



STREP Project funded by:



European Commission



GOCE-CT-2003-506680-WADE

NEWSLETTER

WADE

FloodWater Recharge of Alluvial Aquifers in Dryland Environments

Research in support of the EU Water Initiative

OCTOBER 2005

NUMBER 1

EDITORIAL

Water Harvesting in Drylands

Water is a key issue in worldwide economical and political agendas and of critical concern when it comes to the socio-economic development of semiarid and hyperarid areas. Four main water challenges are usually present in these areas:

- Water scarcity due to natural climatic conditions and prospective of higher rainfall irregularity and flood risk magnitude (IPCC, 2001). This factor is further exacerbated in countries with a lower level of investment in water infrastructures (SADC, 2000).
- Polluted water bodies, caused either by use of chemical pesticides and fertilisers in extensive commercial agriculture and greenhouses (e.g. south-eastern Spain), or by poor waste disposal systems usually linked to rapid growth of urban and peri-urban areas, as in the case of many developing countries.
- Watershed degradation due to overgrazing, deforestation and over-cultivation.
- The management of transboundary river basins (WFD 2000/60/EC; GWP-TAC, 2000).

All these constraints underline the importance, not only of balancing social, environmental and economical perspectives, but also developing innovative scientific methodologies to tackle the water demands of different communities. One of the objectives of WADE is to provide scientific information on water resource availability in dryland areas, in particular by quantifying the groundwater recharge from floodwaters in ephemeral rivers. This constitutes an innovative methodology of investigating the occurrence of floodwater resources, in time and space, to quantify the sustainable water yield of ephemeral streams and to formulate integrated water management strategies for their use. Four basins are currently being studied: the Andarax (SE Spain), the Nahal Arava (Israel), the Kuiseb (Namibia) and the Buffels (Namaqualand, South Africa).

This Newsletter, to be published six-monthly will serve as an open forum to all people involved in water management and welcomes feedback and contributions on topics that are important to the lives of people living in dryland areas: new research methodologies, people, policies and resources. The WADE Newsletter will be released both in paper and electronic format (available at: www.wadeproject.info) with the aim of reaching the diverse range of institutions dealing with water resource management and arid ecosystems inside and outside the current project. With this purpose in mind a version of the Newsletter in Afrikaans will also be available soon.

Gerardo BENITO

WADE Project Coordinator

(References on page 2)

CONTENTS

Editorial:	
<i>Water Harvesting in Drylands</i>	1
What is WADE?	2
Recent Activities in the Southern Africa Sites	3
Pic's of Change?	4
Community Research Assistants	4
Dissemination Activities	4
Upcoming Events	4

News

- Aug. 2005: Delivery of WADE Periodic Report
- Nov. 2005: Exhibition for Twinning Projects in Brussels, at the Communicating European Research conference.
- 6-7th Feb. 2006: WADE meeting in Cape Town.

Advisory Board

- Gerardo BENITO
(Consejo Superior de Investigaciones Cientificas)
- Yehouda ENZEL
(Hebrew University of Jerusalem)
- Christoph KUELLS
(Hydroisotop GmbH)
- Mary SEELY
(Desert Research Foundation of Namibia)
- Rick ROHDE
(University of Edinburgh)
- Timm HOFFMAN
(University of Cape Town)
- Taha OUARDA
(Inst. Nat. de la Recherche Scientifique, Canada)
- Ofer DAHAN
(Ben Gurion University)
- Guido van LANGENHOVE
(Ministry of Agriculture, Water & Rural Affairs, Namibia)
- Harry MAY
(Surplus People Project)
- Coenie COETZEE
(Kamiesberg Municipality)
- Willem ENGELBRECHT
(Nama Khoi Municipality)

Editors:

Varyl Thorndycraft
Gerardo Benito

Contact Address:

WADE Project
Centro de Ciencias Medioambientales
CSIC
Calle Serrano, 115dpo
28040 Madrid - SPAIN

Assistant Editor:

Maria J. Machado

Phone: +34 917452500
Fax: +34 915648060
E-mail: varyl@ccma.csic.es
URL: <http://www.wadeproject.info>

(Continued from page 1)

References:

GWP-TAC (2000). *Integrated water Resources Management*. TAC Background Paper n°4, GWP, Stockholm, Sweden.
 IPCC (2001). *Climate Change: The Scientific Basis*. Contribution of working group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. (published by J.T. Houghton et al. Eds.). Cambridge Univ Press, pp944. Summary for Policymakers:
http://www.grida.no/climate/ipcc_tar/vol4/index.htm.
 SADC (2000). *Protocol on Shared Water Courses in the Southern Africa, Development Community (SADC) Region*, SADC Council of Ministers, Gaborone, Botswana.
<http://www.thewaterpage.com/SADCprotocol.pdf>.
 WFD (2000). *Water Framework Directive 2000/60/EC*
http://europa.eu.int/comm/environent/water/water-framework/index_en.htm

What is WADE?: Water management in drylands based on floodwater resources.

Benito, G.; Thronycraft, V.; Coetzee, C.; Dahan, O.; Engelbrecht, W.; Enzel, Y.; Hoffman, T.; Kuells, C.; Langenhove, G; Matros, A; .May, H.; Ouarda, T.; Rohde, R.; Seely, M. & Todd, S.

The overall scope of WADE is to apply newly developed methodologies and technologies in order to asses long-term (decades to centuries) water resources in selected semiarid to hyperarid ephemeral European and African river basins, by determining long-term magnitude and frequency of floods and quantifying transmission losses and floodwater recharge into alluvial aquifers.

This twinning experience on integrated water resource management, which is being carried out in Spain, Israel, Namibia and South Africa, also aims to contribute to the objectives of the *EU Water Initiative*, launched in Johannesburg at the World Summit on Sustainable Development, and the III World Water Forum (March 16-23, 2003) in Kyoto.

A principal source of water in arid environments around the world is related to floods in ephemeral rivers and the consequent infiltration of floodwater into alluvial aquifers. Despite its importance, until recently no available methodology existed that enabled the quantification of: a) the processes that control this recharge and b) its long term volume that in turn affect the sustainability of this water resource.

Recent methodological and technical advances led by the Ben Gurion University on recharge into alluvial aquifers, developed by Ofer Dahan (Dahan *et al*, patent pending) for the application of TDR in the deep vadose zone, are being applied successfully in the project study basins (Figure 1).

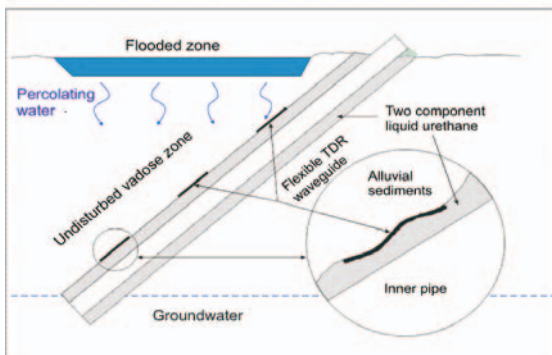


Fig.1. Schematic diagram illustrating the method of drilling and the positioning of the TDR (Time Domain Reflectometry) probes beneath the river channel and the undisturbed vadose zone.

In terms of the state-of-the-art for evaluating long-term recharge, the technological advances for monitoring contemporary transmission losses and the recharge process, schematised in Figure 1, have been combined with the methodology of palaeoflood hydrology (Figure 2) and environmental history, including historical and socio-economic aspects of alluvial aquifer use in the study basins.

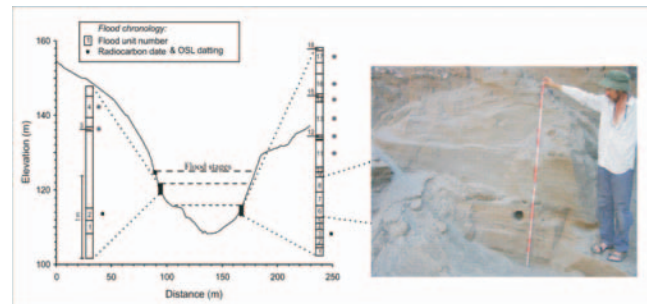


Fig.2. Reconstructing long-term flood discharges from slackwater flood deposits. Photo taken at the Kuseib river during field campaign in 2005.

One of the challenges of WADE is to address a key issue in water resources, namely water for people. Central to this is empowering them to understand and participate at several project stages, including demonstration activities. In a future phase of the project both direct *scientific* data (hydrological, geological, socio-economical) and local knowledge and decisions, will be transferred towards local research institutions and NGO's that can have an important role in the negotiation of environmental and social needs with higher institutions (Figure 3).

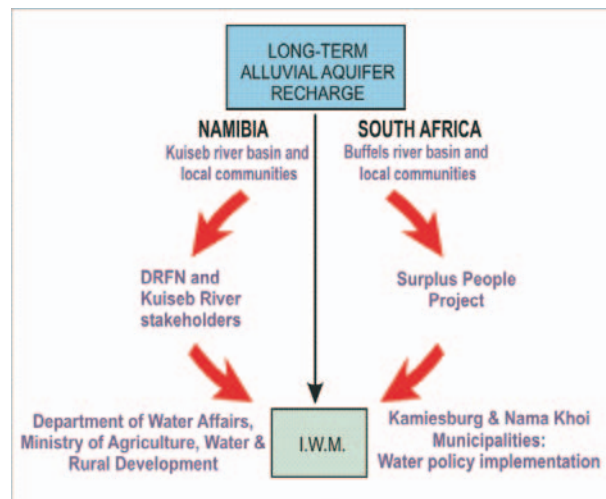


Fig. 3. Participatory water management to determine strategies for integrated water management (IWM), focused on floodwater as a water resource

This interdisciplinary approach (Figure 4) also constitutes a novel approach for evaluating the scarce water resources in drylands and provides the basis for the sustainable management of river basins in these climatic zones. The knowledge generated will provide options and further choices of sustainable lifestyles, water use as well as the promotion of incentives and regulatory policies by the countries involved in the project.

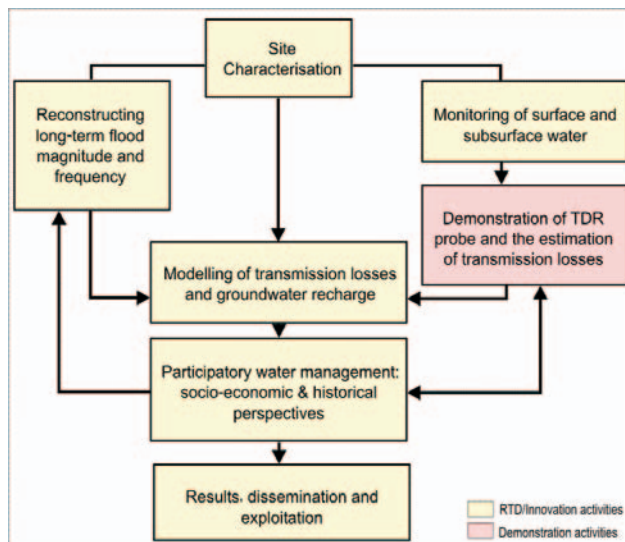


Fig.4. WADE schematic methodological approach.



Fig 5. Participants of the WADE 1st Regional Meeting, in South Africa. From left to right: Anna Matros (DRFN), Christoph Kuells (Hydroisotop), Jack Kambatuker (DRFN), Willem Engelbrecht (Nama Khoi Munic.), Louis van Wyk (Kamiesberg Munic.), Rick Rohde (Univ. Edinburgh), Simon Todd and Timm Hoffman (both Univ. Cape Town), Harry May (SPP), Varyl Thorndycraft (CSIC), Ofer Dahan and Boaz Tatarsky (both Ben Gurion Univ.)

Preliminary results as well as the presentation of the Milestones and Deliverables achieved during the first year of the project were discussed at the *First WADE Annual Meeting*, held in Gobabeb, Namibia (2-4th July 2005). Regarding research in the Buffels (Figure 6) and Kuiseb basins, their characterisation (physical and social) was completed on scheduled time. Extensive fieldwork campaigns dedicated to documenting the palaeofloods in the study basins were carried out by the CSIC and Hebrew Univ. of Jerusalem partners in November 2004 and July 2005 (South Africa) and in April and June 2005 (Namibia). The work included sampling for radiocarbon and OSL dating of slackwater deposits, sedimentological analyses and topographical survey (input data for hydraulic modelling and discharge estimation). The first results will be presented at the *Mid-term Review Meeting* in Cape Town (February 2006).



Fig. 6. Flood (slackwater) deposits of the Buffels river.

Recent Activities in the Southern Africa Sites.

One year has passed since the WADE kick-off meeting in September 2004 and a lot has been happening in the Namibian and South Africa study areas.

Six southern African institutions, governmental (Ministry of Agriculture, Water and Rural Development of Namibia; Kamiesberg and Nama Khoi municipalities, Namaqualand, South Africa; University of Cape Town, South Africa) and non-governmental (Desert Research Foundation of Namibia, and Surplus People Project, South Africa) are working on a people-centred approach on water resources, covering five main fields:

- Evaluation of the social and economical importance of shallow alluvial aquifers;

- Serving as an *Interface* between users' needs (with special focus on women), village communities and municipalities. This role is also important when gaining feedback from end-users and communities regarding the scientific data and experiments conducted at the field;

- Understand environmental changes within catchment areas in terms of water management, land use, policies and climate change;

- Impact of current policy options and institutional structures on the sustainability of alluvial aquifer management practices;

- Support to the other project teams.

The First WADE Regional Meeting took place on December the 2nd, 2004 in Springbok, South Africa (Figure 5). The first phase of the project was evaluated and key logistical issues for months 6-12 were discussed, in particular regarding the timetable of TDR installation. The meeting coincided with the first fieldwork trips in the area for the non-African partners (CSIC, HY and BGU). Meetings between WADE researchers and the communities in the two study areas within the Buffels River basin (Roofontein and Buffelsrivier) were facilitated by the SPP.

Regarding the monitoring of contemporary rates of transmission losses, TDR probes were successfully installed by the Ben Gurion University at two sites in each study basin (Figure 7). The installation was facilitated by the DRFN in Namibia and the University of Cape Town in South Africa. This was one of the major achievements during the first year of the WADE project as this deliverable was the most technically complex within the project..

In the Kuiseb basin, sampling by Hydroisotop identified a longitudinal evolution of the stable isotope composition of groundwater in the alluvium revealing long-term proxy information on groundwater recharge. The groundwater contains tritium and, therefore, has components of recent groundwater indicating that in the hyper-arid lower Kuiseb there is active recharge from floods.

The isotopic profile and the age distribution allow to further quantify the travel times of longitudinal flow in the alluvium and the fraction of recharge from floods in different sections of the Kuiseb. First data indicate that the travel times for longitudinal flow in the alluvium are in the order of a few decades.

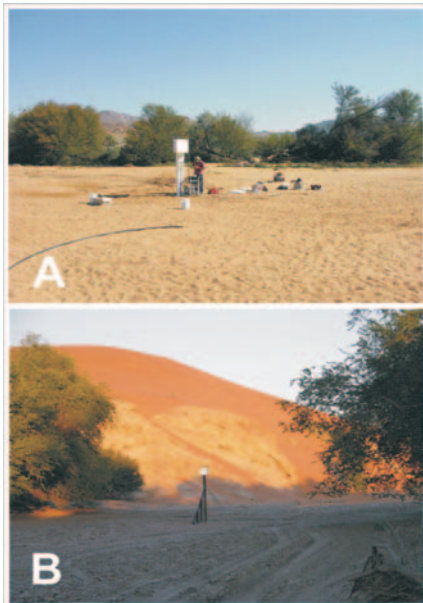


Fig. 7. TDR probes installed at Buffels (A) and Kuiseb (B) rivers.

Pic's of change?

Rick Rohde (UEDIN), Timm Hoffman and Simon Todd (both IPC)

Advances are also being made on the environmental history of the Buffels River catchment. Forty repeat landscape photographs and site surveys (many of them depicting the Buffels River and surrounding area in 1957) have so far been added to the CAS/IPC collection of over 200 repeat landscape photos used to identify vegetational changes in the area. Matched images show that riverine vegetation has changed little over the last 50 years or more, indicating that there have been no major flood events during this period. They also indicate that a major decline in crop cultivation took place during the second half of the 20th century and that many previously disturbed lowland areas are now in the process of re-colonisation by pioneer species. Communal grazing land has remained relatively unchanged whereas significant increases were detected in the cover and diversity of palatable perennial vegetation in commercial livestock farm areas. Overall, the vegetation in the rocky upland areas across the region has remained relatively stable during the 20th century suggesting that this stability extends back into the early colonial period as well. There is some evidence to show that movement of the ecotone between the summer and winter rainfall has occurred as a result of climate change although whether this is related to global warming is unclear. Also there has been an increase in woody shrubs and trees, possibly due to increased atmospheric CO₂. Archival research into 18th and 19th century travellers' accounts and early colonial records reveal that human population and livestock numbers increased dramatically up until around 1960. More recent demographic trends show that a new ecological revolution is underway in Namaqualand due to changes in the global and national political economy. The main symptoms of this are a radical decrease in the urban population, de-agrarianisation, land reform and conservation initiatives.

Community Research Assistants (CRAs)

It is with great pleasure that we announce the addition of two new members of the WADE team, Dafferey Waldeck and Anna-Marie Boyce, who both joined us in March 2005. Dafferey and Anna-Marie are residents of, respectively, the Rooifontein and Buffelsrivier villages of the Buffels River basin. In Namibia, the DRFN is on-hand at the Gobabeb study site to undertake socio-economic research, monitor the TDR installations, provide support to the other WADE researchers and communicate project results to the local community. However, no such support exists in the Buffels basin, therefore, the WADE team felt that the project would be improved by bringing on board members of the nearby villages. The main roles of the CRAs are to: 1) provide general logistical support to the WADE researchers; 2) carry out regular hydrological monitoring; 3) conduct interviews in the community e.g. related to water resource issues in the villages and historical flooding of the Buffels river; and 4) communicate information about the project within the community. The CRAs will be given appropriate training throughout the duration of the project.

Dissemination Activities

- August 2004 - Presentation of the WADE Project by Varyl Thorndyrcraft (CSIC) during the EC Meeting to promote Twinning projects in the VI FP. World Water Week, Stockholm, Sweden.
- February 2005 - Information poster on WADE presented at the "Drylands" conference held at the Royal Society, London.
- May 2005 - Namaqualand Colloquium in Springbok, attended by WADE members including the CRAs.
- August 2005 - Presentation of the methodological approach and advances made on WADE by Ofer Dahan (BGU) during the meeting of the twinning research cluster. World Water Week, Stockholm, Sweden.

Upcoming events

- November 2005 - The WADE Project will be represented at the Communicating European Research exhibition in Brussels (14 & 15th November) where we have stand space in conjunction with the other EC twinning projects (TWINBASIN, RIVERTWIN, TWINBAS & TWINLATIN). On the stand we will have a poster, leaflets, Powerpoint presentation and on-line access to our web page.
- February 2006, 6-7th - the next WADE project meeting (the Mid-term Review) will be held at the University of Cape Town.

The WADE Newsletter is a mechanism for information exchange, in support of the EU Water Initiative, designed for researchers and users of research on water resources and management issues in drylands.

Please join our discussions and tell us about: New Research Methodologies, People, Policies and Resources