

Mainstreaming capacity building in food and water research in the Limpopo Basin: linking across scales and across disciplines

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Abstract

In improving global food production, the problem is not always due to the physical scarcity of water, but rather the lack of integrated land-water management approaches and weak institutional arrangements. An integrated approach to green and blue water management from the farmer's field to the river basin scale is required to promote and upscale smallholder rural livelihood improvements. This cannot be achieved through the introduction of innovations alone, but requires the building of appropriate capacity in land and water management at all the scales at which interventions are implemented, or management decisions are taken. Too often capacity-building is seen as a follow-up activity. As an alternative, WaterNet's approach is to integrate capacity building into the research activities from the planning stage onwards. Key research in PN17 is undertaken by seven Ph.D. fellows and MSc students, registered at WaterNet member institutions and supervised by scientists from universities and CGIAR centres within PN17. Many of these students come from the WaterNet regional masters programme in Integrated Water Resources Management. They are supervised by Ph.D. fellows and scientists from universities and CG centres in PN17. The project also involves capacity building at community, extension officer and water manager level. A particular benefit is the development of transdisciplinary scientific teams for the supervision of students and the guiding of community training. As PN17 progresses, there is constructive feedback between the research project and WaterNet's capacity building programmes, especially the regional masters programme. The programme benefits as researchers from PN17 are brought into teaching, and as new research ideas from PN17 are integrated into the masters curriculum. The masters programme thus provides students who are well-equipped to begin their research projects, some of which are on water and food. Beyond this, WaterNet aims at training a new generation of water managers. By the integration of PN17 and the masters programme, new ideas and philosophies of more crop per drop are passed on to the students, who, returning to their home countries and workplaces in southern Africa, can implement the new knowledge.

Media grab

Too often capacity-building is seen as an add-on to research: a follow-up activity in which the main researchers are uninvolved or uninterested. As an alternative, WaterNet's approach is to integrate capacity building into the research activities from the planning stage onwards. This is show-cased through PN17, which from proposal stage has been integrated with capacity building programmes in Southern Africa. This has a positive impact in terms of research dissemination and in the training of a new generation of water managers.

Introduction

In improving global food production, the problem is not always due to the physical scarcity of water, but rather the lack of integrated land-water management approaches and weak institutional arrangements (Falkenmark and Rockström, 2003; Jaspers, 2003; Love *et al.*, 2006; van der Zaag, 2005). An integrated approach to green and blue water management from the farmer's field to the river basin scale is required to promote and upscale smallholder rural livelihood improvements (Love *et al.*, 2004). This cannot be achieved through the introduction of innovations alone, but requires the building of appropriate capacity in land and water management at all the scales at which interventions are implemented, or management decisions are taken.

Too often capacity-building is seen as an add-on to research: a follow-up activity in which the main researchers are uninvolved or uninterested. As an alternative, WaterNet's approach is to integrate capacity building into the research activities from the planning stage onwards. This is show-cased through Challenge Program Number 17 (PN17), which from proposal stage has been integrated with WaterNet's capacity building programmes in Southern Africa.

Methods

WaterNet's approach is to integrate capacity building into the research activities from the planning stage onwards. PN17 was conceptualized with 6 PhD fellows and 21 masters students. In implementation key research in PN17 has been undertaken by the seven Ph.D. fellows, registered at WaterNet member institutions and supervised by scientists from universities and CGIAR centres within PN17. Each Ph.D. fellow is linked to masters students (40 to date) who undertake their dissertation projects within PN17. Many of these students come from the WaterNet regional masters programme in Integrated Water Resources Management at the Universities of Dar-es-Salaam and Zimbabwe, supported by four other regional universities. Others come from programmes at other WaterNet member institutions. They are supervised by Ph.D. fellows and scientists from universities and CG centres in PN17. The project also involves capacity building at community, extension officer and water manager level. This includes participatory on-farm pilot experiments (involving farmers and

extension officers) and participatory development of institutional and water resources models (involving water managers). Direct training and extension are also provided in key areas.

Results and Discussion

Part of the impact of capacity building within PN17 can be seen in the number (twice the target) and distribution (half of SADC countries) of the masters students (figures 1 and 2).

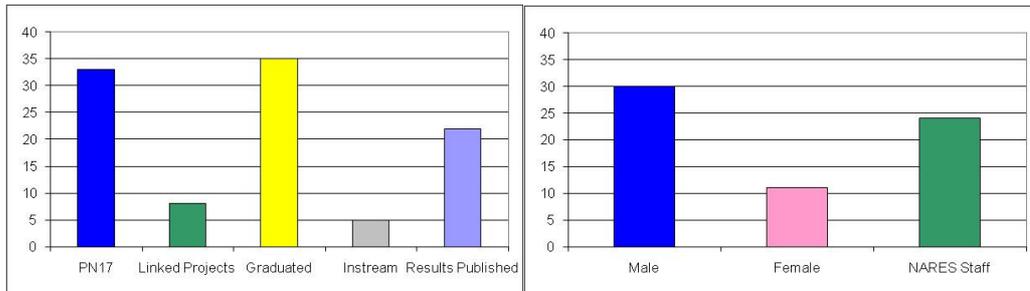


Figure 1. MSc students sponsored by PN17: almost all have now graduated and most have had their work published internationally (left). Whilst staff from national agricultural (or water) research and extension services (NARES) are well represented, gender balance has not been achieved (right).

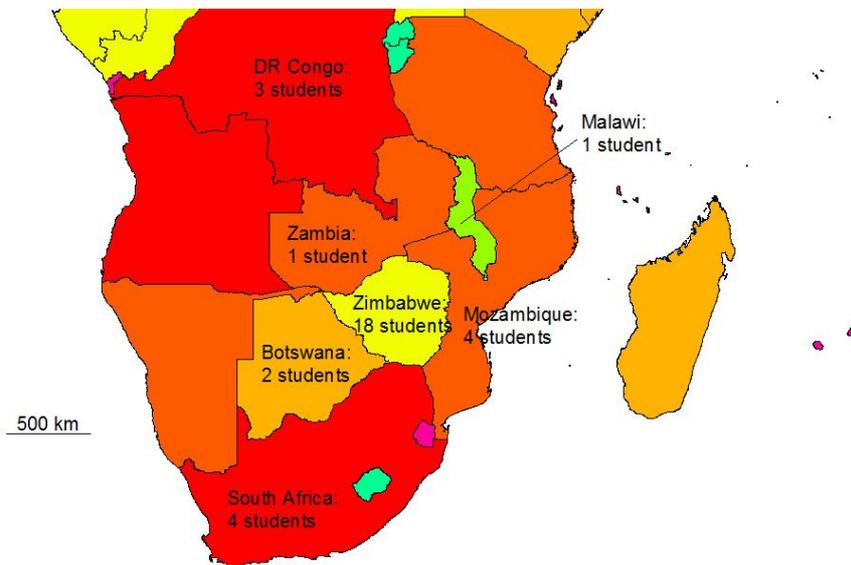


Figure 2. Map showing the distribution by nationality of the MSc students sponsored by PN17 (excludes European exchange students). The bulk are from the four Limpopo Basin countries: Botswana, Mozambique, South Africa and Zimbabwe.

The capacity building component of the project has influenced the project's research output, with 22 students publishing papers, articles or both (figure 1). Contributions have been made in all major areas of PN17 research: Farmer-field based action research (Maisiri *et al.*, 2005; Dhlwayo *et al.*, 2006; Moyo *et al.*, 2006; Mwenge Kahinda *et al.*, 2007), water resources research (Moyo, *et al.*, 2005; Kileshye-Onema *et al.*, 2006; Moyce *et al.*, 2006; Ngwenya *et al.*, 2006; Vilanculos *et al.*, 2006; Tunhuma *et al.*, 2007; McCartney and Arranz, 2008; Chilundo *et al.*, 2008; De Hamer *et al.*, 2008; Khosa *et al.*, in press; Masvopo *et al.*, in press; Ncube and Taigbenu, in press) and institutional research and development (Munamati *et al.*, 2005; Nare *et al.*, 2006; Svubure, 2007) as well as synthesis work such as where Basima Busane *et al.* (2005) integrated the research of four students who had been working on the same small reservoir.

Published research results have an impact in the broader scientific community: van der Zaag (2007) showed that articles published in the journal *Physics and Chemistry of the Earth* following the annual WaterNet/WARFSA-GWP-SA symposia (where most PN17 results have been presented) achieved an impact factor of between 0.3 and 0.8, with the water and land theme having an impact factor of 1.03. The paper by Moyce *et al* received the Phaup Award from the Geological Society of Zimbabwe, for the paper contributing

most to the understanding of Zimbabwean geological science during the year 2006. The approach of Vilanculos *et al.* (2006) is being used for flood forecasting. The work of Maisiri *et al.* (2005) Moyo *et al.* (2006) on drip kits has been developed into a protocol on drip kit distribution which is now widely used in the NGO community in Zimbabwe. Initial steps have been taken for the work by Masvopo *et al.* (in press) to be developed in partnership with a private company, to supply water for smallholder citrus production. The results and model of Khosa *et al.* (in press) has been shared with the Zimbabwe National Water Management Authority for use in planning and at a stakeholder workshop. Recommendations by Svubure (2007) for rolling out water users associations and intermediate tier management structures were adopted by the Mwenezi Subcatchment Council in Zimbabwe.

By a participatory approach, PN17 has trained communities, extension officers and water managers in a variety of interventions (Table 1).

Table 1. Intervention matrix for PN17: examples of interventions developed by a participatory approach

Intervention Package	Community Beneficiaries	Organisational Beneficiaries
Conservation agriculture	Communities in Insiza, Gwanda and Mwenezi (Zimbabwe) and Capricorn (South Africa)	Department of Agricultural Research and Extension (Zimbabwe) Limpopo Department of Agriculture (South Africa)
Rainwater harvesting	Communities in Sekororo (South Africa) and Chókwè (Mozambique)	Limpopo Department of Agriculture (South Africa) Chókwè District Agriculture Department (DDA) (Mozambique)
Low head drip kits	Communities in Insiza (Zimbabwe). But mostly this work was learning from the communities	Department of Agricultural Research and Extension (Zimbabwe) Many NGOs which distribute drip kits
Alluvial aquifers for smallholder irrigation	Communities in Matobo (Zimbabwe) (planned).	Zimbabwe National Water Authority
Improving flood forecasting	-	AraSul (Mozambique)
Modelling upstream - downstream interactions	-	Zimbabwe National Water Authority
Building institutional sustainability	Communities in Sekororo (South Africa), Insiza and Mwenezi (Zimbabwe)	Zimbabwe National Water Authority

A particular benefit of the project is the development of transdisciplinary scientific teams for the supervision of students and the guiding of community training. This is made possible by the broad nature of the PN17 partnership, backed up by the wider WaterNet membership (Figure 3). The involvement of scientists in the supervision of research and capacity building projects at different scales, from farmer's field to river basin, results in the development of a core capacity with an appreciation of the challenges and linkages at the different scales within the basin. Methodologies, research tools and results are shared through integrative scientific and stakeholder workshops. Students are also required to present papers at symposia and encouraged to publish in journals. Quality control is conducted from conceptualisation of research ideas to implementation, publication of papers and synthesis of research findings.

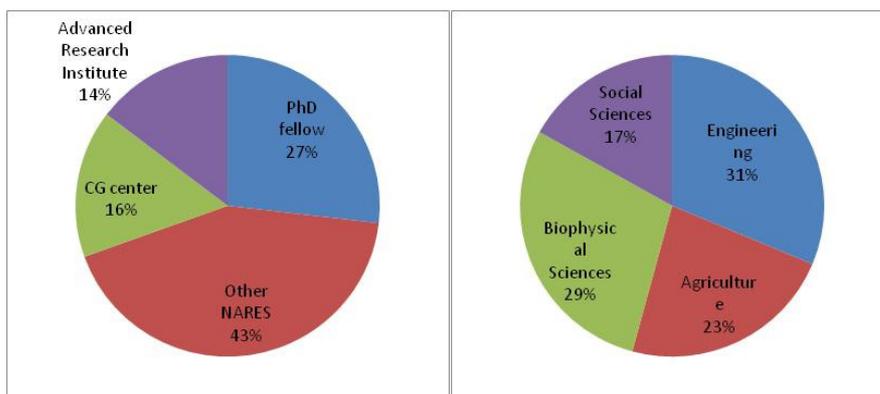


Figure 3. Affiliations and disciplines of supervisors of MSc students. Most students had two or three supervisors. NARES = national agricultural (or water) research and extension services. PhD fellows who are also NARES staff are only recorded as PhD fellows. Institutional affiliation (left) shows the extent to which local scientists had ownership of MSc supervision. There is a good balance between disciplines of supervisors (right), making for good transdisciplinary teamwork.

Conclusions and recommendations

Integrating research and capacity building is a win-win scenario. At WaterNet, the MSc programme benefits as researchers from PN17 are brought into teaching, and as new research ideas from PN17 are integrated into the masters curriculum. The masters programme thus provides students who are well-equipped to begin their research projects, some of which are on water and food. Beyond this, WaterNet aims at training a new generation of water managers. By the integration of PN17 and the masters programme, the new ideas and philosophies of more crop per drop are passed on to the students, who, returning to their home countries and workplaces in southern Africa, can implement the new knowledge see Figure 4).

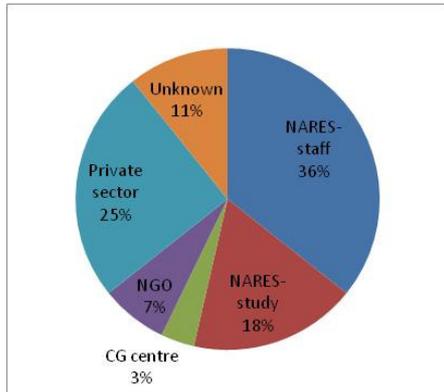


Figure 4. Deployment of MSc graduates from PN17, as at July 2008.

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References

- Arranza, R. and McCartney, M. 2008. Evaluation of Historic, Current and Future Water Demand in the Olifants River Catchment, South Africa. *IWMI Research Report* **118**, 51p
- Basima Busane, Sawunyama, T.,L., Chinoda, C., Twikirize, D., Love, D., Senzanje, A., Hoko, Z., Manzungu, E., Mangeya, P., Matura, N., Mhizha, A. and Sithole, P. 2005. An integrated evaluation of a small reservoir and its contribution to improved rural livelihoods: Sibasa Dam, Limpopo Basin, Zimbabwe. In: Abstract volume, *6th WaterNet/WARFSA/GWP-SA Symposium*, Swaziland, November 2005, p32.
- Chilundo, M.N.G., Kelderman, P. and O'Keeffe, J.H.O. 2008. Design of a water quality monitoring network for the Limpopo River Basin in Mozambique. *Physics and Chemistry of the Earth*, **33**, 655-665.
- De Hamer, W. Love, D., Owen, R.J.S., Booij, M.J. and Hoekstra, A. *in press*. Potential water supply of a small reservoir and alluvial aquifer system in southern Zimbabwe. *Physics and Chemistry of the Earth*, **33**, 633-639.
- Dhliwayo, C., Makurira, H., Mupangwa, W., Love, D., and Twomlow, S. 2006. An on farm comparison of conservation agriculture practices and conventional farmer practices on soil hydrology and maize yield *7th WaterNet/WARFSA/GWP-SA Symposium*, Lilongwe, Malawi, November 2006.
- Dondofema, F *in press*. Applications of GIS and Remote sensing techniques in gully identification and assessment in the Zhulube Meso-catchment, Zimbabwe: implications to water resources management. *9th WaterNet/WARFSA/GWP-SA Symposium*, Johannesburg, South Africa, October 2008
- Falkenmark, M. and Rockström, J. 2003. *Balancing Water for Man and Nature: The new approach in ecohydrology*. EarthScan, London.
- Jaspers, F.G.W. 2003. Institutional arrangements for integrated river basin management. *Water Policy*, **5**, 77-90.
- Khosa, S., Love, D. and Mul, M. *in press*. Evaluation of the effects of different water demand scenarios on downstream water availability: The case of Thuli river basin. *9th WaterNet/WARFSA/GWP-SA Symposium*, Johannesburg, South Africa, October 2008
- Kileshye Onema, J.-M., Mazvimavi, D., Love, D., Mul, M. 2006. Effects of dams on river flows of Insiza River, Zimbabwe. *Physics and Chemistry of the Earth*, **31**, 870-875.

- Love, D., Jonker, L., Rockström J., van der Zaag, P. and Twomlow, S. 2004. The Challenge of Integrated Water Resource Management for Improved Rural Livelihoods in the Limpopo Basin – an introduction to WaterNet's first network research program. In: Abstract Volume, 5th WaterNet/WARFSA/GWP-SA Symposium, Windhoek, Namibia, November, 2004, pp106-107.
- Love, D., Twomlow, S., Mupangwa, W., van der Zaag, P. and Gumbo, B. 2006. Implementing the millennium development food security goals - challenges of the southern African context. *Physics and Chemistry of the Earth*, **31**, 731-737.
- Maisiri, N., Rockström, J., Senzanje, A. and Twomlow, S. 2005. An on-farm evaluation of the effects of low cost drip irrigation on water and crop productivity, compared to conventional surface irrigation system. *Physics and Chemistry of the Earth*, **30**, 783-791.
- Masvopo, T., Love, D. and Makurira, H. *in press*. Evaluation of the groundwater potential of the Malala Alluvial Aquifer, Lower Mzingwane River, Zimbabwe. 9th WaterNet/WARFSA/GWP-SA Symposium, Johannesburg, South Africa, October 2008.
- Moyce, W., Mangeya, P., Owen, R. and Love, D. 2006. Alluvial aquifers in the Mzingwane Catchment: their distribution, properties, current usage and potential expansion. *Physics and Chemistry of the Earth*, **31**, 988-994.
- Moyo, B., Madamombe, E. and Love, D. 2005. A model for reservoir yield under climate change scenarios for the water-stressed City of Bulawayo, Zimbabwe. In: Abstract Volume, 6th WaterNet/WARFSA/GWP-SA Symposium, Swaziland, November 2005, p38.
- Moyo, R., Love, D., Mul, M., Twomlow, S. and Mupangwa, W. 2006. Impact and sustainability of low-head drip irrigation kits, in the semi-arid Gwanda and Beitbridge Districts, Mzingwane Catchment, Limpopo Basin, Zimbabwe. *Physics and Chemistry of the Earth*, **31**, 885-892.
- Munamati, M., Mhizha, A. and Sithole, P. 2005. Cultivating livelihoods: an assessment of water allocation and management practices in small-scale irrigation schemes – case studies from the Mzingwane Catchment, Zimbabwe. In: Abstract Volume, 6th WaterNet/WARFSA/GWP-SA Symposium, Swaziland, November 2005,
- Mwenge Kahinda, J.-M., Rockström, J., Taigbenu, A.E. and Dimes, J. 2007. Rainwater harvesting to enhance water productivity of rainfed agriculture in the semi-arid Zimbabwe. *Physics and Chemistry of the Earth*, **32**, 1068-1073.
- Nare, L., Love, D. and Hoko, Z. 2006. Involvement of stakeholders in the water quality monitoring and surveillance system: the case of Mzingwane Catchment. *Physics and Chemistry of the Earth*, **31**, 707-712.
- Ncube, M. and Taigbenu, A.E. *in press*. Application of the SWAT model to assess the impact of land cover and land use on the hydrologic response in the Olifants Catchment. *Physics and Chemistry of the Earth*, **33**
- Ngwenya, P.T., Love, D., Mhizha, A. and Twomlow, S. 2006. Effects of grazing management on rangeland soil hydrology, Insiza, Zimbabwe. 7th WaterNet/WARFSA/GWP-SA Symposium, Lilongwe, Malawi, November 2006.
- Svubure, O. 2007. A seat at the table: which table and what costs? Participation and institutional reform in the water sector in Zimbabwe: case of the Mzingwane Catchment. MSc dissertation (unpublished), UNESCO-IHE, the Netherlands.
- Tunhuma, N., Kelderman, P., Love, D. and Uhlenbrook, S. 2007. Environmental Impact Assessment of Small Scale Resource Exploitation: the case of gold panning in Zhulube Catchment, Limpopo Basin, Zimbabwe. 8th WaterNet/WARFSA/GWP-SA Symposium, Livingstone, Zambia, November 2007.
- Vilanculos, A., Mhizha, A. and Kaseke, E. 2006. Towards improving flood forecasting and early warning systems through integrated technology in the Limpopo Basin. 7th WaterNet/WARFSA/GWP-SA Symposium, Lilongwe, Malawi, November 2006.
- Van der Zaag, P. 2005. Integrated Water Resources Management: Relevant concept or irrelevant buzzword? A capacity building and research agenda for Southern Africa. *Physics and Chemistry of the Earth*, **30**, 867-871.
- Van der Zaag, P. 2007. The impact of regional water resources capacity building: citations of the published proceedings of the annual WaterNet/WARFSA/GWP-SA symposia in Southern Africa, 2001-2005. *Physics and Chemistry of the Earth*, **32**, 971-975.