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# Research and training in the Olifants and Limpopo basins of Southern Africa

Dominique Rollin,<sup>1</sup> Sylvie Morardet,<sup>2</sup> Hervé Lévite<sup>3</sup> and Hilmy Sally<sup>4</sup>

This paper describes the contribution of the French researchers seconded to International Water Management Institute (IWMI) by the French Ministry of Agriculture in the Olifants and Limpopo benchmark basins of the Challenge Program on Water and Food. The French researchers made available to IWMI are not only involved in the economic, geographic and agronomic aspects of these projects, but also participate in coordinating and developing synergy between different projects in the basins.

In November 2000, the International Water Management Institute (IWMI) opened its regional office for Africa in Pretoria pursuant to an agreement with the South African government. Ever since, the French Ministry of Agriculture has seconded one, and then two, researchers, with scientific supervision from the Centre national du machinisme agricole, du génie rural, des eaux et forêts (CEMAGREF), to agricultural and environmental engineering institute, to assist in the research conducted by IWMI in Africa. This short paper describes the participation of the French researchers in this work and their involvement in implementing research and training activities in the Olifants and Limpopo benchmark basins of the Challenge Program on Water and Food (CPWF) and in developing research partnerships.

Among the many reasons for French researchers to work in partnerships in southern Africa are interest in research activities for development, as well as the importance of social and environmental issues in relation to economic development and redressing the inequalities inherited from the apartheid system in South Africa.

## Olifants and Limpopo benchmark basins

The concept of a benchmark basin was developed by IWMI and CPWF in order to carry out a significant number of research and training activities in these basins, with a long-term commitment and the idea of comparing the basins with one another. The research topics addressed in these benchmark basins include integrated management of water resources to enhance their productivity and sustainability, integration of social and environmental human-based factors in evaluating water productivity, and joint management of surface and ground water.

The 54,000 square kilometer (km<sup>2</sup>) Olifants River basin in South Africa was selected by IWMI as one of its three benchmark basins.<sup>1</sup> Studying this basin is of particular interest for the following reasons:

- It is a priority concern of the South African Department of Water Affairs and Forestry (Van Vuuren et al. 2003) to establish new catchment management agencies for the post-apartheid period following the enactment of the national Water Act of 1998. This law seeks to balance considerations of efficiency, equity and sustainability, and so redress past inequities and ensure a better distribution of the benefits stemming from equitable access to water.<sup>2</sup>
- The opportunity to observe and support, or even influence, major institutional changes such as the establishment of these new catchment agencies, water allocation reform and the general decentralization of water management in the context of political and social change.
- The water resources of this basin are insufficient to reliably satisfy all uses, and the issue of water quality is particularly important because of the substantial presence of mining activities that generate pollution and use a lot of water.
- A full range of water uses, and thus of water-related conflicts, can be found in the basin: agriculture (both subsistence and commercial), forestry, domestic (shaped in part by the very high population density and great poverty in the former homelands), mining, power production (half of South African electric power is produced in the Olifants basin), industry, environment (with a portion of Kruger Park and many private and public natural reserves) and

<sup>1</sup> Along with the Ruhuna basin in Sri Lanka and the Rechna Doab (an Indus River sub-basin) in Pakistan; cf. [www.iwmi.cgiar.org/benchmark/index.htm](http://www.iwmi.cgiar.org/benchmark/index.htm)

<sup>2</sup> South Africa is one of the few countries of Africa suffering from a physical shortage of water, as most of the others face instead a lack of infrastructure.

river fishing. In addition, transboundary obligations include the necessity of maintaining a flow reserved for Mozambique.

- The basin is regularly subject to devastating floods, which often entail dramatic damage in neighboring Mozambique.

CPWF selected the Limpopo basin (413,000 km<sup>2</sup>)<sup>3</sup> as one of its nine benchmark basins. Since the Olifants is one of the main tributaries of the Limpopo, the research conducted in the Olifants basin is particularly relevant to the Limpopo. For most of the CPWF projects, South African sites have thus been selected in the Olifants basin, while Zimbabwean sites have been chosen in the Mzingwane basin and Mozambican sites in the lower Limpopo floodplain.



Map 1: Olifants and Limpopo benchmark basins

### From laboratory to basin, a range of scales

Research on water management requires that efforts be carried out at different scales, from basic soil-water-root interaction to an entire basin spreading over tens of thousands of square kilometers. This includes the range of scales in between, i.e., individual plots, farms, infrastructure and institutions. As the range of scales is broad, so too is the range of disciplines that comes into play.

Databases, geographic information systems and models can be used to move from “laboratories” at the local level to a much broader level, through analyses of the laboratories’ specificity and the degree that it represents the entire basin.

Quaternary catchments (measuring a few hundred square kilometers) were selected in the Olifants basin for implementing research and training activities.

#### Mafefe and Sekororo, two laboratories for the study of integrated water resources management

*Mafefe (quaternary catchment no. B71D, 263 km<sup>2</sup>) and Sekororo (quaternary catchment no. B72A, 534 km<sup>2</sup>) are the two quaternary catchments in northern Olifants selected for implementing IWMI research and training projects. They can be considered representative with respect to a number of major water issues in the Olifants River basin.*

*In Mafefe, the site includes a major tributary of the Olifants River, the Mholapitsi, which makes a significant contribution to the river’s flow during the dry season and provides high quality water as a result of the filtration and buffering role played by its wetlands. Agricultural development in these wetlands, which is important for the subsistence of the local population, raises the concern that the Mholapitsi may become unable to perform this role.*

*Sekororo, a quaternary catchment where a limited supply of water has to meet the demands of commercial farms, subsistence farms in a former homeland and natural reserve, provides the opportunity to study the water distribution between uses and users and assess the potential for multiple-use water-supply systems.*

*At both sites, building a partnership based on the participation of local actors (communities, farmers’ representatives, municipalities, traditional authorities and government representatives) is fundamental. Several students from a variety of disciplines are involved.*

<sup>3</sup> Cf. [www.waterandfood.org/index.php?id=64](http://www.waterandfood.org/index.php?id=64)

### Involvement in CPWF projects

After the first CPWF call for proposals, 25 projects were selected for financing. Of these, six are being implemented in the Limpopo basin, and five of them have sites in the Olifants basin.<sup>4</sup>

The French researchers seconded to IWMI are not only involved in the economic, geographic and agronomic aspects of these projects, but also participate in coordinating and developing synergy between different projects in the basin.

Complementarities and synergies also occur with the Echel-Eau funding<sup>5</sup> and the research activities conducted by other French teams working in the Limpopo and other basins: CIRAD, Institut de recherche pour le développement (IRD) and Groupe d'échange et de recherche technologiques (GRET). The role of intermediary played by French researchers, in disseminating French concepts, tools and methods, is thus essential, as is the role of supervising students from the French system interested in water management, who find favorable study conditions (international experience, cultural openness and research-development links) in the laboratories of these benchmark basins (Lefebvre et al. 2005; Darradi 2005; Sarron 2005). Participants include Institut national agronomique Paris-Grignon; Ecole nationale supérieure agronomique de Rennes; Ecole nationale d'ingénieurs des travaux agricoles de Bordeaux; Ecole nationale du génie rural des eaux et des forêts; University of Montpellier I; Centre national d'études agronomiques des régions chaudes; and Ecole du génie de l'eau et de l'environnement de Strasbourg.

### Involvement of the geographer-agronomist and the economist in CPWF projects

*The geographer-agronomist participates in coordinating and implementing the various research and training projects in the Olifants River basin, specifically the CPWF projects. He plays an important role in building partnerships, certain field operations on water productivity and managing the upscaling from laboratory to basin. He makes important contributions to supervising students and especially to developing synergies between different projects and different disciplines. The systemic approaches proposed by the French scientific community are followed regarding cropping patterns, farming and agrarian systems.*

*The economist is responsible for defining and implementing the theoretical framework of trade-off analysis between agricultural production and environmental protection in the wetlands project (Masiyandima et al. 2005). She also participates in economic analyses conducted in the various projects and the study on financing multiple-use water-supply systems in rural areas. She supervises the work of many students.*

*Both participate in the scientific and executive committees of the various CPWF projects.*

### Partnership development

IWMI research capacities in South Africa are insufficient to allow the Institute to carry out by itself the many projects in which it is involved. Moreover, one of the CPWF objectives is to conduct research in partnership with other CGIAR Centers, national research institutions, nongovernmental organizations, government agencies and representatives of civil society. The researchers made available to IWMI thus play a major role in establishing relations and building partnerships with researchers and French research teams, most of whom are connected to the Gestion de l'eau, acteurs et usages (G-EAU) joint research unit (unité mixte de recherche, or UMR) combining CEMAGREF, IRD, CIRAD, ENGREF, the universities of southern Africa, and the other actors mentioned above.

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<sup>4</sup> These are:

- (i) Crop water technology and market: Increased food security and income in the Limpopo basin through integrated crop, water and soil fertility options and public-private partnerships.
- (ii) Wetlands: Wetlands-based livelihoods in the Limpopo basin. Balancing social welfare and environmental security.
- (iii) Models for implementing multiple-use systems for enhanced land and water productivity, rural livelihoods and gender equity.
- (iv) Waternet: The challenge of integrated water resource management for improved rural livelihoods: Managing risk, mitigating drought and improving water productivity in the water-scarce Limpopo basin (Love et al., 2005).
- (v) Transboundary water governance for agricultural and economic growth and improved livelihoods in the Limpopo and Volta basins: Towards African indigenous models of governance.

<sup>5</sup> French contribution to CPWF

## Conclusion

The presence of researchers from the French Ministry of Agriculture in IWMI is a way to disseminate French approaches and tools in international research (e.g., the Olympe software for modeling of farming systems, multiple agent approaches, trade-off analysis for sustainable management of wetlands areas, etc.) and to compare them with other tools, methods and concepts used in IWMI. The “laboratories” are excellent training grounds and raise awareness of multidisciplinary research among young French researchers. In particular, they provide exposure to real problems confronting rural development and poverty reduction, a comparative view of multiple uses and users of water, and the opportunity to take into account not only technical and economic elements but also social and political factors, through action research.

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<sup>2</sup> Sylvie Morardet, PhD in economy and a senior engineer of the French Ministry of Agriculture, is a specialist in irrigation and water-management issues.

<sup>3</sup> Hervé Lévite, an engineer of the French Ministry of Agriculture, is a specialist on water resource development projects.

<sup>4</sup> Hilmy Sally, a civil engineer and PhD in water mechanics and management, has more than 25 years of experience in water resource management and irrigation in Africa and Asia. Since 2005, he has been in charge of the International Water Management Institute (IWMI) southern Africa office.

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