3 Are Good Intentions Leading to Good Outcomes? Continuities in Social, Economic and Hydro-political Trajectories in the Olifants River Basin, South Africa

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Overview of the Argument

Beginning in the early 19th century, land and water resources in South Africa's Olifants basin were systematically mobilized to benefit commercial agriculture, mines and industries owned by a tiny minority of the population. During the 20th century, the majority African population was increasingly confined to small areas of the basin having little agricultural potential or access to water. This resulted in dramatic contrasts between the wealthy minority and the extremely poor majority. Since the early 1990s, under the new democratic regime, South Africa's constitution, with its basic rights guarantees, including access to water, and its world-famous Water Act, intended both to reverse the wrongs of the past and to conserve scarce water resources for future generations, have raised high expectations. The Water Act is being implemented by politicians and professionals whose good intentions cannot be questioned. However, to date, access to water remains highly inequitable in the Olifants basin, and socio-economic well-being is improving very slowly.

Setting the Physical Scene

The Olifants water management area

The Olifants River is the largest tributary to the Limpopo, one of several transboundary rivers in Southern Africa. Shared by Botswana, Zimbabwe, South Africa and Mozambique, the Limpopo basin has an area exceeding 400,000 km^2 (45% in South Africa). Of a basin population of 14 million, 10.7 million are in South Africa (a quarter of the total population). Turton (2003) emphasizes the critical strategic importance of the Limpopo basin for all four riparian countries and the considerable ethnic diversity overlapping national boundaries.

The total area of the Olifants basin (including Mozambique and South Africa and two large northern tributaries, the Letaba and Luvuvhu) is 73,534 km^2, nearly 17% of the Limpopo basin (ARC and IWMI, 2003). 'Olifants' is the Afrikaans name for elephant. In Northern Sotho, the main language of the basin, it is 'Lepelle', 'the river that meanders along' (Bulpin, 1956). About 770 km long, the Olifants originates east of Johannesburg and

 River Basin Trajectories: Societies, Environments and Development (eds Molle and Wester)

flows north before curving gently to the east. Its upper reaches are in the 'highveld', over 1200 masl. Further east, the lower reaches are below a steep escarpment in the 'lowveld', at altitudes of less than 800 m. The Olifants crosses three provinces (Gauteng, Mpumalanga and Limpopo) into Kruger National Park, then flows into Mozambique, where it meets the Limpopo (Fig. 3.1).

In Mozambique, the Massingir dam, with 2840 Mm^3 of storage, is important for hydropower, irrigation (30,000 ha), flood control, and urban and rural water supply, as well as maintenance of low flows to prevent salt water intrusion at the mouth of the Limpopo (Carmo Vaz, 2000). There have been several devastating floods in recent years.

From the perspective of Mozambique, upstream South African water use is a vitally important issue, fraught with the potential for conflict. Low flows result in salt water intrusion and water shortages (FAO, 2004:87–88). In 2005, the Olifants stopped flowing into Mozambique for 78 days, causing considerable hardship. The implications for Mozambique of South African use of the Olifants have not been addressed by researchers and there is no specific international agreement on water flows. The South African Department of Water Affairs and Forestry (DWAF) is aware of this issue, although its assumptions about the amount that should flow to Mozambique may not be consistent with those of Mozambique officials.

The official Olifants water management area[1] in South Africa drains an area of 54,308 km^2. In 2005, the population of 3.2 million represented 7% of the national population. Of this population, 67% is rural, higher than the national average. Blacks are the majority (94%), with an illiteracy rate of 50%. Distribution of wealth and access to services are highly skewed between urban and rural areas, and between whites and blacks (Magagula *et al.*, 2006). Population growth is slow, although shifting from rural to urban over time. There are seven major tributaries to the Olifants (Fig. 3.1). Based on DWAF's demarcation, the Olifants water management area is a 'primary drainage area' (McCartney *et al.*, 2004), and includes seven secondary, 13 tertiary and 114 quaternary sub-basins. But the basin is normally divided into five distinct water management regions (McCartney *et al.*, 2004; de Lange *et al.*, 2005).

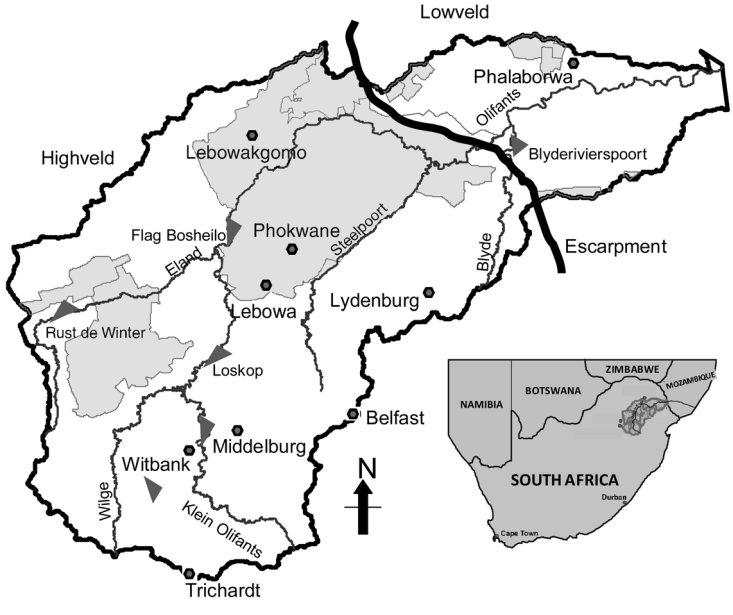

Fig. 3.1. Map of Olifants River, major dams (triangles), tributaries, towns (hexagons) and demarcation of former homeland areas (dotted grey outlines). From McCartney and Arranz (2007).

Physical features

The geology of the basin is complex, and dominated by igneous and metamorphosed rocks. There is a relatively low-relief, gently undulating plateau and a steep escarpment roughly separating the lower Olifants region from the middle and upper regions. Land use consists primarily of cultivation (dry and irrigated), grazing, mining, industry, forestry, and rural and urban settlements. There are many tourist attractions in the basin, including the Kruger National Park, private game reserves, Blyde River Canyon Nature Reserve and several wildlife management areas. There are important fish hatcheries and trout farms, while some reservoirs are also used for recreation.

Climate, rainfall and hydrology

The basin is characterized by warm summers and mild winters, with temperatures influenced by altitude. In summer, maximum temperatures are 30–34°C and with a minimum of 18–22°C; in winter they are 22–26°C and 5–10°C, respectively. Frost occurs only in the southern and western portions of the basin (FAO, 2004).

The mean annual precipitation is 630 mm, with a range of 500–800 mm and coefficients of variation greater than 0.25 in all sub-basins. In the mountains to the east and on the escarpment, annual rainfall can exceed 1000 mm (McCartney and Arranz, 2007). The rainy season is from October to April, with heavy rainfall in December and January producing occasional floods. There are no months when rainfall exceeds potential evapotranspiration, and typically it exceeds 50% of potential evapotranspiration only in November–February (McCartney *et al.*, 2004). Midsummer dry spells are common, making rainfed agriculture risky.

McCartney *et al.* (2004) studied the hydrology, complementing DWAF's work (Basson and Rossouw, 2003; van Vuuren *et al.*, 2003; DWAF, 2004a). The naturalized mean annual flow (MAF) of the whole basin is 2040 Mm^3, only about 6% of the average annual rainfall (McCartney *et al.*, 2004). However, this value masks considerable annual variability. Actual measured runoff, as influenced by human activities and exotic (i.e. alien) vegetation, reaches 1235 Mm^3 (de Lange *et al.*, 2005). All studies agree that with total South African consumption at around 44% of the naturalized MAF and increasing, the basin is already stressed.

DWAF estimates that the total groundwater recharge is 3–6% of mean annual precipitation, which is about 1800 Mm^3. Others suggest that the average recharge is only half this amount, so values are not precise (McCartney *et al.*, 2004). DWAF variously estimates total groundwater abstractions at 75–99 Mm^3, principally from mining, urbanization, stock-water and irrigation.

Estimates of average annual transfers into the basin as of 1990 (the official values have not changed in 18 years) vary slightly at around 196 Mm^3 (McCartney *et al.*, 2004). Most of this (188.8 Mm^3) is used for cooling power stations operated by Eskom (Electricity Supply Commission). It leaves the basin as evaporation and has little impact on basin hydrology. Nearly all these interbasin transfers support large-scale commercial water users (van Vuuren *et al.*, 2003:4, 2ff.). Transfers out of the basin are very small.

Agriculture, livestock and forestry in the basin

Commercial agriculture officially contributes only 7% of Gross Geographical Product (GGP) to the basin economy, but this is nearly twice the national level. Subsistence and small-scale agriculture, whose value is not measured, play a critical role in human survival, child nutrition and potential poverty alleviation.

South Africa generally classifies three farming types: (i) subsistence/semi-commercial farming (typically dryland); (ii) commercial dryland farming (large scale and highly mechanized); and (iii) commercial irrigated farming (export oriented, intensive) (Magagula and Sally, 2005). All three occur in the basin, with commercial dryland on more than 70% of the cultivated area of 1.17 million ha, and commercial irrigated covering around 11% (128,000 ha). Today, the average size of commercial farms in Limpopo Province is 972 ha (van Koppen, 2007). An estimated 70% of water

withdrawals goes to irrigation (30% of which is groundwater) (Magagula and Sally, 2005). Estimated water requirements using the SAPWAT model range from 436.8 Mm^3 (DWAF data) to 569.5 Mm^3 (van Heerden, 2004). Of the estimated R5.3 billion (approximately US$828 million) gross value of agricultural production in 2004, 60% was generated by commercial dryland and 37% by commercial irrigation (Magagula and Sally, 2005). High-value crops for export, such as citrus, are more common here than elsewhere in South Africa. Maize remains the dominant crop by area and is grown in summer under rainfed conditions.

In addition, there is a small-scale irrigation sector, mostly in the former homeland areas. The basin has around 72 small-scale irrigation schemes with a total command area of 9534 ha, 5564 farmers and an average plot size of 1.6 ha. However, many of these are either defunct or underutilized. More than half of the farmers are women and often elderly (Mpahlele *et al.*, 2000; Kamara *et al.*, 2002; van Koppen *et al.*, 2006).

Large parts of the Olifants basin are used for livestock and game farming. Van Vuuren *et al.* (2003) estimate 337,006 livestock units, but there are no data from the former homelands. Cattle are the most common, but there are also sheep. Game (impala, kudu, waterbuck, gemsbok and rhino) is farmed for hunting and meat production, and is becoming popular. Nationally, the 'hunting industry' creates many jobs and a substantial income (www.phasa.co.za/index.php?pid=3).

Commercial forestry (mainly pine and eucalyptus) is an important water consumer; it is estimated to cover 400 km^2 (Le Roy, 2005:10). Non-indigenous trees were originally grown for mining needs, but today commercial forestry is mainly linked to paper production (Lévite *et al.*, 2003), and is dominated by large national and international corporations. These plantations account for 28% of national commercial forestry. Non-indigenous species are seen as depleting far more water through evapotranspiration than indigenous forests. Therefore, DWAF charges companies for the additional 'stream flow reduction' at a rate of R10 per ha (DWAF, 2004b). There are also about 1399 km^2 of indigenous forests in the Blyde River and lower Olifants regions. An assessment of actual evapotranspiration (ETa) in part of the middle Olifants during one day in January 2002, using a remote-sensing technique (SEBAL), found that agriculture accounted for only 24% of actual basin ETa, compared with over 58% through commercial forests (Ahmad *et al.*, 2005).

Expansion of mining in the basin

Mining, a significant user and polluter of water, is the largest economic sector in the basin (22.1% of GGP versus 7% GDP nationally). Employment in mining is growing slowly in the Olifants: declines in gold mining balance growth in platinum mining. Manufacturing is largely a function of the relatively cheap supply of coal and electricity, much of it based on processing minerals. There are eight major coal-fired electricity power stations, generating more than 50% of South Africa's electric supply (van Vuuren *et al.*, 2003). The downstream impact of coal mining from both decommissioned and functioning mines is a major problem, with the release of acidic leachate into both surface water and groundwater (Klarenberg, 2004).

Monopolizing Water and Creating Water Scarcity

From the early 19th century, the history of the Olifants River basin has been a story of resource capture by the powerful. By the late 20th century, a small race-based minority controlled nearly all the land, water and mineral resources and the wealth they produced, while the African majority was becoming increasingly poor and marginalized (van Koppen, 2007).

Warfare and competition on the eve of the Afrikaner Boers' arrival

In the early 19th century, the Olifants basin was inhabited by African ethnic groups, largely agro-pastoralists also engaged in trade with the Indian Ocean. Demand for ivory had led to a quantum leap in its export from Delagoa Bay (today

Maputo, Mozambique) (Reader, 1998:469–470). Rainfall patterns were critical for grazing and sorghum cultivation. The highveld and middleveld areas were more suitable for cultivation and summer grazing; the malaria- and tsetse-infested lowveld was only suitable for dry-season winter grazing and as a major source of ivory. Settlement was largely along streams. People spoke languages that are part of the Bantu language family, divided mainly into Sotho and Nguni languages (Earle *et al.*, 2006:9–16). They were agro-pastoralists, highly mobile groups with loose political affiliations that easily assimilated other groups (Delius, 1983).

Even before the Afrikaner Boers arrived, there was rising competition for water and land, cattle raiding and more serious warfare. Fearing slave-traders (for Europe's colonies and the Cape Colony), waves of the population fled into the Limpopo and Olifants basins, seeking protection from the 1780s to the 1840s (Reader, 1998:464–478). The closing of the land frontier in the narrow coastal areas inhabited by Nguni-speaking people (i.e. Zulus), combined with serious periodic droughts, led to new and bloodier warfare. Conquering tribes came into the Olifants basin, raiding cattle, destroying assets and either subjugating inhabitants or driving them out. As this process (called *mfecane*) was occurring, the Boers began moving in from the south, and with their superior technology (guns, horses) defeated many dominant African groups. They too needed slaves for labour (euphemistically called 'apprentices') to farm (Reader, 1998:472–473). They grew the same crops using the same technologies as the Africans and were often dependent on the Africans' willingness to help them (Delius, 1983; Reader, 1998:480).

As African chiefs became more powerful, social differentiation grew. The Pedi chiefdom, with its centre in the Tubatse (Steelpoort) valley, ultimately controlled tens of thousands of Africans. By the 1840s, it controlled the main trade routes, buying cloth and guns from the coast in return for iron, copper beads, meat, ivory, horns and slaves. In 1876, near the present-day Flag Boshielo dam, Sekhukhune I defeated the Boers. However, 3 years later, his army was crushed when the British joined the Boers and Swazis against him (Delius, 1983).

Opening salvos: white expropriation of land, water and mineral resources, 1832–1913

Migration, alliances and conquests in the early 19th century

During the eight decades from 1832 to the early 1900s, three groups of whites, initially mutually hostile, encroached into the basin: the Boers, a small group of missionaries and the British. Both the Africans and the whites were seriously subdivided, but the whites exploited the cleavages among the Africans more effectively (Thompson, 2001). The early Boers competed directly with the Africans for water, land and trade routes. Although the black population exploded (becoming 20 times more numerous than the whites) over the century, this did not translate into political or economic power. Conflict over land grew, leading to clashes. The Pedi defeat of the Boers in 1876 and the annexation of the *Zuid–Afrikaanse Republiek* (ZAR) by the British in 1877 led to the reorganization of the Republic's administration, enabling it to defeat the Pedi in 1879. The Pedi heartland was put under classic British colonial 'indirect rule', as a 'location' in which black chiefs ruled, supervised by white magistrates (Delius, 1983).

In 1886, gold was discovered in Witwatersrand near the Olifants basin, as well as smaller deposits of gold and minerals within the basin. By 1895, the first coal mine in the upper Olifants region opened. Then the British and foreign-owned corporations wished to control all of Southern Africa. The ZAR, now led by Paul Kruger, vehemently resisted and sought to tax the mines, leading to the Second Anglo-Boer War (1899–1902).

Boers and British: white conquest and expropriation

Understanding the developments in the Witwatersrand (now the largest industrial and urban complex in sub-Saharan Africa) is critical to understanding the Olifants basin development trajectory (Turton and Meissner, 2002). The discovery of gold led to Johannesburg's rapid growth and placed enormous strains on a water supply previously perceived as plentiful.

By 1900, African political power and

control over water, land and mineral resources were nearly destroyed. The Boers controlled the most fertile lands and the best water supplies. British legislation backed by the British Army declared registered water and land to be white private property. A tiny proportion of the land was set aside for African occupation. Boer society was changing rapidly, becoming more inequitable and elitist. A group of new Afrikaner 'notables' became large landowners. Speculators, absentee landlords and companies from outside the basin owned 20% of the land by 1900. Well-watered land, often occupied by Africans, was the first to be controlled. Africans were forced to provide labour to these farms.

With rising market demand for maize and other food crops for miners, large-scale cropping, sometimes irrigated, was initiated. For decades, absentee white owners extracted rents from African tenants and sharecroppers; but as the market grew and railway facilities were constructed, there was a shift to capitalist wage labour arrangements for farm management (Bundy, 1988; Terreblanche, 2002). The Afrikaner notables and British mining interests now had a shared interest in a docile, low-wage labour force, leading to the 'alliance of maize and gold'. Many Boers who could not compete with large farms were also pushed into landlessness, forcing them to compete with cheap African labour.

Nevertheless, African farmers, often sharecroppers on white-owned land, responded effectively to the new food markets, adopting new strains of maize and irrigation. Some of these farmers used communal land and kinship relations as a base; some purchased land using legal loopholes; but most were tenants on white-owned land. Unfortunately, most of these 'peasant capitalists' were soon deprived of their access to land and markets (Bundy, 1988).

The process of creating an ideological and de facto basis for territorial and institutional segregation was consolidated by the South African Native Affairs Commission in 1905. Its purpose was to forge a black male migrant labour force with a black female subsistence base in the 'native reserves'; this labour was allocated proportionally to the mines and to Afrikaner farms. This segregation policy was further consolidated with the Native Land Act of 1913 (Thompson, 2001; Terreblanche, 2002).

The 1913 Act separated the Union into white areas (91% of the land), where Africans, coloureds and Indians were disenfranchised, and black reserves ruled by 'chiefs' as black administrators. The Development Trust and Land Act of 1936 consolidated this exclusionary process. These Land Acts also implicitly deprived Africans of any formal water rights, because riparian rights were tied to land ownership (van Koppen, 2007).

In 1910, with the establishment of the Union of South Africa, a Native Affairs Department was created, and later the Native Administration Act of 1927 formalized 'chiefs' as arms of the government. In 1936, the reserves were placed under the South African Native Trust (later the South African Development Trust), and legitimized the racially and gender-segregated labour market with extremely low wages for men. The apartheid government's homeland policies after 1948 entrenched these patterns more rigidly. Through the Homeland Constitution Act of 1971, existing reserves were reorganized and new ones established, based on nine officially recognized African ethnic groups. In the Olifants basin, the supposed 'Northern Sotho', including the Pedi, were included in Lebowa, created in 1973. Similarly, on the eastern highveld, KwaNdebele was created for the Ndbele, and Gazankulu for the Shangaan to the north-west border of the Olifants basin (see Fig. 3.2).

By the early 1900s, all of the ingredients for state-supported, race-based wealth accumulation were in place, and these greatly determined the Olifants basin development trajectory. These ingredients included:

- A Land Act excluding Africans from claims to most of the land, water and minerals.
- Native reserves as a reservoir of cheap labour.
- Repressive labour laws, enhancing employers' control over the black labour force.
- Discriminatory arrangements favouring white workers.

Henceforth, until late in the apartheid era, water development was used to further deepen the divide between privileged whites and the black majority, what Lévite *et al.* (2003:4) call

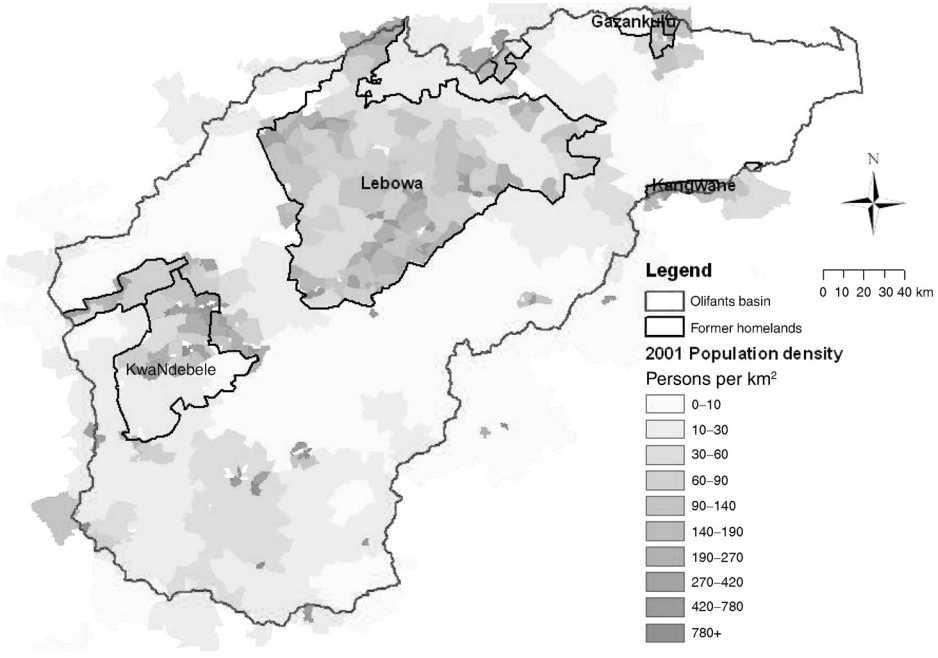

Fig. 3.2. Population densities and former homelands in the Olifants basin. From McCartney *et al.* (2004).

'race-based differentiation in basin development'. The state played a critical role in this hydraulic mission in the Olifants basin, initially mainly catalysing irrigation development, but from the 1970s onwards promoting centrally controlled, large-scale bulk water supplies, in particular to the Witwatersrand and the adjacent Olifants highveld. The era of engineers able to overcome all obstacles to increase the water supply to meet growing demand had arrived (Turton and Meissner, 2002:41; van Koppen, 2007).

State-supported water development in the 20th century

Irrigation development and the role of the state

There were three waves of investment in irrigation in South Africa: around the 1920s (with a peak in 1922), in the 1930s (with a peak of 5% of total state expenditure) and in the 1970s. Until the 1950s, the government exclusively supported irrigation development; support for other users started in the 1950s, and around 1970 priority shifted from agriculture to other uses (Department of Water Affairs, 1986).

The ZAR adopted its first irrigation law in 1884, revised it in 1908 and established an Irrigation Department in 1903 (van Koppen, 2006). By the late 19th century, the Transvaal had adopted the Roman–Dutch permit system (van Koppen, 2007). In 1912, the union government created a national Irrigation Department and promulgated the Union Irrigation and Conservation of Waters Act. This Act adopted the British riparian rights system, which tied water rights to land ownership. This continued until major revisions were made through the Water Act of 1956, when the Irrigation Department became the Department of Water Affairs (DWA). This Act further strengthened government control over water and broadened its scope to ensure industrial and mining interests, the new priority.

From the 1920s, another motivation was to employ poor unemployed whites and to settle potential farmers such as white war veterans. Smallholders were seen as more intensive and committed cultivators, and labour intensiveness was seen as a way of absorbing landless and unemployed whites. The policy also helped to

secure white domination of productive land. Two such schemes were in the Olifants: the Loskop dam and the Rust de Winter scheme (Turton *et al.*, 2004; van Koppen, 2007; see Fig. 3.1). The government encouraged both irrigation boards, i.e. schemes managed by white farmers but heavily subsidized, and government water schemes for white farmers.

The Loskop dam was built by and for poor white men during the depression era. Today, the area below the dam is intensively irrigated, growing, in particular, high-value crops (citrus and table grapes) for export. Most farms are large, modern and capital intensive, employing thousands of workers.

Seventeen irrigation boards were established in the basin (van Koppen, 2007). Public irrigation has been especially important in the middle Olifants, under the Loskop dam. As settlement of white farmers proceeded, Africans were forced to move. But there were a few cases where the South African Development Trust purchased white farms to 'rationalize' boundaries between white areas and homelands, including farms below the Flag Boshielo dam (Stimie *et al.*, 2001:57–58; van Koppen, 2006).

The trajectory of dam construction

McCartney *et al.* (2004) estimate the basin has 37 major and another 300 'minor' dams, plus 3000–4000 small dams, with a total cumulative storage of about 1480 Mm^3 (85% in the major dams). The total storage capacity is 72% of the average annual naturalized flow. McCartney *et al.* (2004) also note that more than half are multi-purpose dams (often including irrigation), while 28% (38% of the storage) are solely for irrigation. Figure 3.3 is a timeline of storage development in the 20th century, distinguishing former homelands from former white areas (Republic of South Africa). There is a clear discrepancy, with nearly all dams aimed at benefitting white users until the 1980s, when two dams were built that also provided some benefits to former homeland areas (see also McCartney *et al.*, 2004:27–31).

Water for mining, industry, energy, and rural and urban sectors

Until the 1940s, water development in the Olifants for urban uses, mining and industry was largely a private affair of municipalities and firms. These schemes were scattered physically, and generally their costs were low. The Water Act of 1956 changed the prioritization of water use and, for the first time, made some subsidies available to non-agricultural local bodies. Coal mining in the upper Olifants basin played a major role in this shift. Eskom (a parastatal created in 1919) constructed coal-fired electricity-generating plants in the upper Olifants highveld, and coal-based industries developed around iron and steel, using ore available locally. For these industries, which require large and highly secure quantities of water, dams were constructed in the upper Olifants from 1950, but demand quickly exceeded supply (van Koppen, 2007).

Mineral deposits had stimulated land speculation, prospecting and railway development. Phalaborwa and Steelpoort became two major mining areas. In Phalaborwa (in the lower Olifants: see Fig. 3.1), first copper and, later, phosphate were the most important minerals, but this has now diversified. Initially, small dams were built to supply water to the mines, white urban areas and black townships. The Phalaborwa Water Board was established in 1963, and after 1994 it was expanded and renamed the Lepelle Water Board. By the 1970s, the assurance of water supply during the dry months to most of these downstream areas had become risky.

The Steelpoort area is even richer in minerals (platinum, magnetite, chrome). Mining was also done within the Pedi native reserve, but under the firm legal control of the union government. Mines created jobs for men, although recruitment was from outside the region. By the 1970s, the appetite of the mining houses was whetted to further exploit the underground wealth in the Olifants basin, and the need to quench their thirst for water increased, a trend that has recently intensified.

Water policies on the eve of democracy: creating the 'white water economy'[2]

After 1970, water for the mining, industrial and white urban sectors became priorities – although support for irrigation continued. This entailed not only large-scale water works, including interbasin transfers, especially to the

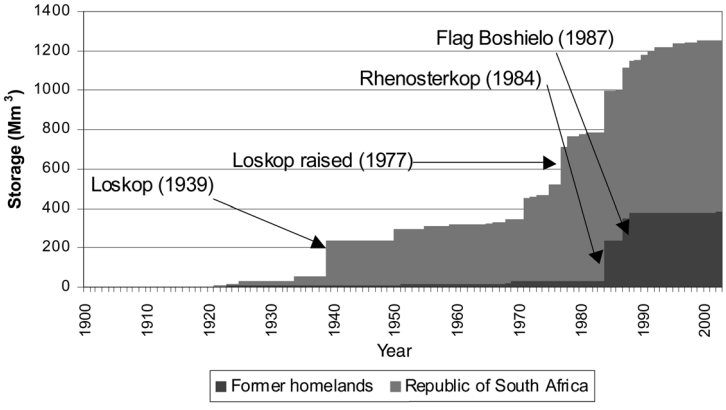

Fig. 3.3. Development of large dam storage in the Olifants basin. From Magagula *et al.* (2006).

upper Olifants for electricity generation, but also providing further assurance of supply to the Witwatersrand (started in the 1980s) through the Lesotho Highlands Project. Based on this, industrial development was promoted outside the white towns but near the homelands (Fig. 3.2) for their cheap labour. As a result, most of the total basin GGP is produced in the urban areas of the upper Olifants.

The same policy led to prioritizing water supplies to mining in Phalaborwa, justifying the construction of the multi-purpose Blydepoort (or Blyderivierspoort) dam in 1975. The third focus was supplying mines in the Steelpoort sub-basin. Stimie *et al.* (2001:38) estimate that the number of mines (around 100) was the primary driver for constructing the Flag Boshielo dam in 1987, although the dam also supports small-scale irrigation and water supply to Polokwane (then called Pietersburg). Agriculture was not neglected: in 1977, the Loskop dam was raised to increase its storage capacity, in tandem with new upstream dams in Witbank and Middleburg (see Figs 3.1 and 3.3).

Water for subsistence: irrigation in the former homelands

The creation of the 'homelands', combined with forced removals and rapid population growth, led to rising tensions and frustration. Lebowa's population grew from 291,000 in 1970 to 629,000 in 1985. The tensions engendered by congestion and poverty further undermined the remaining community-based water management institutions.

From the 1930s, the government tried to minimize poverty by imposing urban-based models, for example by regulating grazing. The 1956 Tomlinson Commission recommended 'Betterment Schemes' as measures to 'develop' the homelands by concentrating access to land only on large-scale male farmers and moving the landless closer to settlements ('homeland towns'). Some domestic water schemes were developed, but in a top-down manner, ignoring the needs of black rural households (e.g. for livestock, gardening).

Black farmers had themselves initiated many small-scale irrigation schemes (around 36), especially along the middle Olifants River. Most of these were developed on lands formerly irrigated by whites, and, in most cases, the South African Native Trust had bought them to consolidate white–black segregation. Most homeland irrigable land was owned by the Trust and sometimes 'improved' with new water management infrastructure before plots were allocated. The plot size was usually 1.28 ha, considered by white definitions sufficient for a nuclear African family to farm full-time and earn a 'reasonable livelihood'. Plot holders were supposed to be males farming full-time, but by 1994 most irrigators on what was called

the 'Olifants River Scheme' under the Flag Boshielo dam were, and remain, women. This was partly due to male migration for work and also reflected women's traditional role (van Koppen *et al.*, 2006).

After 1969, plot holders needed 'Permission to Occupy' (PTO) certificates. In 1993, ownership of all but four 'farms' in the scheme was transferred from the South African Development Trust to the government of Lebowa and the infrastructure was improved by the Lebowa Agricultural Corporation; the Flag Boshielo (then called 'Arabie') dam was built by 1987. The irrigable area was over 2000 ha, controlled by 'white management and leadership', assumed to be the key condition for success. Management dictated crops (alternating wheat and maize), dates of ploughing, fertilizer and chemicals to be used, irrigation and harvesting schedules; provided ploughing services and inputs; and purchased the outputs. Service costs were deducted from the sale price before paying the cultivators. Shah *et al.* (2002:6) observe that farmers were hardly more than labourers on their own plots. These centrally managed schemes collapsed on the withdrawal of government support after 1994.

The Olifants on the eve of democracy: population, poverty and concentrated wealth

The stark differentiation between the poor and well off, blacks and whites, and rural and urban people is worse in the Olifants than at the national level. Sixty per cent of the population reside in the former homeland areas, constituting 26% of the basin area (Fig. 3.2). Two-thirds are in rural areas, mostly in scattered informal villages with limited commerce and services. There are few major urban centres within the basin, but important interactions exist with Pretoria and Johannesburg. Ninety-four per cent are black Africans. Most future population growth will be urban; the rural population is expected to stabilize because of HIV/AIDS (van Vuuren *et al.*, 2003).

According to the 2001 census, 47% of the Olifants labour force is unemployed, with most available jobs outside the former homelands (Magagula *et al.*, 2006). Nearly 50% of formal jobs are in government, 21% in mining and 19% in agriculture. Distribution of wealth is highly skewed between urban and rural areas (van Vuuren *et al.*, 2003). Some 70% of the population live in poverty; 75% of them report they have no monthly income (Magagula *et al.*, 2006).

Much of the area below Loskop dam (a region where International Water Management Institute (IWMI) researchers have worked intensively) is now in the Greater Sekhukhune District Municipality, which today combines prosperous as well as poor, formerly white areas with poor, predominantly black areas. This region contains some of the highest concentrations of heavy metals in the world (chromium, platinum, titanium, vanadium) (Ziervogel *et al.*, 2006). Growth in mining in this area and in the Steelpoort region is enormous but has not yet reduced the municipality's 69% unemployment rate. The 2005 census recorded a population of 1.12 million living in the district, mostly in the former homeland areas. Commercial agriculture is the main employer there (Ziervogel *et al.*, 2006:9–10). Only 30% of households have access to agricultural land.

Post Uiterweer *et al.* (2006) provide a poignant description of the problems characterizing Sekhukhune. In the 19th century, Sekhukhuneland had been a powerful kingdom; today, it is one of the poorest areas in the country and no longer well known. Over 40% of the villages did not have even a basic water supply in 2004.

The Post-1994 Dispensation: Trying to Achieve Equity without Reducing Large-scale Users' Access

The new dispensation in South Africa: constitutional guarantees and idealism

Remarkably, there was a peaceful, negotiated transition from the apartheid regime to a representative, constitutional government based on one person, one vote. The first fully democratic election was held in 1994, and elections have been held regularly since then. The new consti-

tution, created through a wide-ranging public consultation process, has explicit provisions regarding citizens' rights to a healthy, sustainable environment and access to health care and 'sufficient food and water', and requires the government to take reasonable measures to progressively achieve these and other rights (de Lange, 2004).

A widespread, although white-dominated, consultative process during the mid-1990s led to the National Water Services Act (1997) and the National Water Act (NWA) of 1998 being adopted. This process is described in detail by de Lange (2004) and others (De Coning and Sherwill, 2004; Backeberg, 2005; Garduño and Hinsch, 2005; De Coning, 2006). Despite strong differences of opinion, the final bill was broadly supported by all major parties. This is remarkable considering the radical nature of some reforms: for example, the riparian rights system and private groundwater ownership were abolished, as well as the connection between land and water rights. Water is now a national resource, with the Minister of Water Affairs as its custodian on behalf of the government, and a system of licensing for specified periods has replaced water rights in perpetuity.

The NWA has been perceived by senior DWAF officials as an instrument to achieve the broader goals of the new South Africa, captured in the slogan 'a better life for all' (Muller, 2001; Schreiner *et al.*, 2002). It is intended to provide a framework for achieving broad, constitutionally mandated goals, such as equity, productivity and environmental sustainability, as well as specific objectives, such as cost recovery, decentralized management, effective service delivery and flexibility to adapt to changes.

DWAF has been simultaneously carrying out numerous complex activities to implement the NWA while transforming itself structurally and in terms of gender and ethnic balance, and recruiting new expertise. It has carried out studies, prepared policy statements and implementation guidelines, and held many consultations with stakeholders, which have become increasingly race and gender balanced. It has also been pilot testing reforms.

DWAF has also given the highest priority to providing basic water and sanitation services as rapidly as possible to the estimated population of 12 million lacking these in 1994, and is making good progress: as of July 2008, 2.48 million still do not have water supply infrastructure and 13.38 million lack basic sanitation infrastructure (http://www.dwaf.gov.za/dir_ws/wsnis/, accessed 4 July 2008), but this situation is far better than it was a decade ago. Since 2006, this function has been a municipal responsibility. To implement the right to sufficient water, DWAF adopted a 'free basic water' policy, giving every household a right to 6000 litres per month without charge. Where good infrastructure is in place, this works well, but for most poor rural municipalities, implementation is difficult (Post Uiterweer *et al.*, 2006; Muller, 2007). With the handover to the newly created local municipalities, domestic water service has become increasingly problematic without the temporary 'cushion' previously provided by DWAF's technical staff (van Koppen, 2007).

Implementation of the water act in the Olifants basin: institutional transformation?

The Olifants catchment management agency: a stalled process

The NWA provides for establishing catchment management agencies (CMAs) in each water management area, to decentralize and integrate river basin management and to provide stakeholder forums. A CMA is not expected to be fully democratic; its board should be broadly representative of basin interests but is appointed by the minister (Ligthelm, 2001). DWAF officials initially had high hopes for CMAs as 'the key vehicles to implement the new water management paradigm' (Schreiner *et al.*, 2002:127): 'Catchment Management Agencies for poverty eradication in South Africa' is the title of a paper by a senior DWAF official (Schreiner and van Koppen, 2001).

The process of establishing an Olifants CMA was initiated in 1998 by a major consulting firm. The IWMI was appointed as 'peer reviewer'. The process itself, pitfalls and proposed solutions are described from DWAF's perspective by Ligthelm (2001), who was the DWAF task

manager. Wester *et al.* (2003) assessed the process and compared it with a much different approach in Mexico. The draft CMA proposal (van Veelen *et al.*, 2002) was submitted to DWAF, but not taken to the minister, although CMAs are being established in a few other (smaller) basins.

With hindsight, DWAF policy makers were probably overoptimistic about the efforts required to render the consultation process genuinely inclusive, given the highly unlevel playing field. The large public and private water users are well organized to defend their interests. However, the rural poor are not organized, and most were not even aware of the process (Stimie *et al.*, 2001; Wester *et al.*, 2003). There were serious cultural barriers: most of the consultants were white engineers who did not speak the local languages. Only summary translations were provided. Poor communities tended to raise issues such as lack of drinking water, only to be told these problems would be addressed by others. In short, as Wester *et al.* (2003:808) note, 'the effectiveness of the process in the poor rural areas is doubtful'.

Clearly, DWAF and its consultants did not address the core issues. The consultants focused on the organizational structure of the CMA, not on the critical issue of equitable voice and power capture by minority interests in setting the agenda of the CMA. The consultations were not designed to 'balance' political inequalities, for example by investing special efforts in dialogues with poor communities. Therefore, the CMA could never have achieved the government's equity objectives. There were similar experiences in other basins (Wester *et al.*, 2003; Waalewijn *et al.*, 2005; Simpungwe, 2006). DWAF reached out to the new, upcoming local and provincial governments through Provincial Water Summits in 2005 and 2006; in the long run, municipalities are expected to fill the local void, while large-scale users will also cooperate with local and provincial governments. These developments, under the conceptual umbrella of 'Water for Growth and Development', have also served to begin closing the administrative gap between domestic and productive water services (van Koppen, 2007).

Catchment management forums (CMFs)

DWAF senior officials realized the dangers of replicating existing inequities and monitored the consultation processes carefully. A major challenge is involving poor communities, and especially women, in these processes (Schreiner *et al.*, 2004). One solution was to pursue more bottom-up participation (Schreiner and van Koppen, 2001; Schreiner *et al.*, 2002; Simpungwe, 2006). In three other water management areas, DWAF tried to enhance the skills of the poor, especially of women, by getting them involved in this participation (Schreiner *et al.*, 2004). Some resources were also allocated in the Olifants to enable a grassroots organizer (a woman) to demonstrate how this would work (Schreiner and van Koppen, 2001); she organized workshops in the local language, which addressed domestic and productive water issues. A suggestion emerged to organize multi-tiered, small-scale water users' forums as a way to ensure effective local representation in the future CMA governing board. Smallholder water user forums (SWUFs) were thus suggested in the draft Olifants CMA proposal, but this was never followed up.

These proposed SWUFs are not to be confused with the Olifants River Forum (ORF), established in 1993 to promote cooperation for conservation and sustainable use of the river (www.orf.co.za; see Schreiner and van Koppen, 2001; Klarenberg, 2004:89–91). The founders were mostly white representatives of large mining firms, the Kruger National Park and DWAF. Membership today is more varied, but local communities are not well represented. It is clear that this forum was intended, in part, to lobby DWAF and influence the formation of the planned CMA and water allocation processes, and in this sense it is a continuation of the 'white water economy' (van Koppen, 2007). Simpungwe (2006:15) claims that more than 200 CMFs have emerged in other South African catchments, and DWAF has formally endorsed their importance, even in the absence of supporting legislation (DWAF, 2004b:97–98). Like the Olifants River Forum, many of these recent CMFs are de facto dominated by government departments, other formal organizations and white economic interests, minimizing the potential to empower poor water users (Simpungwe, 2006).

Schreiner and van Koppen (2001) reflect on DWAF's high hopes that an inclusive CMA process could lead to institutions able to service the poor better. Unfortunately, there is little evidence that CMAs, or CMFs for that matter, have achieved this. In the Eastern Cape, Simpungwe (2006) found that CMFs have not been effective in achieving equity; while he remains optimistic, his cases suggest that they have not created a level playing field – differential political and economic power distort the outcomes. In the Olifants, DWAF halted the CMA process in favour of attempting to establish CMAs in other, usually smaller, basins, and is using its own authority to manage the basin. Institutional transformation through CMAs is stalled, although there is now greater attention to the role of local and provincial governments.

Water users' associations and transformation of irrigation boards

The NWA provides for establishing local cooperative associations to undertake water-related activities for their members' mutual benefit called water users' associations (WUAs). There are several approaches: transforming existing irrigation boards into more inclusive WUAs; establishing new WUAs on small-scale government schemes; or other water users, farmers or not, forming a WUA. In practice, most are organized around irrigation schemes.

Unlike irrigation boards, WUAs should include all water users, for example farm workers and informal water users. Therefore, in transforming the irrigation boards, whose members are nearly all white men, the board members must reach out to farm workers, neighbouring communities and local government, and give them a voice. The commercial farmers have invested substantially in what they consider as 'their' irrigation scheme; for them, the new rule is problematic as people who have made no investment can participate in decisions that affect the scheme's future (Faysse, 2004; Schreiner *et al.*, 2004).

Comparing seven irrigation boards (two in the Olifants), Faysse (2004:14ff.) identifies two factors explaining the level and outcome of involving 'Historically Disadvantaged Individuals' (HDIs). First, commercial farmers' initiatives to open the management to HDIs occur only where upstream HDIs can affect downstream commercial farmers' water availability or where they are paying fees. Although DWAF policy states that all water users can participate in WUA management whether they pay or not, commercial farmers oppose this and discount non-paying members.

Second, there is a lack of clarity about WUA responsibilities and there are competing definitions of 'equity'. Irrigation boards were invariably set up with access to water, fees and votes based on the proportionality rule; therefore, commercial farmers feel emerging farmers' roles should be on an 'equal footing' under this rule. Emerging farmers, often supported by government departments, feel special treatment is 'equitable', given their inherent historical disadvantages.

Faysse (2004:18ff.) suggests preconditions for the effective inclusion of HDIs: representation based on organizing the HDI community, access to information, and stronger capacity to voice problems and influence decisions. To achieve this, Faysse (2004:23) emphasizes that DWAF must monitor progress and use its enforcement capacity where needed. Only a few irrigation boards have been transformed into WUAs to date. The underlying conceptual framework for WUAs is the same as for CMFs – using 'multi-stakeholder platforms' to level the playing field among stakeholders. Clearly, the assumptions behind this approach need to be questioned.

Transferring management of small-scale irrigation schemes to WUAs

Nearly all small-scale irrigation schemes are in former homeland areas. They were designed with entirely different objectives than commercial irrigation, and the problems they face reflect this history. Although some have older roots, many were built by the government in the 1950s, and farmers were basically contract labourers. Most schemes were highly subsidized and stopped operating when the management parastatals collapsed in the mid-1990s (Mpahlele *et al.*, 2000; Shah *et al.*, 2002; Machethe *et al.*, 2004; Veldwisch, 2006).

In the late 1990s, the Limpopo (then 'Northern') Province tried to 'revitalize' some

schemes. IWMI, the University of Pretoria and the University of Limpopo (then called the University of the North) became associated with this programme, concentrating on the small schemes below the Flag Boshielo dam. The problems of these schemes include low yields, small plot sizes, high operational costs and centralized management. With low and variable farm incomes, most plot-holders depend largely on other sources of income. Irrigated plots are a source of some security, but people do not invest in them. It is only on some vegetable schemes where (mostly) women have very small holdings that productivity and net income per ha are high, but the holdings are too small to provide sufficient household income (see also Mpahlele *et al.*, 2000). In 2003, a much larger revitalization of smallholder irrigation schemes (RESIS) programme was launched throughout the Limpopo province (see the conclusions, below).

Water as an instrument of social reform: water allocation reform (WAR)

The context of glaring inequities between the poor, largely black, majority and the wealthy, largely white, minority is well recognized by government. A basic premise of reform has been that reversing inequities needs democratic institutions that give a real voice to the poor. However, the democracy-as-solution premise itself needs critical re-examination: can water reform really be the driver to reduce poverty and achieve equity, while preserving the economy, i.e. avoiding rapid radical changes in current ownership patterns?

For senior DWAF officials, 'water is seen as a tool in the transformation of society towards social and environmental justice' (Schreiner *et al.*, 2002:129). They acknowledge the challenges and obstacles, but generally offer solutions within this 'new water management paradigm for poverty eradication and gender equity' (the subtitle of the paper by Schreiner *et al.*, 2002). The new legislation did introduce the paradigm, and DWAF officials are seriously committed to meeting equity goals. But paradigms, whether new or old, carry their own implicit, often hidden, assumptions, which may not always be realistic.

While emphasizing the importance of radical water reform, DWAF also perceives a need to 'balance' equity with productivity and profitability. It is cautious about reallocating too quickly lest 'the country suffer economic or environmental damage as emerging users struggle to establish productive and beneficial use of water' (DWAF, 2005:3–4; see also Garduño and Hinsch, 2005:xi; Seetal and Quibell, 2005). Indeed, this caution is expressed in the minister's National Water Act speech to the National Assembly in 1998: 'Our water policy says that our aim in managing water is not just to ensure equitable access to the resource, not a crude dividing up of so many buckets per person. Our aim is to extract and exact the maximum benefit to society from its use.'[3]

However, Minister Kader Asmal goes on to say that 'The mischief we have to right in the economic use of water is to ensure that the benefits from the use of our common water are equitably shared.' Shortly thereafter he states, '… all South Africans have *equal* (emphasis added) rights of access to water resources.' A subsequent minister, Ms Buyelwa Sonjica, similarly emphasizes 'the need to introduce equity in water distribution', and water as 'one obvious tool for the eradication of poverty' (DWAF, 2004b:1–2). Elsewhere, the minister discusses the need for equity, efficiency and sustainability but does not address the underlying potential trade-offs and contradictions of these three policy 'principles'.

Over time, DWAF appears to have lost faith in using CMAs as a means to achieve equity; in the Olifants, DWAF chose not to forward the CMA proposal to the minister and to carry out the CMA functions itself for the indefinite future. To operationalize these intentions in other domains of its competence, DWAF started implementing a 'water allocation reform' (WAR). The NWA replaces the water rights system that previously combined rights tied to land and, in government water control areas, rights based on prior appropriation, with a fixed-period, tradable licensing system. Moreover, water allocation aims at redressing inequities of the past and allows for transferring water from the 'haves' to the 'have-nots'. In a technical and legal sense, WAR involves implementing this potentially radical transformation.

However, superimposing a licensing system is not necessarily appropriate with huge numbers of poor informal users, and alternative tools such as general authorizations are proposed instead (DWAF 2006; van Koppen, 2007).

DWAF (2005:8) notes that the WAR programme is being implemented because of the 'slow progress with, and little evidence of, redress as we enter the second decade of South Africa's democracy'. But the process proposed is careful, measured, 'balanced', and focused on water and not on land or support services. A major objective of WAR is to 'meet the water needs of HDIs and the poor'. The actions to achieve this include financial support to resource-poor farmers and compulsory licensing to support 'equitable (re)allocation of water' (www.dwaf.gov.za/war/).

The WAR position paper (DWAF, 2005) was discussed in all provinces. In the absence of effective forums, poor rural people will have little voice, placing the entire responsibility on DWAF. Investing in creating effective forums facilitated by DWAF to prevent elite capture might have been a way to achieve broad agreement around the programme. Current state-of-the-art views on promoting institutional reforms suggest the state must be the main driver of reform, but the process itself must be structured and designed to facilitate negotiations and create coalitions of stakeholders (Merrey *et al.*, 2007).

Attempts by DWAF to achieve equity without radical reallocation are seeking to 'balance' factors that may really be incompatible or at least not amenable to water allocation reform alone. This is compounded by the government's lack of an integrated approach to agrarian and rural reform. Land reform and support to new emerging farmers are done with little coordination by the national Department of Land Affairs, the provincial agricultural departments and, to a lesser extent, local governments. Indeed, past water-sector reforms have often been attempted internationally without recognizing that they must be part of a larger inter-sector reform programme (Merrey *et* al., 2007). In sum, the evidence suggests that water reform alone is not enough. Land reform accompanied by water reform might have a greater impact on equity.

Household rainwater harvesting: reducing malnutrition while avoiding reform

DWAF is initiating a subsidized, household-level rainwater-harvesting programme based on the experience of the Water for Food Movement and systematic pilot testing. Growing fruit and vegetables has substantial benefits (Schreiner *et al.*, 2004; de Lange, 2006:46–48). Grants are provided to build tanks and train women in nutrition and vegetable production and use of water for household purposes, livestock, etc. (DWAF, 2007).

This programme is clearly useful in assisting poor households to improve nutrition, child performance at school and possibly incomes. However, despite substantial short-term benefits for the poor, it does not address the fundamental equity problems or the need for more radical agrarian transformation, and may even divert attention from this.

Trade-offs' paralysis: environment, Mozambique, big business or the poor?

The NWA requires environmental protection. The reserve is the only water 'right' specified in the Act; it has priority over all other uses and must be strictly met before allocating water to other uses. The reserve comprises: (i) the basic human needs reserve, i.e. water for drinking and other domestic uses, consisting of less than 1% of mean annual rainfall (MAR); and (ii) the ecological reserve (i.e. water to protect aquatic ecosystems, requiring an estimated 23% of Olifants MAR) (McCartney *et al.*, 2004; van Koppen, 2007).

The ecological reserve determination for the Olifants was based on the building block method (Tharme and King, 1998; DWAF, 1999; King *et al.*, 2000; Louw and Palmer, 2001), and does not include basic human needs (Schreiner *et al.*, 2002). Standards are set for different reaches of the river – heavily used sections have a lower standard than more pristine sections, which are seen as worthy of preservation.

Currently, average environmental flow requirements are met in most months, except in some locations during the dry season. Water resources do not match demand; therefore,

DWAF is not fully implementing the reserve to avoid damage to existing economic users. Instead, it plans to phase in full implementation over time. Meeting the reserve requirements while providing more water to mining and commercial agriculture is among the main motivations for infrastructural development (i.e. construction of the controversial de Hoop dam on the Steelpoort River and raising the Flag Boshielo dam; DWAF, 2004a). Implementation of the reserve could significantly improve dry-season flows through the Kruger National Park into Mozambique. We are not aware of any detailed assessment of the costs and benefits – and of losers and beneficiaries – of meeting the ecological reserve.[4]

Projections of water demand and supply: discourse of water scarcity trumps all

McCartney and Arranz (2007:1) assess three scenarios of 'future' water demand, based on plausible and internally consistent projections of water use in 2025. They use the water evaluation and planning (WEAP) model, based on water balance accounting, to build scenarios to answer 'what if' questions on changes in allocation, demand and efficiencies (see www.sei.se; SEI, 2001). After developing a 'historic' water demand (1920–1989) and a 'baseline' demand (1995) for each scenario, McCartney and Arranz (2007) assess the implications of constructing new infrastructure and implementing water conservation and demand management practices, and calculate levels of supply assurance; by combining water productivity data with estimated unmet demand, the authors estimate the economic cost of failing to supply water to each scenario.

The annual net demand in 1995 ranges from 577 Mm^3 to 995 Mm^3, depending on rainfall ('average' 744 Mm^3) (McCartney and Arranz, 2007:21). The basin experiences shortfalls annually, mostly for irrigation (approximately 26 Mm^3), and also smaller shortfalls for mining (in this scenario rural and urban supplies are assured at the 99.5% level, i.e. failure would occur less than once in 200 years). The annual cost of this unmet demand, based on figures from Prasad *et al.* (2006:24) varies from approximately US$6 to 50 million (0.2–1.5% of current GGP), mostly in agriculture. In this scenario, environmental flows are simulated as they are. Full implementation of the reserve would lead to shortfalls in both urban and rural sectors, and would reduce the assurance of supply to mining and irrigation, bringing the total costs to US$13 to 78 million (McCartney and Arranz, 2007:25). The analysis does not assess the benefits of meeting the reserve (there is no market basis for doing so) or the presumed benefits for the livelihoods of poor people.

The three future scenarios project low, medium and high water demand levels, depending on population growth, changes in per capita demand, mine openings and closings, commercial forestry practices and assumptions on implementation of the reserve. They assume no change in commercial irrigation, land use and livestock. Within each scenario, demand fluctuates annually, based on rainfall and hence irrigation requirements, from 625 to 1325 Mm^3 (McCartney and Arranz, 2007: 25).

For all scenarios in 2025, seasonal supply shortfalls occur every year, and since irrigation is given the lowest priority, it suffers the most. In the high-demand scenario, shortfalls occur annually in every sector. The estimated costs range from US$23–404 million (low demand), to US$92–1334 million (high demand), i.e. a range of 12 to 41% of GGP (McCartney and Arranz, 2007:30). The authors also assess the likely impacts of infrastructural development and measures of water conservation and demand management. New infrastructure and water demand management combined result in better levels of supply, although shortfalls are not eliminated; annual costs are reduced to between US$0.6 million (good rainfall in low-demand scenario) to US$191 million (poor rainfall in high-demand scenario) (McCartney and Arranz, 2007:35–36, Table 30).

These scenarios are indicative, offering a useful platform for discussion, and suggest further research, including an assessment of social consequences, the impact of groundwater development and full cost–benefit analyses (McCartney and Arranz, 2007: 33–34). Another gap is linking water productivity and equity with environmental sustainability and international flows to understand the exact nature of their relationship. Current implemen-

tation policies (such as water allocation reform) at least implicitly assume a zero-sum game: achieving greater equity will reduce overall productivity (DWAF, 2005). But there is no evidence to support this perspective for agriculture: smallholders can certainly achieve high levels of water productivity, and more equitable allocation of basic water supplies will undoubtedly have large impacts on local productivity and well-being. In other sectors, there may well be water productivity economies of scale; in this case, benefit sharing becomes crucial, as discussed below.

A more systematic socio-economic and political analysis is needed as a basis for integrated reform policies (e.g. land and water), and researchers could use tools such as WEAP to identify alternatives. Surprisingly, no investigations have assessed more radical alternatives. In future, demand will increase. Plausible scenarios indicate that even with low to medium growth (i.e. net water demand increasing to between 818 and 1073 Mm^3 by 2025), currently planned infrastructure will be insufficient to meet demands, including those of the reserve; shortfalls will occur every year, with irrigation suffering most (McCartney and Arranz, 2007:26–27, Table 20). Water conservation and demand management interventions must be implemented.

Outcomes to Date: Old and New Winners and Losers

We have discussed the extreme inequity in the Olifants basin, its history and drivers. In the mid-1990s, the former homeland areas, with 64% of the population, accounted for less than 3% of the total agricultural GGP, 2.35% of total mining GGP and 3.4% of manufacturing GGP (Lévite, 2003). This inequity continues and may not be improving. Researchers have applied three methodologies for measuring equity of both access to and benefits from water: the water poverty index, equity coefficient and Gini coefficient. All of these measures have limitations, but taken together they reinforce the observation of continuing high levels of inequity. Molle and Mollinga (2003) and Shah and van Koppen (2006) warn that such indicators must be used cautiously and complemented with local in-depth studies, but the findings do provide important insights.

Magagula *et al.* (2006) assess the impact of water scarcity and lack of water access using the 'water poverty index' (WPI), which is based on five component indices: resources, access, capacity, use and environment, each with various sub-indices and using a scale from 0 to 100.[5] A low score indicates high poverty. The WPI of the Olifants basin was 27.1 for 2001, half the national estimated WPI (52.2). The WPI is worst in and near the former homelands, as displayed in Fig. 3.4. Although WPI improved in many quaternaries between 1994 and 2005, Magagula *et al.* (2006) point out that many quaternaries changed very little, despite interventions by DWAF.

Prasad *et al.* (2006) use data from DWAF's Water-use Authorization and Management System and other sources to assess equity – 'who uses how much water, where, and for what purpose' (Prasad *et al.*, 2006:67). They examine 13 tertiary sub-basins and four sectors – agriculture, industry, mining and water supply services – and calculate a measure of 'skewness', the degree of diversion from total equity (which they refer to as 'equity coefficient'), in terms of 'water use per capita' and 'water use per unit area'. The equity coefficient ranges from 0 to 1, zero being the least equitable.

They note the huge variation among subbasins within all sectors. The equity coefficients for per capita water use are highly skewed and low. In agriculture, a few farmers receive most of the water. More striking is that the least equitable sector was basic water services, even in 2003. The water services and agriculture sectors are intended to serve individuals and numerous farms and therefore should be the most meaningful; industry and mining are in the hands of a few large firms, making the measure less useful. Figure 3.5 combines two measures for each sector, i.e. water use per capita and water use per unit area, to provide a composite score. By this measure, the basin-level average equity coefficient is a low 0.161. Agriculture is again the least inequitable and water supply the most inequitable.

Cullis and van Koppen (2007) use the Gini coefficient to assess inequality of access to water in the basin, to our knowledge the first attempt to do so in the world. In a perfectly

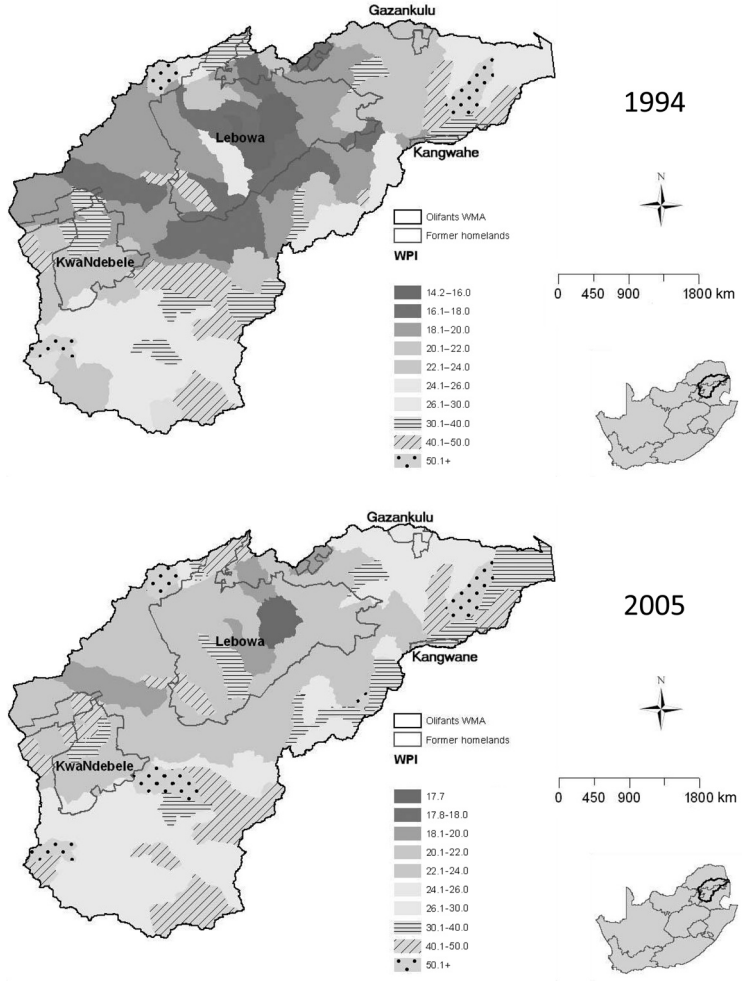

Fig. 3.4. Changes in the water poverty index (WPI), in the Olifants basin (Olifants Water Management Area (WMA)), 1994–2005. From Magagula *et al.* (2006).

equal situation, the Lorenz curve would be a straight line, termed the line of equality, and the Gini coefficient 0.0. In most cases, it diverges below the line of equality, showing the inequality of distribution of income, land or water, with the Gini coefficient moving to 1.0 for total inequality.

The Gini coefficient for South Africa's national income is the second highest among middle-income countries after Brazil, and has been increasing during the past decade, from 0.60 in 1995 to 0.64 in 2001 (Cullis and van Koppen, 2007). This distribution obviously reflects the historical legacy. Inequality of access to land is even worse than inequality of income, and is intimately related to the inequality of access to water and its benefits. Cullis and van Koppen (2007) measure the distribution of direct access to water by rural households and the distribution of indirect benefits of water use in the form of direct employment.

Using DWAF estimates, the Gini coefficient of direct rural water use is a shocking 0.96. The 1782 registered users claim to use 1550 Mm^3 per year, while the 290,000 rural households use an estimated (not 'claimed') 74 Mm^3 per year. Therefore, 99.5% of rural households use just 5% of the total water used, demonstrating an extremely inequitable distribution (Fig. 3.6). These findings may exaggerate the

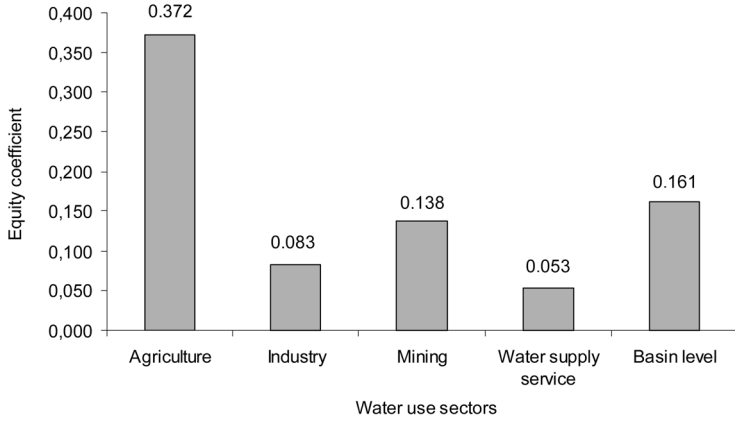

Fig. 3.5. Combined equity coefficients in the Olifants basin, 2003. From Prasad *et al.* (2006).

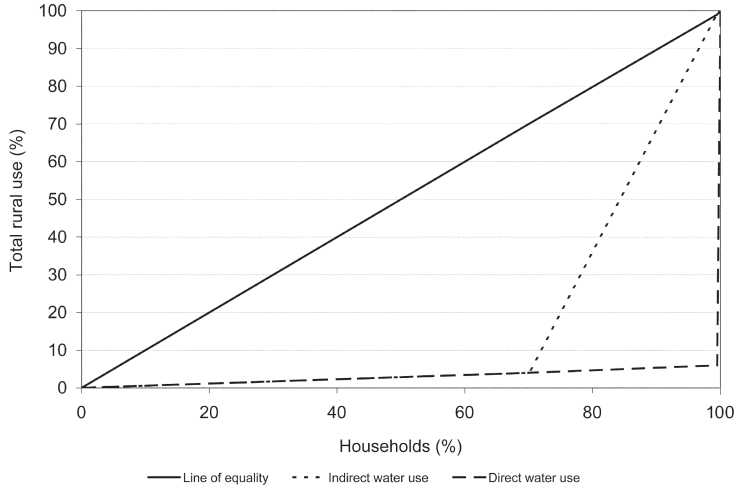

Fig. 3.6. Distribution of estimated direct and indirect rural water use in the Olifants basin. From Cullis and van Koppen (2007).

inequity. 'Claimed' water use is likely to be significantly higher than actual water use, as large-scale users attempt to maximize the amount they can obtain through registration.

Further, as alluded to in the minister's speech quoted above, extracting maximum benefits and sharing these equitably are more important than 'dividing up so many buckets per person'. Using official employment figures and assuming that all industries have equal levels of efficiency and all employed persons benefit equally (ensuring a 'best possible' but highly unrealistic case), Cullis and van Koppen (2007) plot the distribution in terms of employment. The Gini coefficient for the benefits of water use in rural areas is 0.64, better than the 0.96 for direct use but equal to the national Gini coefficient and still highly unequal.

Cullis and van Koppen (2007) also test two policy scenarios: (i) the impact on equality of revitalizing small-scale irrigation; and (ii) increasing the allocations to all rural households. Because it affects relatively few people, revitalizing small-scale irrigation has a marginal impact. This finding is confirmed in an adjacent basin by Hope *et al.* (2008). Increasing the direct allocation of water to unemployed households from the current approximately

255 m^3 per household per year to 610 m^3 per household per year would improve the amount of water available for domestic use and permit irrigation of a garden of 1000 m^2. Existing registered users would have to reduce their irrigation demand by just 6%. The water-use Gini coefficient would improve slightly for both direct water use (0.94 to 0.90) and distribution of benefits (0.65 to 0.58).

The Gini coefficient is potentially a useful tool to assess policy scenarios and measure outcomes, but as shown above mere 'tinkering' to improve equity in a 'balanced' manner will contribute only marginally to achieving the country's equity goals.

The current WAR process is intended to 'promote equity, address poverty, generate economic growth, and create jobs' (DWAF, 2005:1). A recent paper whose first two authors were senior DWAF officials has the intriguing title, 'Washing away poverty: water, democracy and gendered poverty eradication in South Africa' (Schreiner *et al.*, 2004). However, the evidence to date does not support using water reforms as an entry point for wider socio-economic reforms. Reforms in other sectors, especially land, combined with strengthening the political voice of relatively disenfranchised people in an integrated manner is critical.[6] Otherwise, the politically powerful water users will continue to prosper while deprivation continues among the poor. We return to this theme below.

Conclusion: Will the Poor Basin Resident Get Her Fair Share?

Continuities from apartheid to democracy: old paradigms in new bottles

The National Water Act introduced a new water management paradigm to support the restructuring of South African society as mandated by the constitution. Although many new ideas were introduced, we have also been struck by the high degree of continuity – mostly unconscious and denied if pointed out – in assumptions and concepts that may be impediments to achieving the equity goals, as they are hold-overs from an era with antithetical objectives. Van Koppen (2007) has also raised this point with regard to requirements that water investments must be 'economically viable' and even self-financing. Tapela (2005:5) argues that the emphasis on 'efficiency', user-pays principle and 'economic value' of water narrows the prospects of resource-poor, small-scale farmers.

This 'commoditization of water', rather similar to the current reliance on the market for acquiring land to implement land reform, is not conducive to encouraging smallholder farmers; rather, it further strengthens the hand of the large-scale users and weakens the case for reallocation to the poor. Further, in the current discourse, 'water scarcity' is redefined as an entirely physical phenomenon, not one that is largely socially and politically constructed (and can therefore be reconstructed, though not easily). By choosing to accommodate the large-scale water users and environmental requirements as a de facto high priority, it forces water reforms to deal at the margin.

The truth is that South Africa and the Olifants basin are not seriously constrained by an absolute physical scarcity of water; rather, the perceived 'scarcity' has been created by large allocations to commercial agriculture and mines, and now also to the ecological reserve, thus closing the door to other alternatives. But the discourse on this created situation of 'scarcity' is always – misleadingly – in terms of physical scarcity, thus avoiding assessment of other choices. Hence, the few attempts at scenario building, if they refer to reallocation at all, propose relatively small transfers from the rich to the poor, certainly potentially benefitting the poor while not threatening the rich but definitely not having much impact on equity. They assume the current status quo, i.e. continuing priority to large-scale sectors.

Another continuing, unexamined assumption is that, in agriculture, 'large is best'. The historical development of white agriculture in South Africa has led to large-scale, highly capitalized farms, now seen as inevitable: there is no vision for small- or medium-scale farmers, except as transitional to larger farms. Indeed, Lahiff (2007:11, 13) points out that explicit legal and policy restrictions against subdividing farms remain in place, based on a 1970 apartheid-era law 'inspired by the danger of … blackening of the countryside'. Lahiff suggests

the failure to subdivide is the single greatest contributor to the underperformance of land reform. It is based on the 'viable size' argument for maintaining white farmers' minimum incomes. Over time, the agrarian economy has been structured around the model of large-scale agriculture.

There is a hidden assumption of a trade-off between equity and productivity. However, small farms tend to be undercapitalized, with poor access to information and markets – lower water productivity is certainly not an inherent characteristic of small or medium-size farms, although total income from a small farm is lower. Therefore, official discussion revolves around how more of the large farms can become black owned, not whether there are more equitable alternatives.

As far back as 1977, South African water managers believed their approach was aligned with international standards, as documented at the Mar del Plata conference (van Koppen, 2007:36). Although the rhetoric emphasizes economic viability and user-pays principle, DWAF has continued to subsidize modern, large-scale white farms – the Lower Blyde Irrigation Board's new pipeline replacing a leaky canal was financed with a loan guarantee from DWAF (i.e. a subsidy) on a promise that 800 ha of additional land for previously disadvantaged farmers would also be included.[7]

The programmes to 'revitalize' small-scale irrigation in former homelands are also based on some old assumptions: that farmers are mostly men, and that small farms based on the old land allocations (1.28–5 ha) can be 'economically viable' for black families if only they have better technologies and better links to markets.[8] The Limpopo province is currently implementing a billion rand (US$130–200 million) revitalization programme. Initially designed to emphasize farmer empowerment, capacity building and community involvement, pressures to spend funds quickly led to a shift to promoting sophisticated technologies installed by commercial contractors with little beneficiary participation (de Lange, 2006:21–22; Denison and Manona, 2007:32–33, 35). It is unlikely that such a programme will make a substantial difference, as Tapela (2008) also concludes.

While DWAF is being substantially restructured, the main functional difference from the old department is the addition of forestry to its mandate: there has been no restructuring of water, land and agriculture into some kind of agrarian reform ministry, for example. Most literature has emphasized the break with past policies and paradigms, which in many respects is real, and South Africa deservedly receives much credit as an IWRM pioneer; however, even before 1994, South African water planners perceived themselves as pioneers in IWRM principles (van Koppen, 2007). It is important also to note the reality of continuity underpinning the new paradigm: it may be a new bottle but the contents are a mixture of old and new.

Institutional stagnation

While institutional reforms are stalled in the Olifants, there are many innovative experiments underway elsewhere, such as the estimated 200 catchment management forums. Therefore, it is a mistake to generalize to the entire country from this discussion – although it is equally wrong to claim that the Olifants findings are not relevant elsewhere. However, the evidence shows that transformation of irrigation boards to participatory and representative WUAs has stalled nationally. Promotion of new WUAs in small-scale schemes is proceeding slowly. In a few basins, catchment management agencies have been initiated, but in the Olifants the process was stopped when DWAF realized it was not leading to the kind of stakeholder-driven institution envisioned by the Water Act. Unfortunately, DWAF did not promote smallholder water user forums in the basin, to enable broader participation. The water allocation reform (WAR) programme itself is progressing slowly, partly because the disadvantages of the conversion of former rights to licences are becoming clearer. For example, it is simply impossible to issue credible licences to the thousands of small users.

One problem may be that DWAF is trying to do too many different and complex things simultaneously. Trying to achieve very difficult institutional reforms while also meeting stringent environmental standards, strengthening local government capacity and implementing major infrastructural projects, all while undergoing its own restructuring, is probably an

impossible task for any organization. This is compounded by a more serious problem – the lack of an integrated approach across sectors and departments to institutional reform: land reform, agricultural services and mining are all under different departments. How can one achieve significant water equity unless the associated inequity in land is addressed simultaneously? How can local communities benefit from mines in their midst if they do not have a voice to demand a reasonable share of the benefits? This fragmentation may be the reason for DWAF's search for a 'balanced' approach – it has no choice.

Finally, the discourse on 'water scarcity' as a largely physical phenomenon has not helped. This socially created perception is rarely questioned and leads to claims that there are serious trade-offs between equity and productivity, that the options are limited and that satisfying downstream international and environmental demands while achieving real equity in benefits is impossible. This discourse has resulted in an inability to envisage alternative visions for the Olifants.

Potential for change under the democratic dispensation

The development trajectory of the Olifants basin simultaneously reflects the broader patterns of historical development in South Africa and the 'typical' pattern of basin development, where demand for water exceeds the available supply. The current incomplete and uncertain status of reforms represents a pattern characterizing most middle-income countries (for example, see Wester (2008) on Mexican reforms). All river basins are 'unique' in many respects, but there are also commonalities that provide grist for the science of river basin management.

The following are the most salient conclusions emerging from this study; they are discussed further below:

1. The Olifants is an extreme example of capture and development of natural resources, including water, for the benefit of a very small minority at the expense of the majority of inhabitants: it is a trajectory of water resources development initially for commercial agriculture, mining and energy, and more recently for industry and cities, now accompanied by concerns for environmental flows and availability of water for basic human needs.
2. Promulgation of a revolutionary water reform process after 1994, driven by constitutional and political imperatives, and expressed through the National Water Act of 1998, has not met expectations to date.
3. There are glaring contrasts among high expectations of using water as an instrument for poverty eradication and social reform, the cautious technocratic approach to implementation of reforms and disappointing outcomes to date.
4. A rhetorical and formal break with the past priority on development for the few has been accompanied by continuities that undermine reform objectives.
5. Opportunities for reducing poverty through achieving a higher degree of water equity and productivity do exist.

Within the international water management community, the NWA is rightly famous and is held up as a model. It is based on international 'best practices' such as Integrated Water Resources Management (IWRM) principles, democracy, meeting basic human water needs and prioritizing ecological requirements. Implementation of the NWA in the Olifants basin had begun even before it became law. There can be no doubting how seriously implementation is being pursued, or the professionalism of government departments, including DWAF. Nevertheless, progress has been slow.

The optimism about using water as a lever to achieve social and economic reforms was unrealistic for at least two reasons: (i) the cautious technocratic approach to implementation of water reforms; and, probably more salient, (ii) the lack of an integrated multi-departmental implementation.

DWAF wishes to achieve radical reforms without damaging the perceived stream of benefits from large-scale uses. Its officials usually work to 'perfect' policies and procedures in writing through consultation before any field testing is initiated. It has therefore been slow in establishing WUAs, transforming irrigation boards and implementing water

reallocation. It has delayed the process of implementing the CMA out of well-placed fears that it would be captured by existing elites, but it has failed to promote proposed democratic grassroots forums. During this process, DWAF has seemed reluctant to try new ideas on a small scale to learn lessons before scaling up. Recently, it appears that DWAF has really been internalizing lessons learned, for example through its new initiatives on Water for Growth Development.

Another problem is the technocratic, as opposed to political, approach taken by DWAF. This reflects the technical expertise and mandate of the department. After the first Minister of Water Affairs (Professor Kader Asmal), the succeeding three ministers focused their attention primarily on delivering water supply and sanitation to the previously unserved population. This priority is understandable but may have been at the expense of actively supporting reforms.[9] Both the aborted CMA proposal process and the WAR programme have been left to technocrats, as if one can 'engineer' a satisfactory solution that provides water to new users while avoiding serious inconvenience to large-scale interests.

In fairness, it must be stated that the disappointing outcome of this cautious approach is largely a product of the lack of an integrated multi-departmental approach to reform – a higher-level political failure. Although DWAF has undertaken various efforts to establish coordinating committees with the Department of Agriculture, with mixed results, the problem is, to reiterate, a higher-level political failure. This is compounded by the efforts required to establish an entirely new local and provincial government structure to replace the pre-1994 territorial and institutional segregation. In hindsight, such an integrated approach might have directed attention to the root problem recognized in 1998 by the Minister of Water Affairs: the point is not 'dividing up so many buckets of water per person' but to produce and share equitably the maximum possible benefits.

The new South Africa is dramatically different from the old. There is now a remarkably open, democratic, inclusive and still idealistic political system. Nevertheless, as also noted by van Koppen (2007), one can also perceive striking continuities between the old and new regimes, suggesting a high degree of hidden 'path dependency'. Ideologically, ideas about the importance of the economy (cost recovery) have continued, even when accompanied by the reality of state subsidies. For example, the de Hoop dam will benefit large-scale mining firms most, with some 'trickle-down' to poor communities. While acknowledging substantial public investments for domestic water supply schemes for people in no position to cover the costs, these schemes are constructed to an entirely different standard (25 litres/person/day) than those in the wealthy cities. This seems similar to the old idea that the required landholding for a black farmer to be self-sufficient is smaller than for a white farmer. In the past, infrastructure was built to promote the interests of race-based (i.e. white) capitalists; today, with 'Black Economic Empowerment', a new black and white elite continues to receive extraordinary benefits. Water, like land, continues to be monopolized by a small group of privileged people, while the government continues its 'hydraulic mission', with priority for promoting large-scale interests (usually sweetened by reference to community benefits).

One lesson learned is that a single-factor or single-sector approach is inadequate. Providing a better water supply in the absence of other inputs is not enough for profitable agriculture. Similarly, hamstrung by legal impediments to subdividing farms, government has tried to allocate land to groups with little experience in agriculture and with insufficient institutional support. There has been insufficient examination of alternative futures for South African agriculture and water use.

It would be presumptuous for us to propose such alternative futures. However, we are prepared to offer the following ideas to stimulate thinking on this issue. In the short to medium term, government could adjust its investments to improve equity, productivity and well-being. Examples include large-scale implementation of household rainwater harvesting and other water infrastructure; a more bold approach to reallocating water from large-scale users to others; more effective technical, financial and institutional support for smallholder producers to enable them to increase their incomes in a sustainable way; and paying greater attention to ensuring that

the benefits from large commercial water users such as mines are shared equitably with communities. Even the modest reallocation of water from large-scale commercial users to rural households is likely to have a useful impact on the well-being of poor rural people.

But for the longer term we believe a new agrarian vision is urgently required. A possible approach would be to commission a small group of eminent visionary people to articulate a set of alternative agrarian futures, including specific ideas on integrated implementation arrangements. The goal would be to achieve equitable land and water reforms that satisfy the needs and demands of rural and peri-urban people, recognition of women's roles in agriculture and small enterprises, provision of effective private and public support services to new farmers, and new models for wider sharing of benefits while minimizing local costs of mining mineral wealth. The commission's report can be used for widespread consultations on the alternatives, with strong political participation. These consultations would provide a platform for political leaders to move forward.

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Notes

1 There are 19 officially designated 'Water Management Areas' in South Africa, which are intended to be river basin management units under the National Water Act of 1998.
2 The term 'white water economy' is taken from van Koppen (2007).
3 This quote and subsequent ones are taken from a selection of policy statements provided to us by Mr Mike Muller, former Director General of DWAF.
4 For lack of space we have not dealt with issues of water quality; however, there is increasing concern about its impacts on humans and wildlife; see, for example, the following report on crocodile deaths in the Olifants within the Kruger Park: www.int.iol.co.za/index.php?set_id=1&click_id=31&art_id=vn20080605055357280C518855, accessed 4 July 2008.
5 See Sullivan (2002) and Sullivan *et al.* (2002) for explanations of the WPI index calculation.
6 A point fully recognized by some officials, including B. Schreiner, but the institutional barriers to such integration are overwhelming.
7 Two years after the approval of this loan guarantee, it appeared the 'solution' was one or two large farms to be owned by black Africans under the government's Black Economic Empowerment (BEE) programme; BEE is increasingly controversial – critics perceive it as insufficiently broad based and therefore leading to changing the colour of the elite and not greater equity. Land claims have stalled this process. The new pipeline is currently operated profitably by the Rand Merchant Bank. We have no recent information on which to base further remarks.
8 Locally, small plots are often seen as acceptable because they enable more equitable land allocations, given the limited irrigated area available.
9 However, the 'Masibambane III' programme, co-financed by the European Union and other partners and recently launched by the DWAF Minister Hon. Lindiwe Hendricks, explicitly includes completion of departmental restructuring and promoting institutional reforms, as envisioned by the NWA (Water Wheel, 2008).

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