codes generating the outputs were separated from those running the main simulations.*
- *CLICOM data conversion: A subroutine for converting CLICOM data to PT format data was designed and incorporated into the software.*
- *Context-sensitive buttons: Context-sensitive buttons were included in all the dialogues and forms.*
- *Help file: The help file was edited so that text matched figures and missing pictures were included.*
- *Background information: References to scientific papers on PT software were added and tutorials were improved.*
- *The installation setup file which used Windows Installer, which creates an "msi" package, was replaced by "Wise" installation software, which creates an executable setup program.*

More details of the improvement of the software are contained in Annex A and in the PT software CDs versions 2.2 to 2.4.

4.1.3 Strategies for sustainability of service provision

Main requirements for sustained provision of regional service to support use of PT software to a range of clients were determined, communicated and promoted. This involved the establishment of PT Help office, the design and conducting of short courses and institutionalization of PT software at SUA. The PT Help office was established and initially housed at Soil-Water Management Research Group by June 2002. The office was later moved to the Directorate of Computer Center in March 2005. The SUA permanent staff who were members of the PT project (Prof. Filbert Rwehumbiza and Dr. Siza Tumbo) are also part of the new PT Help office in addition to the two Computer Center staff, one being an Assistant Lecturer in Computer Science and another being a Computer Analyst. Services that are being offered and activities being undertaken by the PT Help office include training, tracking of users, data provision and formatting, responding to users' queries, maintaining PT website and coordinating upgrade of PT software.

The issue of short courses was also tackled. One of the reasons for establishing short courses was income generation. The generated income would be used to sustain PT Help office. The experience during the project period showed that PT software is still at infancy and it will not be able to generate enough income for its own sustainability. It was therefore decided that the short courses on PT software will continue to be provided by the Computer Center, which has permanent staff most of whom have background in Computer Science. During the project period, the team implemented several courses to potential clients including: District Agricultural and Extension officers, Tanzania Meteorological Agency staff, participants who attended SIAC courses in 2002 and 2003 and AICAD course in Irrigation and Water Management. More details relating to the short courses or the training that were conducted are included in Annex A. These short courses contributed to the development of training materials, which resulted into the production of PT software handbook (Annex B11). The handbook contains examples suitable for various types of clients, including examples suitable for District Agricultural and Extension officers, students taking courses in Agricultural Engineering, Soil Science and Crop Science.

The other issue was concerned with linking PT Help office with Bureau for Agricultural Consultancy and Advisory Service (BACAS). It was realized the PT Help office should be linked and be based with the Directorate of Computer Center instead of BACAS. The first reason to link PT Help office with the Computer Center was the mandate given to the Center, which includes:

- *To put in place conducive and motivating environment for software development;*
- *To encourage researchers to seek computer-based technical solution to research problems; and*

- *To promote software development capability to industries applying expertise related to SUA programmes.*

The second reason was to be able to house the PT Help office in a permanent established unit of the University since the Government is covering the basic costs such as workers' salaries. Therefore, it will be much easier for it to develop. The linking process with the Computer Center was challenging and involving than initially thought of. The process involved writing an official letter, conducting joint training activities, involving the Computer Center in PT workshops and upgrading of the software.

Another area of sustainability involved working closely with target Districts, MAFS, TMA and SUA. The use of PT software package will be sustainable if clients have been brought to the realization of the PT software importance and their capacity built. The project provided training and computers to the two target districts of Same and Mwanga. In each district, three officers were trained. The project also provided training to TMA staff and some academic staff at SUA in the Departments of Agricultural Engineering, Soil Science and Crop Science. The same staff have been involved in designing strategies for sustainability of the software as detailed in Annex A.

4.1.4 Uptake Promotion of the PT Software

The uptake promotion of the PT software involved the development of case studies and virtual experiments. The process involved participants from district agricultural offices from Kilosa, Morogoro and Same; researchers from Uyole and Ilonga Agicultural Reseach Institutes; Tutors from Uyole and Ilonga Agricultural Training Institutes; Academic staff from Sokoine University of Agriculture, Tanzania Meteorological Agency and the Ministry of Agriculture and Food Security. Two training sessions were organised for participants who were not conversant with the software i.e. those from districts, research and training institutes, before embarking to the development of the final products.

For the other groups, the approach used was that of writeshops. Participants proposed titles/topics they wish to develop with the PT software and other panellists were allowed to comment on them for improvements.

4.2 Achievements

Most of the targets that were set out during project inception and the UP phase were achieved, especially upgrading the software to be more user-friendly and establishment of the PT Help office. The list below highlights some of the achievements that the project was able to achieve during implementation:

- *The software was successfully upgraded and the current version (V 2.4) is more user-friendly compared to version 2.1. There was a successful production of version 2.2, which was followed with production of versions 2.3 and 2.4;*
- *Same District has used the software to identify appropriate areas for underground water storage systems, whereas MIFIPRO has distributed rain gauges to collect rainfall data to be used in the PT software l;*
- *Establishment of a website at SUA and a mirror site at Katholieke Universiteit Leuven (KUL), Belgium;*
- *Extra funding from Water Research Fund for Southern Africa (WARFSA) for adding macro-catchment sub-routine, which will lead to the production of PT v3.0; and a PhD dissertation;*
- *Involved in the joint project between Katholieke Universiteit Leuven (KUL)in Belgium and Makerere University in Uganda in the transfer of PT software to Lake Victoria Basin as resource persons;*
- *The software has been used to analyze maize yield in Same and Mwanga Districts;*
- *SUA authorities have acknowledged PT to be one of the outstanding professional products of SUA and more academic staff have started to explore possibility of using it as a virtual laboratory for their students. Currently, two courses, one in Soil Science and another is Agricultural Engineering, are using PT software package;*
- *Departments of Agro-meteorology and Food Security and Early Warning in the Tanzania Meteorological Agency and Ministry of Agriculture and Food Security, respectively, have acknowledged and accepted the software as one of the tools that they would use to add value to their data and reports.*
- *Six District-level frontline extension staffs from three districts (Kilosa, Morogoro and Same) have been trained in the use of PARCHED-THIRST (PT) software..*

- *Three districts (Kilosa, Morogoro and Same) have been able to use PT software to address issues in their own areas.*
- *Four National-level staffs, two from the Ministry of Agriculture and Food Security – Crop Monitoring of Early Warning Systems and two from Tanzania Meteorological Agency – Agro-meteorology Department, have been capacitated in the use of PT software through involving them in the development of case studies. The case studies were identified by them.*
- *University lecturers (Sokoine University of Agriculture) and college tutors (Ilonga and Uyole Training Institutes) were able to realize the importance of PT software in carrying out virtual laboratory experiments and therefore they have designed and developed experiments to make use of the PT software..*
- *A national from Burundi has been trained in the use of the PT software*

4.3 Things to be Done to take Research Findings Forward

Several issues identified during solicitation of clients' needs and feedback can be used to formulate the way forward beyond the project lifetime. Some of the critical issues that need to be taken forward immediately include:

- *Uptake and promotion of the software in Colleges of Agriculture including Sokoine University of Agriculture: Deliberate efforts need to be done to develop virtual laboratory exercises that will be used in different course. About 13 courses have the potential of using PT software as a virtual laboratory at SUA alone. This is an important strategy at the moment because majority of graduates from SUA are now being employed by Districts. Therefore, this approach will accelerate uptake of PT at District levels.*
- *Inclusion of nutrient component in the software: Since PARCH version 2.1 has subroutines for nutrients such as Nitrogen and Phosphorus, which are also very important in Tanzania; SWMRG will discuss this with University of Nottingham and specifically Dr. Neil Crout to acquire these subroutines. The advantage of including those subroutines is because PT software is Windows-based while PARCH is still DOS-based.*
- *Inclusion of other crop varieties: Including maize varieties, such as staha and hybrid, will increase significantly software visibility to a wider community in Tanzanian. This will also open a window to countries in East, South and Central Africa sub-region.*
- *Development of soil and climatic databases: There is a need to build a strong database on soils and climatic data for different locations in the country. Experience has shown that people would like to test the software by applying it to the environment that they are used to. Currently, it is almost impossible to get daily weather data and when accessible the price is extremely high.*
- *Add GIS capabilities: Geographic information system (GIS) has revolutionalized analysis of information having geographic dimension. Some of the agro-hydrological packages now come bundled with GIS functionality. Addition of GIS capabilities to PT software will ensure that the software stays with cutting-edge technologies and therefore improve attraction to potential users.*
- *Software upgrading: Improvement of the software is a continuous process. Therefore, PTl like any other software needs continuous improvement as new needs and requirements arise. Some of the needs and requirements were not fulfilled within the project timeframe, therefore, the PT Help office will have to coordinate or look for funds so that those needs can be fulfilled.*
- *Training of Agricultural and Extension Officers: Staff in the Districts and at the Headquarters of the Ministry of Agriculture and Food Security need training in agro-hydrological simulation models such as PT software. Most staff trained in the use of the software have shown great interest and advised the need to train more staff and training period to be about two weeks (Annex A).*
- *Championing the uptake, promotion, tracking and support for the PT software. This requires full dedication to PT software by a network of champions at this infancy stage for not less than 5 years. The current possibility is a network of champions at Sokoine University of Agriculture (Tanzania), University of Newcastle Upon-Tyne (UK), Katholieke Universiteit Leuven (Belgium) and Makerere University (Uganda).*

4.4 Research Products

PT version 2.2, 2.3 and 2.4

These products (Annex B14) are software compiled available in CD format and version 2.3 is available on SUA and KUL website.

PT Handbook

The handbook (Annex B11) is available as an electronic document in Microsoft Word and Acrobat formats. It contains brief background information on the software and application examples relevant to different areas of specialization such as in agricultural extension in rainwater harvesting systems for crop production, crop science, soil science and agricultural engineering.

PT Flier

This flier (Annex B12) contains background information on PT software and highlights some of areas that PT software can be used.

PT Poster

The poster (Annex B13) also contains background information on PT software and some of the areas that PT can be used. In addition, it contains pictures of the Vice President of United Republic of Tanzania and Minister of Science, Technology and Higher Education receiving some information from Prof. Nuhu Hatibu on PT Software.

Scientific papers

Mzirai, O. B., Rwehumbiza, F. B., Tumbo, S. D. and Hatibu, N. 2003. PARCHED THIRST model: Introduction and How to get Started. SWMnet Discussion Paper No. 2, System Databases and Simulation Models as Tools for Soil and Water Management in ECA. In Hatibu, N and Rao, K. P. C. (Eds.). Towards Increased Research Efficiency and Impact. Report on a Regional Workshop held at ICRAF Campus, Nairobi, 28 – 30 October 2002. 54 – 56.

Tumbo, S. D., Mpulila, T, Mzirai, O. B., Mahoo, H. F., Rwehumbiza, F. B., Semoka, J. R. M., Hatibu. N. 2005. Maize yield simulation under rain-fed and rainwater harvesting systems Using Parched-Thirst model. Paper presented at the East Africa Integrated River Basin Management Conference, held at ICE, Sokoine University of Agriculture, Morogoro, Tanzania, 7 – 9th March, 2005. 8pp. (Annex

Mzirai, O. B, Tumbo, S.D., Bwana, T., Hatibu, N., Rwehumbiza, F.B. and Gowing, J.W. 2005. Evaluation of Generator of Synthetic Missing Weather Data Required for Agro-hydrological Modeling and Water Management Planning in Agriculture and Other Sectors: The case of the PARCHED-THIRST Weather Generator (PTWG) and Marksim Models. Paper presented at the East Africa Integrated River Basin Management Conference, held at ICE, Sokoine University of Agriculture, Morogoro, Tanzania, 7 – 9th March, 2005. 12pp.

Teaching Compendia

Tumbo, S. D. and Mahoo, H. F. (Eds). 2005. A Manual for Virtual Experiments in Agriculture: The Use of PARCHED-THIRST Software in Agricultural Systems Simulations. Sokoine University of Agriculture, Morogoro. 107p.

Mwalukasa, E. H., Mohamed, J. K., Mathew, L., Mbiza, A. B. C., Tumbo, S. D. and H. F. Mahoo. 2005. A Manual for Virtual Laboratory Experiments in Agriculture for Agricultural Colleges: The Use of PARCHED-THIRST Software in Agricultural Systems Simulations. 29p

Posters

Using the PARCHED–THIRST Software to Determine Appropriate Water Management Practices for Maize Production: A Case Study of Fulwe Village in Morogoro District.

Using PARCHED – THIRST Software to Match the Catchment Area to the Cropping Area in Rainwater: Harvesting System: The Case Study of a Field in Makanya Village in Same District.

PARCHED–THIRST SOFTWARE as a Tool for Understanding Importance of Soil and Water Conservation Measures: A Case Study of Vidunda Village in Kilosa District.

Using PARCHED–THIRST Software to Understand Drought and Planting Dates for Morogoro Peri-urban, Tanzania.

Using PARCHED–THIRST Software to Forecast Maize Yield.

Case Studies

Tarimo. F. R., Munga, J. J., Tumbo, S. D., Mapulila, T and Rwehumbiza F. B. 2005. PT Software as a Tool for Studying Farming and Conservation Measures in High Slope Areas: Case-Study of Vidunda Village in Kilosa District for Kilosa District. SWMRG Publication. 13p.

Pangapanga, C. P., Marijani, B. J., Tumbo, S. D., Mapulila, T. and Rwehumbiza, F. B. 2005. The Use of PT Software in Determining Appropriate Management Practices for Maize production in Fulwe Village in Morogoro District for Morogoro District. SWMRG Publication. 12p.

Mjema, H. E., Magohe, E. E., Mjenga, J. O., Tumbo, S. D., Mzirai, O. B., and Mahoo, H. F. 2005. Using PT Software to Understand the Importance of Rainwater Harvesting in Semi-Arid/Arid Areas: The Case Study of a Field in Makanya Village, Same District for Same District. SWMRG Publication. 12p.

Ntikha, O. Tibanyenda, C., Tumbo, S. D., Mahoo, H. F. and Mbanguka, R. P. 2005. Using PARCHED-THIRST Software and Seasonal Rainfall Forecasts to Forecast Maize Yield: The Case of Morogoro Peri-Urban. SWMRG Publication. 12p.

Hyera, T. M., Mboya, M., Tumbo, S. D., Mahoo, H. F., Mzirai, O. B., and Mbanguka, R. P. Use of PT software to study drought recurrence and planting dates in Tanzania: A Case of Morogoro Peri-Urban. SWMRG Publication. 15p.

4.5 Promotion of Products

One of the project objectives was to promote PT software in Tanzania and in East, Central and Southern Africa. Within Tanzania, the software was promoted at Sokoine University of Agriculture, target Districts (Same and Mwanga), Ministry of Agriculture and Food Security and Tanzania Meteorological Agency. It was also promoted through various events such as conferences and exhibitions in the country. For example, the software was launched in the country by the Minister of Science, Technology and Higher Education (Annex B15). In that event, key directors from different Ministries and organizations attended. Some of the directors who attended were from Commission of Science and Technology, Research and Development in the Ministry of Agriculture and Food Security and Tanzania Meteorological Agency.

In East, Central and Southern Africa Sub-region, the software was promoted through SIAC courses, which were conducted annually in Nairobi, Kenya; through SEARNET and SWMnet, which are both regional level organizations dealing with rainwater harvesting and soil and water management research, respectively. The launching at sub-regional level was done during SEARNET Annual Conference in Zambia in 2002, where representatives from 10 countries attended (Annex A). This was followed by promotion of the software at the SWMnet workshop in October 2002. Participants from 10 countries attended this workshop. Details of the promotion initiatives at National and Regional levels are contained in Annex A.

There has been greater awareness on the need of scientific methods in decision making at District, National and University level. For example, an NGO in Mwanga District, the Mixed Farming Improvement Project (MIFIPRO) Trust Fund has strengthened its efforts in daily rainfall data recording and fabricated more rain gauges and distributed them to their target villages. This happened after one of the MIFIPRO staff attended PT software training and underscored the importance of rainfall data in yield prediction and analysis in rainwater harvesting systems. In Same District, the software is being used to determine best locations for water storage systems. The Tanzania Meteorological Agency has realized that the PT software can be a useful tool for seasonal yield analysis. SUA academic staff have been convinced that PT can be used as a virtual laboratory in different courses offered at SUA and initiatives are underway to promote the software at Farmers' and Trade and Industries shows. At sub-regional level, simulation models are receiving more attention through SWMnet and the Drought Monitoring Center (DMC) both with headquarters in Nairobi, Kenya. The new SIAC courses will put more emphasis in the use of models in adding value to climatic data.

Agro-hydrological models such as PT software are likely to dominate the future of agricultural extension, research and training because of the decrease in prices of computers, the increase in computing power, the

increase in computer literacy and cost of physical data collection (e.g. yield data). Different professionals, at the International, National, District and University levels, whom the project interacted with have shown strong or renewed interest in either modeling or use of models for extension, research and teaching. In general, the promotion of PT software has awakened the dream of many agricultural professionals especially within SUA, who had already despaired with the possibility of using these types of advanced technologies. Some of them had already received training in modelling but had not seen efforts being made towards its use in the real world. This shows the impact of interactive promotion of the model with potential clients.

5 Research Activities

The activities undertaken in this project were aimed at achieving the four main outputs, which were (1) to determine clients' needs for further improvement of PT software, (2) to develop and communicate improved version of PT software package, (3) determine, communicate and promote requirements for sustained provision of service to support use of PT software and (4) Uptake promotion of PT through development and design of case studies, development and design of virtual laboratory experiments.

5.1 Activities 1.1 to 1.6 for the 1st Output

The questionnaires were designed and distributed with CDs to 138 clients, registered in our database, by mail and others in person during workshops and training sessions such as the SIAC courses (Annexes A and B1). The software was made available at SUA website for clients to download but the tracking in the number of downloads was difficult because the implementation did not force clients to register themselves before they can be given access to download. Recently, a mirror site has been established at KUL and the site forces clients to register before they can download the software.

Launching of the software was done by the Minister of Science, Technology and Higher Education in Tanzania in which several directors of different departments in the line Ministries attended and were presented with PT software package CDs. At the regional level, the software was launched during the SEARNET workshop in Zambia and all National Coordinators of Rainwater Harvesting Associations from 10 different countries were presented with CDs of PT so were representatives of 10 countries to SWMnet workshop in Nairobi.

Facilitation so that the software is used as a teaching aid at SUA was done by integrating some components of the software into two courses: Rainwater Harvesting (AE 317) and Land Husbandry and Conservation (SS 302). The software was also demonstrated to the Vice President Hon Fredrick Sumaye during National Water Week, Members of Parliament who visited SUA and to the Minister of Works during Engineers' day in 2004.

5.2 Activities 2.1 and 2.2 for the 2nd Output

Feedback from clients and reviewers, in the first output (Section 5.1), were analyzed. Feedback directly concerned with improving the software to become more user-friendly, such as frequent crushing of the program, was used in the production of improved versions of PT software. Those feedback, which required scientific input such adding more crop varieties/cultivars, were left to be addressed in future research projects.

Since improvement of models is a continuous process, after incorporation of some initial feedback from users and external reviewer, version 2.2 was produced in May 2003. More feedback were incorporated (including the previous initial feedback that were not included in version 2.2 and feedback from SIAC course in 2003) and this led to the production of version 2.3 in December 2003. Further feedback and evaluation of version 2.3 led to the production of version 2.4 in January 2005.

The tools used in producing these versions included Visual Basic 6 development environment, Project Analyzer for Visual Basic, Visustin software for visualization of flow charts, Microsoft HTML Help Workshop and Wise for Windows Installer (Annex A). The software was also validated using data from rainfed and rainwater harvesting systems. The results were presented during the East Africa River Basin Management Conference held in March 2005 at Sokoine University of Agriculture, Morogoro, Tanzania.

5.3 Activities 3.1 to 3.3 for the 3rd Output

The PT Help office was established within SUA at the Soil-Water Management Research Group office to provide help, support and advisory services to clients. The PT Help Office was then moved to the Directorate of Computer Center. Short courses/course modules on PT software were developed with the intention of improving its use. Courses involving PT only and some incorporating PT software were conducted to various categories of clients, inside and outside the country, with background in agriculture, agronomy, extension, irrigation, civil engineering and meteorology. The PT Help office was linked with the Directorate of Computer Center instead of BACAS. The process involved negotiation with the Computer Center, training of its staff and jointly working in training District Agricultural and Extension officers and production of PT software version 2.4. The process involved the Dean of Faculty of Agriculture, the Head of Department of Agricultural Engineering and Land Use Planning, senior academic staff with background in modeling in the Departments of Agricultural Engineering and Land Planning, Soil Science and Crop Science.

5.4 Activities for uptake promotion

Training on the use of PARCHED-THIRST software was done to agricultural extension officers from three districts of Kilosa, Morogoro and Same, Agricultural College Tutors from Ilonga and Uyole Agricultural Training Colleges and Agricultural Researchers from Ilonga and Uyole Agricultural Research Institutes. The two Agricultural Institutes were responsible in the breeding and release of TMV1 and TMV2 maize varieties. These varieties are used in the PT software. Case studies were developed by the three Districts (Kilosa, Morogoro and Same) and by the Ministry of Agriculture and Food Security and Tanzania Meteorological Agency. The case studies were used to develop posters, which are simple and can easily attract other development workers in the Government and Non-Government organizations. Virtual laboratory experiments were designed and developed by lecturers at Sokoine University of Agriculture and by tutors and researchers of Ilonga and Uyole Training and Research Institutes. These stakeholders were assisted in the development of the knowledge sharing products by the PT Help office comprising members from Soil-Water Management Research Group and the Computer Centre, which house the Help office. The feedback workshop was substituted with publishing of the manual for virtual laboratory experiments, case studies and posters so that the products can reach as many people as possible within and outside Tanzania. The five computers that were planned to be purchased were substituted with the purchase of 50 used computers from Computer Aid (UK) so that enough computers will be made available to frontline extension staff to provide advise to farmers, to students at University and the two Agricultural Colleges so that they can get adequate exposure and practice in the use of PARCHED-THIRST software. Moreover, a National from Burundi was fully involved in the uptake promotion process hence participated in the development of case studies and virtual experiments using the PT software.

6 Environment assessment

6.1 Environmental Impacts from the Research Activities

The project did not have any negative environmental impact because it mainly focussed on improvement of the software so that it becomes user-friendly using feedback from clients. The second focus was promotion and validation of the software. If anything, it contributed positively towards better planning of land and water resources.

6.2 Their Effects in the Dissemination and Application of Research Findings

The likely positive environmental impacts after widespread dissemination will be better and improved planning and design of rainwater harvesting systems with good mitigation measures for both upstream and downstream locations and communities.

6.3 Evidence During the Project's Life and its Detection and Monitoring

There was no evidence on environmental impact during the project's life.

6.4 Recommended Follow up Action

It is recommended that the adoption and use of PT software be monitored at watershed level to keep track with respect to its effect on upstream/downstream water supply.

7 Contribution of Outputs

7.1 The Contribution of Outputs to NRSP's Purpose

The NRSP's purpose aimed at developing and promoting improved strategies for scaling-up the integrated management of rainwater that benefit the poor in semi-arid areas. This project contributed to the purpose by facilitating the availability and use of PT software for planning and management of rainwater harvesting systems to organizations responsible for providing advice (Same and Mwanga Districts, TMA and SUA) to farmers in semi-arid areas. The purpose was attained through upgrading of the software, building capacity of target users and establishment of the PT Help office. First, the original version of the package (PT v2.1) had to be upgraded to a level that was acceptable to users. Therefore, the software was upgraded up to version 2.4. Second, the project contributed to capacity building of potential clients who will use the software to assist poor farmers in semi-arid areas in the proper management of rainwater. Lastly, the project facilitated the establishment of the PT Help office within the Directorate of Computer Center at SUA which will support software users.

7.2 Attainment of OVIs at Purpose Level

OVI 1: By December 2004, SUA senior authorities are sufficiently convinced of demand for PT software to take essential steps to sustain PT Help Office in SUA's system for service provision

SUA senior authorities have been convinced of the demand for PT software for teaching, research and extension purposes. The Administration has realized that the software can be used to enhance training to more than 12 undergraduate and graduate courses. The software can be used as a research tool due to its capability of explaining daily effects of input variables and daily responses of output variables. The software can be used to advise farmers on the best planting dates, for the need of supplementary irrigation and many others especially if the software could be improved to include nutrient subroutine and more crop cultivars. The main administrative authority, which is the Directorate of Computer Center, has taken the step in housing the PT Help office that will also serve for other types of specialized software for agricultural applications (Appendix 1).

The process of convincing SUA senior authorities took longer than expected by both the project team and the SUA community. During promotion, the team realized that the software had more problems that required to be addressed than originally thought. Therefore, the project had to concentrate on the pre-requisites for software acceptability, which were improving the software to be more user-friendly, find means to validate the software and find areas, which the software could be used to solve real-life problems.

On the SUA administration side, the team identified two problems that could have hampered PT hosting, which were higher staff turnover and accepting new responsibilities. As is the case in other developing countries, professionals in computer science are few in comparison to the demands. Since the SUA salary scheme could not compete with those of private organizations, the Directorate of Computer Center has faced very high staff turnovers. It was until recently when demand and supply started to stabilize and SUA increased the salaries that the high turnover has stopped. Accepting new responsibilities sometimes has negative effects otherwise thorough analysis and evaluation is done. Due to lack of experts, the Directorate of Computer Center was in a difficult position to decide the hosting of the software. Through its new staff, the Directorate of Computer Center was able to independently evaluate the software and identify benefits that could be brought by housing it. Now, the software is being hosted by the Directorate of Computer Center at SUA.

OVI 2: By December 2004, at least one client builds capacity for use of PT software

The uptake promotion component extended the number of clients capable of using PT software in terms of numbers and ability. Same District and TMA, who had some capacity in the use of PT software package, their knowledge were extended further and are now more comfortable in the use of PT. Morogoro and Kilosa Districts, Ministry of Agriculture and Food Security, lecturers of Sokoine University of Agriculture and

tutors of Ilonga and Uyole Agricultural Training Institutes were the other stakeholders, whom their capacity were increased through training, development of case studies and virtual experiments and provision of computers. In addition, a National from Burundi who participated in the uptake promotion was made sufficiently conversant with the PT software.

OVI 3: By December 2003, at least one target district has produced improved RWH plans assisted by the PT software

Target districts partially used PT in the production of RWH plans. Same District used PT software to design a new charco-dam and RWH structures under RELMA and SASAKAWA Global 2000 projects, both funded through the District, directly. More details are provided in Appendix 2. Therefore, in order for the districts to be able to use the software to develop RWH plans, comprehensive databases of soils, crop and weather, will need to be built, efforts that are currently being undertaken after the staff were exposed to the PT software. For example, MIFIPRO has distributed rain gauges in its target area. Same District is currently soliciting training opportunities for its staff in the area of geographic information system (GIS) to build databases for the district that will include areas under crop production, soil and climatic information.

In summary, the two districts are using the software to identify areas suitable for underground water storage systems and advising farmers on proper RWH systems for crop production. The software allowed Districts staff to determine the amount of runoff from the catchments of interest and therefore to design water storage structures of appropriate sizes.

OVI 4: By September 2003, PT has been adopted by at least one Meteorology Department as an example of a value added product utilizing weather data

The Tanzania Meteorological Agency (TMA) has shown interest to adopt the PT software to add value to their weather reports. The TMA is planning to use the software to perform seasonal yield analysis, which will explain the effects of the amount and distribution of rainfall and the length of rainfall season. The TMA is also thinking of using the software for yield forecasting using seasonal weather forecasting and analogue years. This was learnt by the project team interactions with TMA staff during PT training, workshops and seminars. A letter of commitment by the TMA in using the software in their applied and research activities is shown in Appendix 3.

It has to be realized that changing people's conventional way of thinking and their way of doing things is not an overnight activity as it was originally thought. The three years project period was not enough for TMA to adopt the software to the extent of starting producing information to the public using PT. Therefore, the Help office will have to continue to support TMA towards use of the software.

7.3 Impact on Research Partners, Stakeholders, Policy Approaches and Techniques

Interaction with research partners and stakeholders has helped to change their mindset about models, which was viewed as just programming exercises. For example, the target Districts, TMA and MAFS realized that they could use crop models, such as PT, to advice farmers and perform some crop performance analysis (ANNEX B8). According to the District Agricultural and Extension Officers and NGOs, some of the opportunities that the software provides included, being able to advise farmers on proper techniques for rainwater harvesting, planting dates and assessment of weed effect. The mentioned PT opportunities to TMA and MAFS included, using it for verification of seasonal weather forecast, yield estimates and as a complimentary tool to FAO/WRSI software. Furthermore, MAFS indicated that if the software could be improved further to include more maize cultivars and nutrient subroutine then they could use it to estimate seasonal maize yields for the whole country. The yield estimates is one of the element considered by policy makers in formulating agricultural policies. The current method, which uses survey methods, is unreliable.

7.4 Promotion of Research and Experience

Further uptake promotion of the PT software is required urgently because some stakeholders have shown great interest on it in the ECA sub-region. There is already a small project in Uganda that is promoting uptake of PT. In Tanzania, some relevant SUA staff have shown interest in integrating the software into their courses. Target districts, TMA and MAFS have shown interest in the use of the software to advice farmers, seasonal weather analysis and yield estimate and forecasting, respectively. It is proposed to have a project that will focus its promotion in Tanzania to solidify the current successes that have been achieved. The promotion should focus on three main areas as follows:

- building existing and new capacities of district staff in the use of the software for extension and planning purposes,
- building existing and new capacities in agricultural colleges in the use of the software for extension, applied research and training
- building database for weather, soil and some crop cultivars for wider application of PT software

The proposed project is planned to start 1st June 2005 and end 31st March 2006. The detailed proposal is attached as Appendix 4.

8 Publication and Other Communications Materials

8.1 Symposium, conference, workshop papers and posters

Tumbo, S. D., Mwakalila, S., Mzirai, O. B., Rwehumbiza, F. B., and Hatibu, H. 2003. Tanzania Country Paper. SWMnet Discussion Paper No. 2, System Databases and Simulation Models as Tools for Soil and Water Management in ECA. In Hatibu, N and Rao, K. P. C. (Eds.). Towards Increased Research Efficiency and Impact. Report on a Regional Workshop held at ICRAF Campus, Nairobi, 28 – 30 October 2002. 30 – 32.

Rwehumbiza, F. B., Mzirai, O. B., and Tumbo, S. D. 2003. Issues Paper on Research and Development in the Management of Soil and Water: The Role for Models. SWMnet Discussion Paper No. 2, System Databases and Simulation Models as Tools for Soil and Water Management in ECA. In Hatibu, N and Rao, K. P. C. (Eds.). Towards Increased Research Efficiency and Impact. Report on a Regional Workshop held at ICRAF Campus, Nairobi, 28 – 30 October 2002. 37 – 38.

Mzirai, O. B., Rwehumbiza, F. B., Tumbo, S. D. and Hatibu, N. 2003. PARCHED THIRST model: Introduction and How to get Started. SWMnet Discussion Paper No. 2, System Databases and Simulation Models as Tools for Soil and Water Management in ECA. In Hatibu, N and Rao, K. P. C. (Eds.). Towards Increased Research Efficiency and Impact. Report on a Regional Workshop held at ICRAF Campus, Nairobi, 28 – 30 October 2002. 54 – 56.

Tumbo, S. D., Mpulila, T, Mzirai, O. B., Mahoo, H. F., Rwehumbiza, F. B., Semoka, J. R. M., Hatibu. N. 2005. Maize yield simulation under rain-fed and rainwater harvesting systems Using Parched-Thirst model. Paper presented at the East Africa Integrated River Basin Management Conference, held at ICE, Sokoine University of Agriculture, Morogoro, Tanzania, 7 – 9th March, 2005

Mzirai, O. B, Tumbo, S.D., Bwana, T., Hatibu, N., Rwehumbiza, F.B. and Gowing, J.W. 2005. Evaluation of Generator of Synthetic Missing Weather Data Required for Agro-hydrological Modeling and Water Management Planning in Agriculture and Other Sectors: The case of the PARCHED-THIRST Weather Generator (PTWG) and Marksim Models. Paper presented at the East Africa Integrated River Basin Management Conference, held at ICE, Sokoine University of Agriculture, Morogoro, Tanzania, 7 – 9th March, 2005

8.2 Academic theses

Rubarenzya, M.H. 2003. Analysis of rainwater harvesting by PARCHED-THIRST model, MSc. Dissertation. Katholieke University Leuven, Belgium. 92pp

Kazuzuru, B. 2004. Potential for rainwater harvesting. MSc Dissertation. School of Applied Statistics, University of Reading, UK. 131pp

8.3 Extension-oriented leaflets, brochures and posters

Soil-Water Management Research Group. 2003. PARCHED-THIRST Model for Rainwater Harvesting. *SWMRG Flier*. Morogoro, Tanzania. Soil Water Management Research Group.

Soil-Water Management Research Group. 2003. PARCHED-THRIST Model – A Planning, Research and Teaching Tool. *SWMRG Poster*. Morogoro, Tanzania. Soil Water Management Research Group.

Soil-Water Management Research Group. 2005. Using the PARCHED–THIRST Software to Determine Appropriate Water Management Practices for Maize Production: A Case Study of Fulwe Village in Morogoro District. *SWMRG Poster*. Soil-Water Management Research Group.

Soil-Water Management Research Group. 2005. Using PARCHED – THIRST Software to Match the Catchment Area to the Cropping Area in Rainwater: Harvesting System: The Case Study of a Field in Makanya Village in Same District. *SWMRG Poster*. Soil-Water Management Research Group.

Soil-Water Management Research Group. 2005. PARCHED–THIRST SOFTWARE as a Tool for Understanding Importance of Soil and Water Conservation Measures: A Case Study of Vidunda Village in Kilosa District. *SWMRG Poster*. Soil-Water Management Research Group.

Soil-Water Management Research Group. 2005. Using PARCHED–THIRST Software to Understand Drought and Planting Dates for Morogoro Peri-urban, Tanzania. *SWMRG Poster*. Soil-Water Management Research Group.

Soil-Water Management Research Group. 2005. Using PARCHED–THIRST Software to Forecast Maize Yield. *SWMRG Poster*. Soil-Water Management Research Group.

8.4 Manuals and guidelines

Mzirai, O.B., Bwana, T., Tumbo, S. D., Rwehumbiza, F.B. and Mahoo, H. F. 2004. Kijitabu cha maelezo juu ya utumiaji wa PARCHED-THIRST modeli. AICAD, Morogoro, Tanzania .24pp

Mzirai, O.B., Bwana, T., Tumbo, S. D., Rwehumbiza, F.B. and Mahoo, H. F. 2004. Utumiaji wa kompyuta na visaidizi vyake katika kupanga mipango endelevu ya maji katika kilimo. AICAD, Morogoro, Tanzania .19pp

Mzirai, O.B., Bwana, T., Tumbo, S. D., Rwehumbiza, F.B. and Mahoo, H. F. 2004. Parched-Thirst Handbook, SWMRG, Sokoine University of Agriculture. Tanzania. 65 pp

Bwana, T., Tumbo, S. D., Muhana, G. and Runanu, P. 2003. Application and Modeling: Rainwater and PARCHED-THIRST model (Climatic Generator Component), SWMRG, Sokoine University of Agriculture, Tanzania. 27pp

Tumbo, S. D. and Mahoo, H. F. (Eds). 2005. A Manual for Virtual Experiments in Agriculture: The Use of PARCHED-THIRST Software in Agricultural Systems Simulations. Sokoine University of Agriculture, Morogoro. 107pp.

Mwalukasa, E. H., Mohamed, J. K., Mathew, L., Mbiza, A. B. C., Tumbo, S. D. and H. F. Mahoo. 2005. A Manual for Virtual Laboratory Experiments in Agriculture for Agricultural Colleges: The Use of PARCHED-THIRST Software in Agricultural Systems Simulations. 29pp

8.5 Media presentations

Television: PT Model Launching by Minister of Science, Technology and Higher Education on ITV (T) Television

Internet: http://www.suanet.ac.tz/cc/PTmodel.htm

8.6 Reports and data records

8.6.1 Internal project technical reports

Bwana, T., Mzirai, O. B., Tumbo, S. D., Rwehumbiza, F.B. and Hatibu, N. 2003. Use of Parched Thirst v2.2 in SIAC course Nairobi, SWMRG, Sokoine University of Agriculture, Tanzania. 14pp

Tarimo. F. R., Munga, J. J., Tumbo, S. D., Mapulila, T and Rwehumbiza F. B. 2005. PT Software as a Tool for Studying Farming and Conservation Measures in High Slope Areas: Case-Study of Vidunda Village in Kilosa District for Kilosa District. SWMRG Publication. 13pp.

Pangapanga, C. P., Marijani, B. J., Tumbo, S. D., Mapulila, T. and Rwehumbiza, F. B. 2005. The Use of PT Software in Determining Appropriate Management Practices for Maize production in Fulwe Village in Morogoro District for Morogoro District. SWMRG Publication. 12pp.

Mjema, H. E., Magohe, E. E., Mjenga, J. O., Tumbo, S. D., Mzirai, O. B., and Mahoo, H. F. 2005. Using PT Software to Understand the Importance of Rainwater Harvesting in Semi-Arid/Arid Areas: The Case Study of a Field in Makanya Village, Same District for Same District. SWMRG Publication. 12pp.

Ntikha, O. Tibanyenda, C., Tumbo, S. D., Mahoo, H. F. and Mbanguka, R. P. 2005. Using PARCHED-THIRST Software and Seasonal Rainfall Forecasts to Forecast Maize Yield: The Case of Morogoro Peri-Urban. SWMRG Publication. 12pp.

Hyera, T. M., Mboya, M., Tumbo, S. D., Mahoo, H. F., Mzirai, O. B., and Mbanguka, R. P. Use of PT software to study drought recurrence and planting dates in Tanzania: A Case of Morogoro Peri-Urban. SWMRG Publication. 15pp.

Bwana, T., Mzirai, O.B., Tumbo, S. D., Rwehumbiza, F.B. Hatibu, and N. 2003.Promotion of Parched-Thirst v2.2 and Assessment of Potential Users in WPLL and Maswa Districts. SWMRG, Sokoine University of Agriculture, Tanzania. 10pp

8.6.2 Software applications

PARCHED-THIRST Software v2.3 Released December 2003

PARCHED-THIRST Software v2.4 Released January 2005

8.6.3 Project web site

http://eng.suanet.ac.tz/swmrg/PTmodel.html

http://www.agr.kuleuven.ac.be/vakken/IC03_IC04/runoffirri/PTmodel_download.aspx

9 R8088A - Project Logical Framework

Title: **Improved Pro-poor Strategies for Scaling-up the Integrated Management of Rainwater in Semi-arid Areas**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Key Assumptions
GOAL = NRSP SA Output 1: Strategies for improving the livelihoods of poor people living in semi-arid areas, through improved integrated management of natural resources, under varying tenure regimes, developed and promoted	By 2002, livelihood strategies of poor individuals, households and communities including their dependence on the various components of the NR base, and the relative importance of access to common pool resources, in target areas in at least 2 target countries, understood By 2005, strategies for improving the livelihoods of poor people, by increasing the productivity of water in rainfed agriculture, through the use of appropriate rainwater harvesting and/or soil nutrient management practices, developed and promoted in target areas in at least two target countries By 2005, strategies that improve access to, and sustained use of, common pool resources by the poor under the most appropriate tenure and management regimes identified, tested and promoted in at least one target area in each of 2 target countries	Reviews by programme manager Reports of research team and collaborating /target institutions Appropriate dissemination products Local, national and international statistical data Reviews by programme manager Reports of research team and collaborating /target institutions	
PURPOSE: Improved strategies for scaling-up the integrated management of rainwater that benefit the poor in semi-arid areas **Developed** and **Promoted**	• By June 2005, at least 3 approved District agricultural Development Plans (DADPs) contain comprehensive plans and activities for integrated management of rainwater	DADP Documents submitted and approved by the ASDP	Target beneficiaries adopt and use the developed strategies and/or approaches
Component 1: – HELP Office and Upgrading of the PARCHED-THIRST Model Improving access to and service provision for the uptake and use of the PARCHED-THIRST model for improving RWH systems	• By Dec 2004, SUA senior authorities are sufficiently convinced of demand for PT software to take essential steps to sustain PT Help Office in SUA's system for service provision • By Dec 2004, at least one client builds capacity for use of PT software • By December 2003, at least one target district has produced improved RWH development plans assisted by the PT software • By September 2003, PT software has been adopted by at least one Meteorology Department as an example of a value added product utilising weather data	Minutes of SUA faculty and senate meetings Records of a specified PT client District Agricultural Development Plans (DADP). Processed met data available for district planning from the Tanzania Meteorology Department,	The current commitment to increased transfer, uptake and up-scaling of outputs from the NARS, as elaborated in the recently drafted Medium Term Plan (MTP) is maintained to create an enabling environment

Component 1: – HELP Office and Upgrading of the PARCHED-THIRST Software			
OUTPUTS			
Narrative Summary	**Objectively Verifiable Indicators**	**Means of Verification**	**Key Assumptions**
1. Clients needs for further improvement of PT software **determined**	• Feedback on the performance of PT v2.1 from end-users received and complied latest by June 2002 • At least 2 organisations represented at SIAC course, provide client-feedback • By June 2003, agreement reached on format of outputs from software with target users in at least two districts	• Project Progress Report • SWMnet workshop participants assessment report • SIAC course report	Target Institutions have budget to invest in the necessary requirements (Manpower and Hardware) to use the PT Software.
2. Improved version of PT software with more user-friendly features developed and **communicated** to target users	• By 31March 2003, Beta software of (V2.2) issued to frequent users for feedback • By 31 May 2003 V2.2 produced • By 30 September 2003 prototype V2.2 tested with frequent users (minimum 10) • By November 2003, V2.3 produced incorporating user feedback	• Project annual reports • SUA reports on short courses	
3. Main requirements for sustained provision of regional service to support use of PT software by a range of clients (researchers, non-researchers, GO, NGO, PVO) **determined, communicated to** and **promoted with** relevant policy makers	• By June 2002, PT Help office at SUA, established. • By Dec 2002, monitoring system set up to log client demands and service provider client support. • By March 2004, at least one short course including PT, fully paid for by clients, implemented. • By Dec 2003, strategy for sustaining PT Help Office developed • By March 2004, PT Help Office can present evidence to external reviewers of SUA capacity to sustain the PT Help service. • By Dec 2004, strategy pilot tested over at least one year and feasibility proved	• Project reports • NRSP MTR report • Project pre-FTR presentation and FTR	

1 ACTIVITIES for Component 1	Milestones	Budget	
1.1 Design and produce a simple questionnaire for soliciting feedback from end-users of PTv2.1. 1.2 Prepare a list of target end-users in Tanzania and in the Region and distribute the software by CD. 1.3 Make the software available on SUA website. 1.4 Implement an official launching involving the Minister of Science and Technology in Tanzania, and undertake promotion of the software, at Regional level. 1.5 Promote the software at regional workshops through organisations such as SWMnet and SEARNET. 1.6 Facilitate the use of PT software as a teaching aide in courses at SUA and others such as the SIAC.	Feedback on the performance of PT v2.1 from end-users received and complied latest by June 2002 By 31March 2003, Beta software of (V2.2) issued to frequent users for feedback PT v2.2 produced by the end of May 2003 Sub-routines for climate data conversion and runoff prediction are produced by end of June 2003 Beta version of PT v2.3 produced by end of Sept. 2003 Sub-routines for climate data conversion and runoff prediction have been incorporated in the PT v2.3 By the end of December 2003 PT v2.3 produced By December 2003, at least one target district has produced improved RWH development plans assisted by the PT software By September 2003, PT software has been adopted by at least one Meteorology Department as an example of a value added product utilizing weather data By December 2004, at least one client builds capacity for use of PT model By Dec 2004, SUA senior authorities are sufficiently convinced of demand for PT software, and the opportunities for self help income generation, to take essential steps to sustain PT Help Office in SUA's system for service provision At least 2 organisations represented at SIAC course, provide client-feedback By Dec 2002, monitoring system set up to log client demands and service provider client support At least one short course including PT, fully paid for by clients, has been implemented by March 2004 SUA administration has been convinced that PT software can be an income-generating product by March 2004 See above	Staff cost UK = £1,540 Staff cost TZ/Kenya = £32,075 Overheads = £ 14,046 Equipment = £ 2,860 Travel and subsistence = £ 20,909 Miscellaneous = £1,850 See above	Target users who receive the PT software use it effectively and are willing to give feedback
2.1 Analyse the received feedback and identify modifications needed to further improve performance of the software. 2.2 Undertake the necessary modifications and validate in the PT v2.2 in the "model catchments"			
3.1 Use feedback from users to determine and develop a Help, Support and Advisory service that will be demanded by users of PT and other models 3.2 Develop short courses and seminars on RWH modelling that are demand driven so as to sustain the PT Help Office 3.3 Develop mechanism for linking the Help Office with the Bureau for Agricultural Consultancy and Advisory Services (BACAS) of Faculty of Agriculture at SUA.			

10 Keywords

PARCHED-THIRST software, PT, Semi-arid, Rainwater harvesting, Uptake, Agro-hydrological modeling, Tanzania

11 List of Annexes

Annex	Description/Title
Annex A	Main Report
Annex B1	Questionnaire and Distribution List
Annex B2	User Feedback, Identified Problems and Modifications on v2.1
Annex B3	Launching of Parched-Thirst Model of Rainwater Harvesting
Annex B4	Scientific Papers on PARCHED-THIRST Model
Annex B5	Expert Review of PT v2.1
Annex B6	PT Training for District Agricultural and Extension Officers
Annex B7	Expert Evaluation of PT Model v2.3
Annex B8	Report on Parched-Thirst Model Workshop held on 18th January 2005 at ICE, SUA
Annex B9	Report on Parched-Thirst Model : User's tracking
Annex B10	Report on the Use of PT v2.2 During SIAC 2003
Annex B11	PARCHED-THIRST Handbook
Annex B12	PARCHED-THIRST Flier
Annex B13	PARCHED-THIRST Poster
Annex B14	CD: PARCHED-THIRST Model (Versions 2.1, 2.2, 2.3 and 2.4)
Annex B15	CD: Launching of PT Model by Minister of Science, Technology and Higher Education shown on ITV (T) – Video Clip
Annex B16	PARCHED-THIRST Model – Training Module
Annex B17	Theses Titles and Summaries on PT Model
Annex B18	SWMnet Discussion Paper 2: Title page, Introduction and Objectives
Annex B19	District Case Studies
Annex B20	District Communication Products
Annex B21	Case Studies – TMA and MAFS

Annex B22	Communication Products – TMA and MAFS
Annex B23	A Manual for Virtual Laboratory Experiments in Agriculture
Annex B24	A Manual for Virtual Laboratory Experiments in Agriculture for Agricultural Colleges

12 Appendix 1: Signed Letter by the Computer Center to Host PT

SOKOINE UNIVERSITY OF AGRICULTURE
COMPUTER CENTRE
P.O BOX 3218, Tel: +(023) 2-604838;
Fax No. +(023) 2-604838; 3511/4; E-mail: dircc@suanet.ac.tz
MOROGORO, TANZANIA

Our Ref. Comp **Your Ref** **Date:** **01 April, 2005**

To Team Leader
Soil-Water Management Research Group (SWMRG)
Telephone: 255-(0) 23-2601206
Fax: 255-(0) 23-2604649
Postal address: P.O. Box 3003, Morogoro, Tanzania
Electronic mail: swmrg@suanet.ac.tz; swmrg@yahoo.co.uk

Dear Prof. Mahoo,

REF: HOSTING PARCHED-THIRST MODEL BY COMPUTER CENTRE.

We would like to inform you that the Computer Centre shall provide full support for hosting PARCHED-THIRST (PT) model.

We welcome this idea of hosting the model because it is one area in our mandate of establishing the Computer Centre and as per SUA ICT Policy and Guidelines, section 2.4.7. We shall review our curriculum so that PT Model is included in some of our courses similar to the way we have included other software packages. We will host PT website, promote PT Model through the SUA website, coordinate upgrading of the model, provide special training on PT model based on demands and respond to clients' queries.

The Help Office would comprise of the Computer Center staff, who were involved in upgrading PT model from version 2.3 to version 2.4 and the two SWMRG members (Dr. S. D. Tumbo and Prof. F. B. Rwehumbiza), who have expertise in PT model. SWMRG through its two members would provide leadership of the Help Office for one year in order to build more capacity of the Computer Center in hosting PT model.

We commend your efforts and welcome SWMRG to continue to collaborate in reengineering the PT model.

Yours truly,

Prof. R.R. Kazwala.
DIRECTOR
SOKOINE UNIVERSITY OF AGRICULTURE
COMPUTER CENTRE
P.O. BOX 3218
MOROGORO.

QUOTATION OF REF. NO IS ESSENTIAL

13 Appendix 2: Same District – Capacity on PT and its Application

SAME DISTRICT COUNCIL

P.O.BOX 138
14/01/2005

WORKSHOP ON PT MODEL ON 18TH JAN 2004
SUA – SWMRG.

SUB: EXPERIENCE ON THE USE OF PT MODEL ON DADPs DEVELOPMENT AND APPLICATION IN SAME DISTRICT.

1.0 INTRODUCTION.

The use of PT model on DADPs development and application started after a series of training to few agricultural officers in Same district. The training was done under the support of SUA – SWMRG.

2.0 ACHIEVEMENTS.

2.1.0 Design of new charco dam under DADPs project.

The ongoing process of contract for excavation of Vumari Charco dam at Same District was done after application of PT model in assessing the potentiality of flow from the adjacent sloping land to the charco dam proposed site. PT model parameters like drainage rates, evaporation and rainfall (long term) were studied.

2.2.0 Basic tool for advising farmers.

PT. Model is being used as a basic tool for advising farmers on issues related to

- Planting dates
- Type of crops to be planted (e.g. maize crop is being discouraged at Same west low lying area due to insufficient rains it experiences each year)
- Promotion of drought tolerant crops.
- Crop yield.
- Plant population
- Potential cropping area.

2.3.0 Rain water harvesting structures

The insufficient rainfall which can not take many crops to maturity stage as the PT model predicting in the western part of same, leads into judgments for introduction of RWH structures.

RELMA AND SASAKAWA Global 2000 has assisted some farmers in Mwembe, Bangalala and Makanya villagers in construction of RWH structures.

- The judgment of location of the structures requires partly the application of PT model results. e.g. – catchments area, runoff amount and rainfall prediction.

3.0 FUTURE PLANS FOR MORE USE ON PT MODEL

3.1.0 The use of Arc view GIS software. The introduction of Arc view software will also enable the district extension officers to use the maps produced for assessing the,

- Runoffs along gullies
- Demarcating the potential areas for RWH in the district, The PT model is also used in this case.

  e.g. - comparison of crop yield in different areas,
  - assisting in knowing the conserved and non conserved area, which is also a factor to be considered in the use of PT model.

4.0 CONCLUSION AND RECOMMENDATION

(i) The use of PT model requires good background of knowledge in soil and water management, analysis of rainfall datas etc. In this case the PT model user need to have constant use and application of the software in order to get more challenges.

(ii) The use of Arc view GIS software whose results can also be used in PT model is not yet known to many district agricultural officers. It is therefore advised to provide Arc view software training to the district extension staffs.

(iii) The Sokoine University of agriculture with the SWMRG – SUA have made a commendable effort in training various extension staffs in the Same District The extension staffs wish SWMRG – SUA much success and sustainable bright future.

(iv) PT model should be known to more extension staffs by providing similar training.

14 Appendix 3: TMA commitment letter on the use of PT software

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF COMMUNICATIONS AND TRANSPORT
TANZANIA METEOROLOGICAL AGENCY

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28 April 2005

Our ref: TMA/3060
Sokoine University of Agriculture
Faculty of Agriculture
Soil-Water Management Research Programme
P.O.Box 3003, Morogoro-Tanzania

Attn: Prof. Henry H. Mahoo

REF: USING PARCHED-THIRST MODEL AS TOOL FOR ADDING VALUE TO MET DATA

We wish to thank SUA SWMRG for involving TMA in the use of the PT model. In particular we appreciate the exposure that you availed TMA to the potential uses and benefits of the model through training of our staff and enabling them to participate in a number of related seminars and workshops. We wish to hereby confirm our continuing cooperation in this regard and to assure you that TMA is going to take the PT model on board in its applied and research activities.

Please, find enclosed a report of the TMA participants to the last training seminar and response to the questionnaire that you sent us. Please take the indicated usefulness and suggested improvement areas as the minimum numbers that came to our minds at the moment.

Once more we would like to thank you for your invaluable PT model gift and to assure you of our continuing cooperation.

Best regards

T.M.Hyera
For Director General

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15 Appendix 4: Scaling-up and Uptake Promotion of PT Software

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Goal			
Robust strategies for integrated management of soil and water for improving the livelihoods of the poor in Tanzania **developed** and **promoted**	By end of March 2005 there is evidence that Parched-Thirst Software has been widely adopted in Tanzania.	Inventories of relevant strategies for up-scaling of PT software at the PT Help office.	
Purpose			
Robust and sustainable strategies for scaling-up and promoting uptake of PT software in Tanzania **enhanced.**	By March 2006 there is evidence that at least three districts are using assisted by PT Software. By March 2006 there is evidence that at least four instructors are using PT software as a virtual laboratory.	Assessment of District agricultural plans reports. Assessment of training material of the target institutions.	Potential stakeholders to be targeted by this project will be fully involved and supported by the project.
Outputs			
1. Capacity of district staff in the use of PT Software to advice farmers **strengthened**.	By March 2006 at least three districts has been assisted by PT Software in advising farmers.	Assessment of District documentations.	The existing demand for increased impact from research in NRM is maintained while adequate resources are made available at regional and national level.
2. Capacity of agricultural colleges in the use of PT Software **developed**.	By March 2006, at least one capacity building training targeted at college instructors implemented in each of the target countries.	Training evaluation report Report from feedback survey	
3. Database for wider application of PT Software **developed**.	By March 2006, at least databases have been established.	CDs containing databases	

Activities	Milestones	Budget	Important Assumptions
1.1 Identify key stakeholders for use of PT Software in some specific institutions. 1.2 Train district staff in the target districts in the use of PT Software. 1.3 Track the use of PT Software through pilot projects.	June 2005, key stakeholders have been identified. August 2005, training has been undertaken. December 2005, two follow-ups on the use of PT Software done.	Staff Costs = £ 26,400 Overheads = £ 13,200 Miscellaneous = £ 24,900 Total = £ 64,500	Most key stakeholders in the target countries will be available and will maintain interest in the use of PT software.
2.1 Identify colleges and college instructors committed in using PT Software. 2.2 Train identified college instructors in the use of PT software. 2.3 Track the use of PT software as a virtual laboratory through pilot projects.	June 2005, college instructors identified. September 2005, training implemented. March 2006 follow-ups completed.		
3.1 Establish databases on climatic, soil and crop cultivars. 3.2 Develop assistant subroutine for parameters established. 3.3 Develop PT modules for extension advice and virtual laboratory.	February 2006 databases established. February 2006 an assistant completed. September 2005, modules completed.		