

## WATER SHORTAGE, DEFORESTATION AND DEVELOPMENT: SOUTH AFRICA'S WORKING FOR WATER PROGRAMME

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### ABSTRACT

In the post-apartheid era, South Africa is experiencing a serious water supply crisis as demand increases from both rural areas and rapidly growing towns and cities. New dams and water transfer schemes are being constructed, but they are both controversial and unlikely to fully satisfy demand. Alien species of trees and plants have invaded many parts of the country, taking over land from indigenous species. These alien species consume much more water than the indigenous vegetation, as well as threatening biodiversity and constituting a significant fire hazard. The Working for Water Programme, established in 1995, and working in partnership with local communities, aims to clear invasive alien species and thus increase water supply. The programme is examined in terms of its impact on environment and the livelihoods of predominantly poor rural communities. Questions are raised about the future sustainability of the programme. Copyright © 2001 John Wiley & Sons, Ltd.

KEY WORDS: water; alien species; eradication; poverty alleviation; sustainability; South Africa; deforestation

### INTRODUCTION

Post-apartheid South Africa faces a serious water supply crisis. Unreliable and inadequate rainfall, together with a burgeoning demand from agriculture, industry and towns have led to a water supply problem which cannot be satisfied entirely by the construction of large dams and water transfer schemes, however controversial such projects might be. It has been recognized that the widespread introduction and spread of alien tree and plant species has done much to exacerbate the country's water shortage problem, such that the eradication of these species could actually make a very significant impact on the availability of water. The ambitious Working for Water Programme, introduced in September 1995, aims to involve local communities in the destruction of vast areas of invasive alien species across the country, and in so doing improve the water supply for both rural and urban areas.

As a direct consequence of the programme, in certain parts of South Africa once densely forested water catchments are now totally denuded, a sight which might raise some concern among European and North American observers who are more familiar with the long-standing orthodoxy favouring the afforestation of catchments to stabilize soils and prevent silting of dams and water courses. Furthermore, the mass felling of trees perhaps seems even more contradictory when viewed in the light of the assertion that more than half of South Africa is actually under the threat of 'desertification' (Preston-Whyte and Tyson, 1988: 262).

However, the Working for Water programme is more than just an exercise in the eradication of alien species. Through the direct involvement of local communities, it has been promoted as having a major role to play in the 'upliftment' of rural communities, leading to the alleviation of poverty and the creation of jobs. As the South African Department of Finance commented in May 2000, '... The Working for Water Programme is the most effective and efficient poverty relief instrument of Government' (quoted in WFWP, 2000b: 3).

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## SOUTH AFRICA'S WATER SUPPLY PROBLEM

Much of South Africa can be classified as semiarid, with some 70 per cent of the country receiving less than 600 mm of rain per annum. In fact, about 20 per cent of the land actually receives less than 200 mm—the USA defines an arid climate as one which receives less than 250 mm of precipitation per annum. In areas of summer rainfall, evapotranspiration rates can be extremely high, reducing levels of run-off and availability of surface water for agriculture and human consumption. In the hot, dry northwest of the country, for example, evaporation losses can exceed 2750 mm yr, whereas along the south and southeast coast such losses are often less than 1250 mm. Rainfall variability is also a problem in many parts of the country, with as much as 40 per cent difference from the annual average in the northwest, while in the lower Orange River valley it is frequently 50 per cent above or below the norm (Lester *et al.*, 2000). The major mountain catchments of South Africa comprise only 10 per cent of the land surface area, yet yield over 50 per cent of its water (Hosking and Du Preez, 1999: 442). South Africa apparently has, one of the lowest conversions of rainfall to runoff relationships (8.6 per cent) of any country in the world (Petitjean and Davies, 1988; O'Keeffe *et al.*, 1992). The combined annual run-off of South Africa's rivers is estimated to average 53 500 million m<sup>3</sup>, but only 33 000 million m<sup>3</sup> (62 per cent) of this can be exploited economically, due to considerable variability of flows and the high evaporation losses from storage.

In 1990, South Africa's total annual national water demand was just over 19 000 million m<sup>3</sup>, a figure that was expected to rise to over 25 800 million m<sup>3</sup> by 2010. While this figure is theoretically within the limits of water availability, spatial and temporal variations can in practice lead to serious deficiencies (O'Keeffe *et al.*, 1992; Carpenter, unpublished thesis, 1999). The national water supply situation is further compounded by the escalating demand for water, on farms and in towns, most especially in the large and rapidly growing conurbations of Johannesburg–Pretoria (in Gauteng province), Cape Town (Western Cape province) and Durban (KwaZulu-Natal). With South Africa's population growing at an estimated 1.7 per cent per annum, (less than many other African countries, but much greater than in Western Europe and North America), and some 53.7 per cent of the population living in urban areas at the time of the 1996 census (StatsSA, 1998), the demand for water is steadily increasing. The average annual urban population growth rate between 1996 and 2000 was 3.2 per cent, with Northern province and Mpumalanga over 4 per cent, while Eastern Cape province was approaching 6 per cent (DBSA, 2000: 6).

It is probably true to say that, '... throughout its history the provision of an adequate water supply has been one of the key limiting factors in the economic development of South Africa' (Lester *et al.*, 2000: 25). Ambitious water transfer projects have been a key feature of government policy in both the apartheid era and during the 1990s. Early schemes, for example, involved the transfer of water from the Tugela River in KwaZulu-Natal into the Vaal River, which supplies the Johannesburg region, the economic powerhouse of South Africa. The country has also relied on sourcing water from neighbouring countries, and it has been suggested that, '... Apartheid South Africa used its military and economic might to coerce its neighbours into acting as sources of water, sometimes to the detriment of these countries' own water needs and of the subcontinental watertable' (ANC, 1994: 28).

The dependence of South Africa on neighbouring countries for augmenting its water supplies continues, such that, in the late 1990s, the first stage of the World Bank-sponsored US\$8 billion Lesotho Highlands Water Project was completed. This collaborative Lesotho–South Africa project involves moving water from the massive Katse Dam, in the sparsely settled and water abundant northeastern region of Lesotho, through a complex system of tunnels and dams and eventually to the Johannesburg region some 300 km north of Lesotho (Lester *et al.*, 2000). Nel and Illgner suggest that, 'The sale of what is locally-known as 'white gold' will boost Lesotho's economy by an impressive 6 per cent or US\$40 million per annum' (Nel and Illgner, 2001). In the period up to 2020 a further four dams are planned in Lesotho to meet Gauteng's seemingly insatiable demand.

The water supply question occupied a prominent position in the development planning strategy of South Africa's first democratically elected government when it came to power in 1994. The Reconstruction and Development Programme (RDP), launched by the African National Congress (ANC) before the first democratic elections of May 1994, and then pursued by the Government of National Unity afterwards, endorsed the principle that all South Africans have a right to convenient access to clean water. The RDP asserted that, 'The fundamental principle of our

water resources policy is the right to access clean water—water security for all’ (ANC, 1994: 28). It was estimated that between 12 and 16 million South Africans did not have adequate access to a clean supply of water (RDPWCP, 1996: 2). The National Water Act (Act 36 of 1998) states that, ‘... all water, wherever it occurs in the water cycle, is a resource common to all’, and the *ownership* of water is replaced by the *right to its use*, with a provisional target supply of 25 litres per person per day. This Act really does represent a very significant shift in policy. Additionally, the Act recognizes the need to protect and maintain a so-called ‘ecological reserve’, which is, ‘... the quantity, quality and reliability of water required to maintain the ecological functions on which humans depend’ (WFWP, 1998: 10). It is fair to say that good progress was made in water supply provision by the first ANC government (1994–99) and, in his 2001 address to the nation, President Thabo Mbeki commented that, ‘... from 1995, the Community Supply Programme extended the water supply to 6 495 205 recipients by November 2000’ (Mbeki, 2001). Some of this success must be attributed to the National Water Conservation Campaign and the Working for Water Programme.

### THE WORKING FOR WATER PROGRAMME

In March 1995, the National Water Conservation Campaign was launched by the charismatic Minister of Water Affairs and Forestry, Professor Kader Asmal, who commented that, ‘... we could not simply continue to build ever more expensive infrastructure (dams and pipelines) with ever diminishing returns. We will have to find other ways of maximising our water supply’. In response to this need, the Working for Water Programme was launched by Asmal in September 1995 at a cost of R25 million, and involving a programme of mass eradication of alien invasive tree species which, it was argued, ‘... not only displace rare indigenous vegetation, but they use precious water that people desperately need’ (RDPWCP, 1996: 2).

So what is the justification for the Working for Water programme? What does it involve? And what contribution is it actually making towards enhancing the sustainability of both environment and the livelihoods of poor communities? The vision for the programme is that, ‘... it will sustainably control invading alien species, to optimise the potential use of natural resources, through the process of economic empowerment and transformation. In doing this, the programme will leave a legacy of social equity and legislative, institutional and technical capacity’ (WFWP, 2000a: 2). More specifically, the stated aims are:

- To enhance water security, promote equity, efficiency and sustainability in the supply and use of water.
- To improve ecological integrity and counteract abnormal fires, erosion, flooding, scouring, siltation and protect biodiversity.
- To restore the productive potential of land and promote sustainable use of natural resources, and to develop economic benefits from land, water, wood and people.
- To invest in the most marginalized sectors of South African society, and to optimize the social benefits in such a public works programme.

Alien plants have been introduced into South Africa from many different parts of the world at different times, but particularly since the arrival of Dutch settlers at the Cape in 1652. A total of 744 tree species and 8 000 shrubby and herbaceous species have been introduced into South Africa, of which some 153 introduced species are regarded as ‘invasive’ (WFWP, 1998). The early introductions were virtually all from Europe and only one, *Pinus pinaster*, imported from the Mediterranean region, is regarded as invasive. A total of 19 species were introduced from Europe, 64 from Central and South America, 14 from North America, 25 from Asia and 26 from Australia. Only 110 of the 744 (15 per cent) tree species introduced into South Africa are regarded as invasive (WFWP, 1998: 3). After about 1830, the intentional importation of tree and shrub species from areas with a similar climate and/or ecology to South Africa—most notably southern and western Australia—had a particularly significant effect. Some 45 per cent of the plant species brought from Australia have become serious invaders (Carpenter, unpublished thesis 1999; Richardson *et al.*, 1992). The black wattle (*Acacia mearnsii*), for example, introduced from Australia in 1858 to provide shade, fuelwood and tanbark, had by 1998 invaded an estimated 2.5 million ha

of land. With a valuable high tannin content in its bark, large-scale commercial plantations of black wattle were established in Natal from the late nineteenth century (Carpenter, unpublished thesis, 1999).

As the founding minister of the Working for Water Programme, Kader Asmal commented,

The picture is bleak. Invading alien plants have covered some 10 million hectares, an area larger than the province of KwaZulu-Natal, or about 8 per cent of South Africa. If all of the invading plants were packed densely together, they would more than cover the whole of the province of Gauteng. Invading alien plants are causing us to lose some 7 per cent of the annual flow in South Africa's rivers each year-about 3300 million cubic metres of water. (This excludes their severe impact upon groundwater reserves.) Were we to do nothing to redress the situation, then the plants would continue to invade at a rate of about 5 per cent per year, doubling their impact every 15 years! Our Working for Water Programme is the world's most comprehensive initiative to clear invading alien plants. It is estimated that approximately 750 000 hectares will need to be cleared each year to win the battle over a 20-year period. The costs of doing so are huge (up to R600 million per year), and a great deal of innovative action will be needed to achieve this goal (Asmal, Foreword, p.i, in Versveld *et al.*, 1998).

As Figure 1 shows, the areas of the country which are under most stress from invasive alien species are: first, the Cape Floral Kingdom in Western Cape province, extending eastwards into Eastern Cape province as far as the Grahamstown area; second, the Natal Midlands in KwaZulu-Natal province; third, an area between Ulundi and the coast in KwaZulu-Natal province; fourth, the escarpment and low veld in Mpumalanga; and fifth, the central bush veld area in the southern part of the Northern province.

In the relatively short time span since its inauguration, the Working for Water programme has impressed a number of international commentators, for example, the US Secretary for the Interior, Bruce Babbitt, who endorsed Kader Asmal's words when he commented to President Thabo Mbeki in February 2000 that, '... the Working for Water Programme is the world's leading initiative to combat invading alien plants' (Babbitt, quoted in WFWP, 2000b: 3).

At the national level, the Working for Water programme is governed by a board of 12 ministers who establish policy and ensure interdepartmental collaboration. As Table I shows, the government's Poverty Relief Fund and the Department of Water Affairs and Forestry represent the largest sources of income. Income is also received from other departments, notably Land Affairs and Welfare. Rand Water has been a long-standing partner, supporting investment in clearing alien plants and rehabilitation of wetlands in Free State, northern KwaZulu-Natal and Gauteng. Overseas funding has come from the Finnish, Dutch, Norwegian and US governments. Finland, for example, has extended its R14 million investment by funding a youth project on secondary industries in Mpumalanga, while the Dutch government has invested in youth programmes in the Kruger National Park and Lake St Lucia. The International Development Research Council of Canada has funded a programme of social and economic research.

### LEGISLATION SUPPORTING THE WORKING FOR WATER PROGRAMME

Since the launch of the Working for Water Programme in September 1995, there has been concern by the government to give strong legal support to the programme by modifying and updating a number of existing Acts of Parliament and, where appropriate, introducing new legislation. Some of the most important pieces of legislation are now considered.

The *National Water Act (36 of 1998)* provides considerable support for the Working for Water Programme. The Act requires the progressive development of a national water resource strategy to provide, '... the framework for the protection, use, development, conservation, management and control of water resources for the country as a whole' (Government of South Africa, 1998a: Ch. 2, pt 1, 24–26). In the context of sustainable catchment management, the Act requires each catchment management agency, in which local stakeholders are represented, to develop a catchment management strategy which includes a water allocation plan for existing and prospective users. It is also suggested that water users will be charged in order to raise the portion of funds necessary to ensure

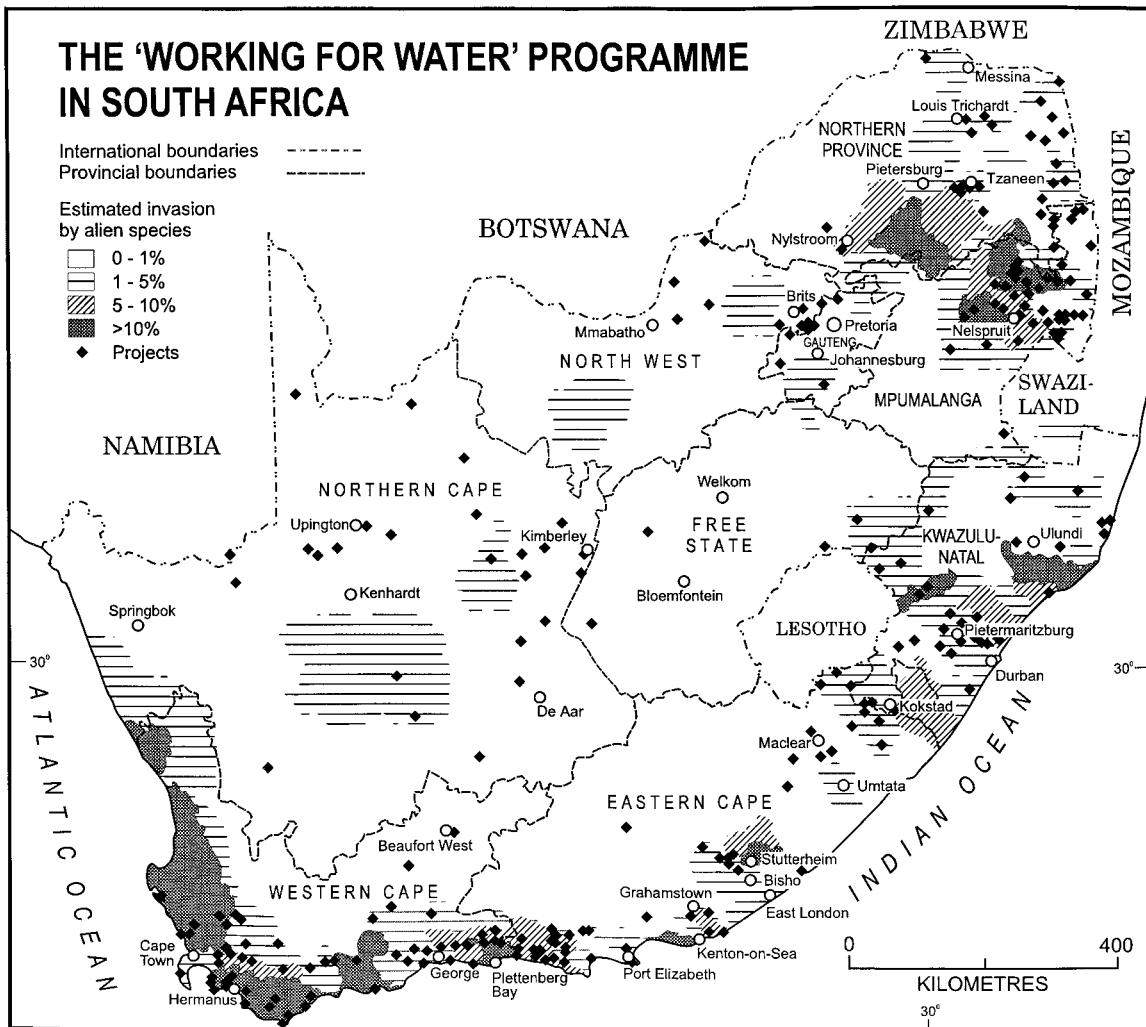


Figure 1. The Working for Water Programme in South Africa.

that catchments are kept clear of invading alien plants. If such charges are not levied, it is likely that water users will incur greater costs if regular clearing is not undertaken. Two quite controversial provisions in the Act could well be implemented in the future. First, a section on pollution in the Act makes it possible to charge landowners whose alien plants cause seed pollution on the land of others. A second provision which could be implemented is that stream-flow reduction charges could be levied on landowners whose alien plants reduce streamflow, the charge contributing to the clearance of invading alien plants in affected catchments.

Also concerned with the issue of pollution, is the *National Environmental Management Act* (107 of 1998), which aims to, '... prevent pollution and ecological degradation ... (and) ... secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development' (Government of South Africa, 1998c: 10). Section 28 can require persons causing significant pollution or damage to the environment to remove the source of the pollution, reinforcing the commitment that, '... The costs of remedying pollution, environmental degradation and consequent health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment' (Government of South Africa, 1998c: 14).

Table 1. Working for Water Programme: provisional financial statement, 1 April 1999–31 March 2000. Figures in SAR '000

Income	1999/00	1998/99	1997/98	1996/97	1995/96	TOTAL
Poverty Relief	123 000	120 000	150 000	50 000	25 000	468 000
Dept of Water Affairs and Forestry	93 900	115 000	90 000	7 000	–	305 900
Rand water	12 500	10 000	11 059	4 291	–	37 850
Municipalities	1 985	218	–	20 000	–	22 203
Foreign funding	6 693	8 915	377	43	–	16 028
Dept of Land Affairs	1 599	5 426	–	–	–	7 025
Dept of Welfare	1 771	–	–	–	–	1 771
Private sector	314	975	–	5 334	2 046	8 669
<b>TOTAL INCOME</b>	<b>241 762</b>	<b>260 534</b>	<b>251 436</b>	<b>86 668</b>	<b>27 046</b>	<b>867 446</b>
<b>Expenditure</b>						
Northern Province	14 663	19 642	25 620	3 623	1 705	65 253
Mpumalanga	16 779	16 026	16 206	5 849	2 498	57 358
Gauteng	3 459	6 712	3 122	–	–	13 293
North West Province	9 251	18 133	8 837	604	411	27 236
Free State	11 978	5 374	4 410	1 027	–	22 789
KwaZulu/Natal	24 838	30 601	36 947	15 258	3 464	111 108
Eastern Cape	27 852	40 248	47 527	12 748	4 815	133 190
Western Cape	67 982	91 482	75 760	37 892	13 222	286 338
Northern Cape	9 439	14 787	21 308	–	–	45 534
SA National Parks	21 400	–	–	–	–	21 400
Other	15 272	15 886	5 554	3 004	658	40 374
<b>TOTAL SPENT</b>	<b>222 913</b>	<b>248 891</b>	<b>245 291</b>	<b>80 005</b>	<b>26 773</b>	<b>823 873</b>
Balance	<b>18 849</b>	<b>11 643</b>	<b>6 145</b>	<b>6 663</b>	<b>273</b>	<b>43 573</b>
per cent spent	<b>92 per cent</b>	<b>96 per cent</b>	<b>98 per cent</b>	<b>92 per cent</b>	<b>99 per cent</b>	<b>94 per cent</b>

Source: Working for Water Programme, 2000b. Annual Report 1999/2000. WFWP: Cape Town.

A third Act, the *National Veld and Forest Fire Act (101 of 1998)*, can be used to control vegetation that creates a fire risk, which has been identified as a particular problem with alien invasive species (Government of South Africa, 1998b).

New regulations which are proposed, but not yet implemented, under the *Conservation of Agricultural Resources Act (43 of 1983)*, (often referred to as 'CARA' by those in the Working for Water programme), are proving to be particularly controversial and have been strongly opposed by certain environmental groups, such as the Earth Alliance, as will be shown later. The proposed amendments to CARA will declare various species of plants to be 'weeds' and 'invader plants', and will strictly control the circumstances under which they can be grown. Nurseries will be required to have a permit to grow or sell invasive alien plants. The regulations provide for powers to enter land without the permission of the landowner to clear such plants. Restrictions will also be placed on the transfer, rezoning or subdivision of land, and departures and changes to land-use practices, unless weeds and invader plants are cleared or financial provision is made for clearance. Powers are also given under the Act to require an impact assessment to test the risk of invasion by imported plant materials and then require financial guarantees (such as insurance) should the plant materials be found to be invasive.

A revised list of 153 'declared weeds and invaders' has been compiled (Department of Agriculture, 1999). The list divides declared weeds and alien plants into three categories;

*Category 1 (86 listed).*– 'weeds which serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. Such plants shall be eradicated. Examples include:

- Screw-pod wattle (*Acacia implexa*),
- Long-leaved wattle (*Acacia longifolia*),

- Kangaroo wattle (*Acacia paradoxa*)
- Camel thorn bush (*Alhagi maurorum*).

*Category 2 (31 listed).*—‘plants that are useful for commercial plant production purposes, but are proven plant invaders under uncontrolled conditions outside demarcated areas’. Examples include:

- Green wattle (*Acacia decurrens*),
- Black wattle (*Acacia mearnsii*),
- Australian blackwood (*Acacia melanoxylon*),
- Sisal hemp/sisal (*Agave sisalana*)

*Category 3 (36 listed).*—‘plants mainly used for ornamental purposes in demarcated areas, but are proven plant invaders under uncontrolled conditions outside demarcated areas’. Examples include:

- Bailey’s wattle (*Acacia baileyana*),
- Pearl acacia (*Acacia podalyriifolia*),
- Jacaranda (*Jacaranda mimosifolia*)
- White/Common mulberry (*Morus alba*)

(Department of Agriculture, 1999).

Category 2 and category 3 plants are to be restricted to clearly demarcated areas and precautionary measures should be taken to reduce the spreading of seed or any other propagating material to land outside the demarcated areas.

Despite the controversial nature of some of this legislation, and particularly the proposed amendments to CARA, the managers of the Working for Water Programme have said that, ‘The programme is determined to take advantage of the legislative powers to which it has access, and initially to develop high-profile test cases to send out strong signals about its intentions. Those who think this may be an idle threat should look at the programme’s track record for carrying out its intentions’ (WWFP, 1999: 21).

There are two broad strands to the Working for Water Programme: first, the clearance of alien species to improve water supply, and second, an associated broad development strategy that could have long-standing benefits for communities which are involved. Each of these strands will now be examined in greater depth.

### THE CLEARANCE OF ALIEN SPECIES

The Working for Water Programme is regarded as:

... a technical initiative to combat the dire threats posed by invading alien plants—threats of a magnitude that few in our country understood until the launch of the programme in 1995. These threats are not simply to our biological diversity, as is often portrayed in the literature on invasive species. These are threats of massive economic and social consequences, in terms of our water security, the productive use of land, the intensity of fires and floods, and ultimately the ecological integrity of the natural systems upon which we all finally depend’ WWFP, 2000b: 3).

These are indeed powerful words.

Although a wide variety of alien tree species is involved (see Richardson *et al.*, 1997), perhaps the most significant are wattles (black wattle *Acacia mearnsii*, silver wattle *Acacia dealbata*), and bluegums from Australia (*Eucalyptus* (spp)) and pines from the Mediterranean and California (especially *Pinus pinaster*) (Versveld *et al.*, 1998). It has been estimated that alien species cover a ‘condensed area’ (i.e. the total invaded area with different percentage cover, adjusted to bring cover to 100 per cent) of 1.7 million ha in South Africa (Versveld *et al.*, 1998). While this represents only 1.5 per cent of the country’s land surface, Figure 1 indicates that about 40 per cent of the land surface has some cover of alien species.

There has been much debate about the merits and problems associated with clearing alien plants and trees. For some considerable time there has been small-scale clearance in parts of South Africa, which yielded positive results, '... ecosystem services were preserved, cost-benefit analysis showed the clearing to be efficient, and jobs were created' (Hosking and Du Preez, 1999: 442). The Working for Water programme argues that first and foremost the alien species consume a great deal of water which might otherwise have been used by humans, agriculture or industry. Communities visited by the authors in the Stutterheim region of Eastern Cape strongly supported this statement. The loss of water, it is argued, affects the ability of catchments to sustain economic activity, such as the deciduous fruit industry in the Western Cape, which in 1993 generated gross export earnings of over R2 billion and employed 250 000 people (WFWP, 1998).

But it is also suggested that alien species displace many indigenous plants and animals, thus reducing biodiversity. South Africa is a signatory to the 1992 Convention on Biodiversity and is therefore obliged to, '... prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species'.

The Cape Floral Kingdom, with its distinctive *fynbos* vegetation, is the smallest of only six 'plant kingdoms' in the world, covering 90 000 km<sup>2</sup> in the Western and Eastern Cape provinces, or only 4 per cent of the land surface of southern Africa. Furthermore, it is the only floral kingdom which is found entirely within the borders of a single country. Yet, in terms of plant diversity, it is regarded as a vital resource, with 45 per cent of the subcontinent's plant species, representing the highest recorded species density for any equivalent-sized temperate or tropical region in the world (Myers, 1990; Cowling and Holmes, 1992). The invasion of the *fynbos* biome by alien trees and plants represents the greatest threat to this biodiversity and it is estimated that about 750 indigenous species are at risk. Large areas of *fynbos* have already been lost to urbanization, agriculture and forestry. (Richardson *et al.*, 1992). Some would also suggest that the invasive alien plants also spoil scenic tourist areas. The Cape of Good Hope Nature Reserve, an area of great plant biodiversity, attracts some 400 000 tourists each year. In economic terms, the *fynbos* flora has been successfully harvested for cut and dried flowers and for thatching grass, such that in 1993 the estimated annual value of these industries was about R80 million, with some 25 000 associated jobs (WFWP, 1998; Carpenter, unpublished thesis, 1999).

Another concern is that alien plants are also a greater fire hazard than many indigenous plants. The invasion of grasslands and shrublands by tall trees and shrubs increases the amount of plant material, or 'fuel load' that can burn. As the Working for Water programme comments,

Scientific studies have shown that typical fuel loads in grass and shrublands are around 0.3–4 tonnes per hectare, while invaded sites have up to 10 times more fuel (10–25 tonnes per hectare). While ecosystems in South Africa are normally quite resilient to regular burning, these increased fuel loads lead to higher intensity fires and a range of detrimental effects, including physical damage to the soil (leading to severe erosion, silting of dams and further water loss through reduced storage capacity) (WFWP, 1998: 12).

Natural *fynbos* vegetation can burn with flames up to 5 m high, whereas when alien trees burn the flames can be 15 m high (RDPWCP, 1996).

There is now a considerable amount of evidence drawn from research undertaken in different parts of South Africa to suggest that the clearance of alien species does actually improve water supply. It is estimated that invading aliens use 3.3 billion m<sup>3</sup> of water in excess of that used by indigenous vegetation every year—almost 7 per cent of the runoff of the country (WFWP, 1998: 8). Examining some particular empirical investigations, a study undertaken in 1994, for example, in a commercial forestry plantation near Lydenburg, Mpumalanga Province, measured stream flow at two weirs along a tributary of the Crocodile River as it passed through an area of dense exotic pines and wattles. The vegetation was then cleared by the forestry company SAPPI to a distance of 30 m on either side of the water course, with dramatic effect in terms of increasing stream flow (RDPWCP, 1996). In the Western Cape among the *fynbos* biome, catchment experiments have shown that dense stands of alien trees can reduce runoff by between 30–70 per cent, depending on factors such as annual rainfall and the age and density of the alien stand. Estimates suggest that invasion could result in an average decrease in water production from *fynbos* catchments of 347 m<sup>3</sup> of water ha each year over 100 years, resulting in an average loss of more



than 30 per cent of the water supply to the city of Cape Town (Richardson *et al.*, 1997; Le Maitre *et al.*, 1996). Another study, undertaken along the Sand River in Eastern Cape province northwest of Port Elizabeth, examined the effects on stream flow of black wattle invasions in the riparian zone (Beyers, unpublished thesis, 1998). Comparing both cleared and uncleared sections of the riparian zone, it was found that black wattle caused a significant reduction in streamflow, particularly during the hottest and driest months when stream flow is crucial. The study confirmed previous research findings that alien plant invasions in the riparian zone use significantly more water than the alien plant invasions in a catchment, and a strong recommendation was made that the clearance of alien trees in riparian zones within the Eastern Cape should be given high priority (Beyers, unpublished thesis, 1998).

A further study, undertaken in September 1994 on the SAPPI property of Kalmoesfontein, convincingly demonstrated the significance of the increase in stream flow associated with alien vegetation eradication. Some 25 000 m<sup>2</sup> of invasive trees were cleared from riparian zones, leading to an increase in streamflow of an estimated 30 480 litres of water per day, sufficient to supply more than a thousand people with a daily allowance of 30 litres of water (Dye and Poulter, 1995: 29). Carpenter, considering the Krom and Kouga River catchment areas for Port Elizabeth's present and future water supply, undertook a detailed cost-benefit analysis which compared the eradication of alien species with various other possible water supply schemes involving water transfer and dam construction. He concluded that the eradication programme of the Kouga Working for Water project is indeed, '... an economically desirable option of augmenting the water supply to the Port Elizabeth region' (Carpenter, unpublished thesis, 1999: 105). Carpenter argues that, '... the eradication of invasive alien vegetation is a cost-efficient supply option which improves social welfare ... and has a host of environmental benefits'. The improvement of social welfare is the key focus of the community development strategy associated with the Working for Water Programme.

### A BROAD COMMUNITY DEVELOPMENT STRATEGY

The Working for Water Programme:

... is a developmental initiative that seeks to optimise the full potential of the social interventions that the programme offers—initially in the labour-intensive nature of the work, and thereby in the training and empowerment that is then possible. Its work in addressing the social conditions that confront the poor and the marginalised in our country, is of critical importance in these still early days of democracy' (WFWP, 2000b: 3).

Job creation and poverty alleviation are key objectives of the Working for Water Programme. While South Africa has an 'official' unemployment rate of 36 per cent, figures of over 50 per cent are quoted in many parts of the country, increasing to over 80 per cent in the deep rural areas and the former Black Homelands (DBSA, 1991). In these areas, an average of 53 per cent of people depend on remittances and pensions for survival, with only 3 per cent of households relying on farming as their main source of income (StatsSA, 1999).

Much of the clearance work in the Working for Water programme is undertaken by rural-based, and generally poor, communities. Money allocated to Working for Water projects comes from the government's Poverty Relief Fund. In the early days of the programme community members were hired on a daily piece-work system. But more recently a contractor system has been introduced. Any person living in a community located within a catchment which has been identified for clearance of invading alien plants, can apply for contract work by submitting a tender to the Department of Water Affairs and Forestry (DWAF). Successful applicants, or 'contractors' as they are known, then receive enough equipment to supply their work teams of about 20 workers, who receive a daily wage of R30. Contracts are usually awarded to persons who have had experience of the daily wage system in the Working for Water Programme. Contractors then select their workers, some of whom may be new to the programme. In keeping with RDP principles, the Working for Water Programme encourages employment which meets the criteria of 60 per cent women, 20 per cent youth and 2 per cent disabled, in an effort to enhance their quality of life. Project management teams in each area gather detailed socio-economic information on members of

Table 2. Achievements of the Working for Water Programme by March 2000

Province/Region	Total jobs	Initial treatment (ha)	Follow-up treatment (ha)
Eastern Cape	3189	10 537	9 548
Free State	493	1 274	422
Gauteng	382	10 268	1 526
Kwazulu-Natal	8 764	12 268	29 438
Mpumalanga	1 815	21 650	18 614
Northern Cape	1 095	4 674	898
Northern Province	747	2 402	1 021
North-West Province	382	2 180	1 247
Western Cape	2 874	28 709	41 496
SA National Parks	1 180	4 628	13 540
South Africa	20 921	98 590	117 750

Source: Working for Water Programme, 2000b. Annual Report 1999/2000 WFWP: Cape Town.

work teams, to ensure that poverty alleviation objectives are being met. Each project has to establish a Project Steering Committee (PSC) which meets each month and is responsible for managing the project and employing workers. By March 2000, some 290 projects had been established across the country, providing 20 921 jobs, clearing 98 590 ha of invasive alien trees and shrubs, with a further 117 750 ha of land cleared earlier being treated in the follow-up programme to prevent regrowth (Table II).

A wide range of skills training is involved in the Working for Water Programme, since many of the participants in poor rural communities have had little, if any, formal education. It is suggested that, 'Training is an important benefit to workers and crucial for government's commitment to job creation, poverty alleviation and human resource development' (WFWP, unpublished report, 2000c: 1). The stated aims of the training policy are to:

- Orientate team members and equip them with basic knowledge, understanding and skills required to implement the Working for Water programme.
- Raise the level of environmental awareness.
- Enhance the productivity and work ethic of team members.
- Create viable options for team members' future economic participation.
- Empower disadvantaged individuals, especially women, youth and disabled.
- Optimize the benefits for the communities from which the team members are drawn
- Promote life-long learning. (WFWP, 2000c)

The Working for Water Programme is keen to develop a properly accredited training programme, in which all team members and contractors are eligible for a minimum 48 training days in a two-year employment cycle. Training sessions are paid at 75 per cent of the daily equivalent wage and only those who attend full training sessions are paid. Transport costs are also paid. All participants receive an orientation course, which explains the aims and principles of the Working for Water programme, the methods used, the nature and conditions of employment, rules and regulations, and issues such as acceptable behaviour and team work. Subsequent to this induction, other training includes technical courses such as machine operation (particularly chain-saw), herbicide application and drivers' training. Life-skill courses include HIV/AIDS and Cholera awareness, primary healthcare, personal finance, race and gender and literacy and numeracy. Contractors receive additional training in technical and financial management and administration, entrepreneurial skills and personnel management. Project managers receive separate courses in technical, financial and personnel management. Such issues are important, since under the apartheid regime black workers received little training in these areas and had little, if any, experience of being in a leadership role. The training courses are undoubtedly playing an important role in strengthening skills and building confidence. As the Institutional and Social Development Co-ordinator of the Amatola Working for Water project in Eastern Cape province commented, 'Now people are starting to own the project—I see a lot of change

after the training courses. People are no longer passive, they are decision-makers' (Radebe, 2001: personal communication).

In the Amatola project, a pilot child care scheme has been established at Keiskammahoek, supported with funding from the Department of Welfare. Since one of the key objectives of the Working for Water programme is to involve women in various aspects of the programme, the provision of childcare facilities is recognized as an important requirement for female participation. In this particular case, the community has built the childcare centre, while Working for Water is training volunteers and purchasing essential equipment. Parents pay R5 per month to send a child to the crèche. At a Project Steering Committee (PSC) meeting in Stutterheim there was a strong call from women members for early and more widespread provision of childcare facilities (Radebe, 2001: personal communication).

### *Secondary Industries*

In relation to the medium- and long-term sustainability of the Working for Water programme, it is envisaged that participants will be able to utilize the skills they have acquired during the forest clearance projects, by engaging in a variety of so-called 'secondary industries' which can be sustained long after the alien species have been cleared. The Department of Trade and Industry has a key collaborative role to play in assisting the Working for Water programme to design and launch a Secondary Industry Programme using the cleared wood for productive purposes. Pole production, fencing, furniture making and charcoal production are all possible spin-off industries from the clearance programme. Another initiative involves mixing wood chips with cement, to make panels for new houses which provide excellent insulation (WFWP, 1999: 8). Two communities at Pirie and Tyusha near King William's Town in Eastern Cape province were, in early 2001, negotiating with a silicon smelting company in Pietersburg, Northern Province, to supply charcoal at a price of about R440 per tonne. In addition to paying for the charcoal, the company will pay the wages of some 120 people who are cutting, stacking and processing the timber. A trust fund has been set up in each community to manage the funds. The company will construct the charcoal kilns and train local people in production methods (Buckle, 2000: personal communication).

## WORKING FOR WATER IN EASTERN CAPE PROVINCE

Eastern Cape province has potentially much to gain from initiatives such as the Working for Water Programme. It is South Africa's second largest province (170 616 km<sup>2</sup>) and one of the poorest, since it includes the two former Black Homelands of Ciskei and Transkei. While South Africa had an average Human Development Index (HDI) of 0.705 (out of a possible 1.0) in 1992, comparable to countries such as Peru and the Philippines, Eastern Cape province had an HDI of only 0.507, the second lowest in the country after Northern Province, and comparable to the HDI of Papua New Guinea and Cameroon (DBSA, 1996). In terms of a range of social and demographic variables, Eastern Cape in 1996 had the highest infant mortality rate in the country (55 infant deaths per 1000 live births), the highest 'official' rate of unemployment (48.4 per cent) and the second lowest life expectancy (61 years), though this figure is likely to deteriorate rather than improve with the effects of HIV/AIDS (Binns, 1998; DBSA, 2000).

With a predominantly rural-based population, Eastern Cape in 1996 had the lowest percentage of households with access to water (53.5 per cent, compared with a national average of 79.8 per cent) and access to sanitation (64.1 per cent, compared with a national average of 82.5 per cent) (DBSA, 2000). But as people have moved from poor rural areas to nearby towns, and then into large cities such as East London and Port Elizabeth, the province has experienced an average annual urban growth rate of over 6 per cent between 1996 and 2000, the highest in the country. It has been estimated, for example, that the population of the Port Elizabeth-Uitenhage area in Eastern Cape province would increase at a rate of 2.4 per cent per annum, between 1980 and 2010, from 740 000 in 1980 to 1 510 000 in 2010. The corresponding annual water demand, however, would increase by about 4.2 per cent per annum, from 51 million m<sup>3</sup> to 177 million m<sup>3</sup> (Ninham Shand Inc., 1996). In summary, therefore, Eastern Cape is in urgent need of both job creation and poverty alleviation strategies, while the demand for water supply and proper sanitation is likely to increase rapidly in the next decade.

By early 2001 there were 39 Working for Water projects in Eastern Cape province, engaged in intensive clearance of alien invasive species. Black wattle (*Acacia mearnsii*) is the main species being cleared, with a total of 49 022 ha to be found in the province (Versveld *et al.*, 1998). The wattle and other alien species are being replaced by indigenous grasses to help restore the natural valley bush veld which is typical of many parts of the Eastern Cape. There is a good market for debarked wattle, exported through the port of Richards Bay, which can command prices of R320 per tonne from Japanese paper manufacturers. In fact, the price increased by 16 per cent during 2000. There are also good markets in South Africa for charcoal produced from wattle.

The various stages involved in the alien plant and tree eradication programme in Eastern Cape are as follows:

- From the top of catchments the area of wattle is mapped. Technical advisors assist with this process and advise in such matters as species recognition.
- Meetings are arranged, where necessary, with private landowners who have invasive species on their land. Under the various pieces of legislation relating to the Working for Water programme, there are considerable powers to act against landowners, notably under the proposed amendments to the Conservation of Agricultural Resources Act (43 of 1983).
- A sample plot is examined to determine the workload. Data are collected on the number of stems per hectare, level of maturity and diameter at breast height.
- The area to be cleared is subdivided into blocks, such that the amount of ground to be covered in periods of one month and three months is demarcated. This provides the work teams with incentives (Buckle, 2000, personal communication). Clearing is then undertaken, with the minimum wage for slashing being R30 per day. Those responsible for felling trees with chain-saws received R45 per day in early 2001, while herbicide appliers received R38. Ideally, cutting should start at the top of the catchment to prevent seeds blowing downslope on to cleared areas. The timber is cut into lengths of 2·4 metres, so that they can be easily carried by train. Work teams are mixed, comprising a target composition of 60 per cent women. The contractors, who are drawn from local communities, direct the clearing process with their respective community members. Contractors generally receive about R70 per day.
- A year or so after clearance, a follow-up treatment of the cleared areas is needed, generally involving further clearance and herbicide treatment. The main herbicide used is Timbrel<sup>®</sup> (Triclopyr), while *Melantarius maculatus* beetles are also used to control the spread of wattle seeds.
- After clear-cutting, rehabilitation of sites is undertaken. In order to prevent erosion after clearance there is an intensive programme of reseeding the cleared areas with indigenous vegetation. Indigenous species of trees and grasses are planted, but capacity constraints have led to some delays in this process. A nursery has been established at Cradock in Eastern Cape to supply large quantities of indigenous seedlings.
- Cut timber is then removed from the area, while that which is designated for charcoal making is stacked until it is dry enough to be fired in the kiln.

Project steering committees (PSCs) in Eastern Cape meet monthly to air views and concerns of work teams and to discuss the progress of projects. Each team of workers sends a worker representative and the contractor, plus two other people from each village—one male and one female. At a typical PSC meeting in Stutterheim, attended by the authors, nine villages and their project teams were represented—12 of the 21 members present were women (personal observation, 12 February 2001). One of the issues raised at the meeting concerned a contractor who had left the project with the community's funds. A discussion ensued about the inability of some contractors to manage the workers in their teams and the importance of efficient and transparent accounting. In fact, the whole area of forward planning and budgeting was evidently regarded as problematic, particularly because it often took management teams up to six months for project business plans to be approved before clearance work could start. Business plans submitted before the start of the financial year in April were often not approved until September or October. Delayed payments to contractors, and therefore subsequently to workers, were also a source of concern at the PSC.

Committee representatives also expressed concern about the urgent need to follow up clearing as soon as possible to prevent regrowth of alien species. Members commented that if the regrowth reaches up to 3 m without being checked then the same laborious clearance operation would have to be undertaken again.

PSC members were initially hesitant when questioned about whether they felt that they had benefited from the Working for Water programme. However, job creation was certainly perceived as a definite benefit of the programme. One forthright woman contractor commented, 'We have jobs now—we are not just looking at the sun. All that has changed' (personal communication, 2001). PSC representatives were in broad agreement that there was now more money available for essential family needs such as food, clothes and paying school fees. There was a feeling, among both men and women, that women had certainly been empowered as a result of their involvement in the programme, whereas in the past Xhosa men apparently dominated committees and decision making. One woman commented, that, 'We feel that freedom now and we have the same rights as others in the community' (personal communication, 2001). Another, speaking of the value of the training courses, argued that, 'The courses were very interesting. I went on a budgeting course, so now I can plan my budget month by month' (personal communication, 2001).

When asked about the environmental impact of the programme, many project workers felt that the area looked more attractive and there was a general consensus that the water supply had improved, with the nearby Rooikrantz Dam now being much fuller than it used to be. A dam on the outskirts of Grahamstown, in the area of the Albany Working for Water project, also contained much more water than in pre-clearance times. In both cases these observations were corroborated by local project managers. In terms of the future sustainability of the Working for Water programme, PSC members felt they had acquired valuable skills which they could carry forward into other jobs. Contractors suggested that after the end of the clearance programme they would apply to tender to the Department of Forestry to fell certain forest areas and market the timber. Community members were keen to discuss the possibilities for establishing secondary industries such as furniture construction and charcoal making.

Evidence from both field research and documentation in Eastern Cape province suggests that the Working for Water Programme has had positive effects on both people and environment. There has been a perceived improvement in both water supply and in the livelihoods of poor and historically disadvantaged communities, through the provision of jobs and training in a wide range of technical and transferable skills. It remains to be seen whether such benefits are sustainable and lead to a steady improvement in living conditions in one of South Africa's poorest provinces.

## CONCLUSION

The Working for Water programme is an exciting and innovative initiative, but there are many questions that still need to be answered, either through the passage of time and/or through further detailed research. As with the programme itself, concern focuses on two broad areas: environmental impact and the socio-economic implications.

In terms of the latter, there is concern about the sustainability of the programme. As the managers of the programme themselves have clearly stated, 'The programme is geared to work itself out of a job, in that we are trying to get rid of the invading alien plants' (WFWP, 1999: 7). Presumably, follow-up work such as the control of alien regrowth, will need to be undertaken well into the future. But this is likely to be a costly and time-consuming process and there is concern about whether sufficient government funding will be available for this and what proportion of present workers, if any, will continue to be employed? Research undertaken during the mid-1990s, in 16 communities in Eastern Cape engaged in a public works programme, revealed considerable disillusionment concerning the absence of alternative employment opportunities when government funding ceased (Nel, 1999).

The development of a range of secondary industries would undoubtedly provide some alternative employment, but evidence from the Eastern Cape Working for Water Programme, suggests that very few such projects have actually been initiated. Establishing secondary industries would require considerable amounts of capital and expertise in areas such as securing contracts, ensuring regular supplies of products and marketing. There is also

some serious doubt as to whether there is sufficient local human capacity for this to happen. Inefficient marketing, for example, has proved to be a major weakness in other community-based projects in South Africa, due to the frequent absence in rural areas of telecommunications to liaise with potential buyers, and a lack of transport among poor communities (Binns and Nel, 1999). On a more positive note, the Working for Water Programme has apparently provided project workers with some useful skills training, and among previously disillusioned and historically disadvantaged communities there is now often a sense of community spirit and empowerment, most notably among the women.

Even if timber-related industries were to develop, the destruction of vast areas of alien species would mean that less timber would be available for future use and the industries would have to draw upon indigenous species. Related to this, is the fact that vital fuelwood supplies for poor rural communities have been severely depleted through the Working for Water Programme and there was concern among communities visited that adequate fuelwood lots should be maintained for local use.

Considering some of the environmental issues raised by the Working for Water Programme, there is some concern that the clearance of large areas of forest will lead to increased erosion and silting of water courses and reservoirs. However, discussions with project officers suggested that erosion was in fact a greater problem in areas invaded by alien species, since the trees have shallow root systems. These trees are apparently frequently uprooted in strong winds, thus increasing the susceptibility of the soil to erosion. The programme also aims to reseed areas with indigenous species soon after clearance. However, it is recognized that there is an erosion threat in the period between clearance and the establishment of the indigenous seedlings. This problem was confirmed by the authors' observations in the Waainek area of Grahamstown, Eastern Cape, where serious localized erosion did in fact occur after heavy rain in areas which had been recently cleared.

A further focus of concern is the effect of massive forest clearance on flora and fauna and loss of habitats. There seems to be little available evidence to either support or refute this suggestion, and further research is needed in this area. Considerable concern has been expressed by certain environmental organizations about the proposals to amend the Conservation of Agricultural Resources Act (Act 43 of 1983), with the inclusion of a three-category list of 'declared weeds and invaders'. One of the more extreme viewpoints was exemplified in a recent statement (15 February 2001), titled 'Mass destruction of certain trees and plants to be made law in South Africa', issued by the Earth Alliance, which has condemned the proposed amendments to the Conservation of Agricultural Resources Act, 1983. The Earth Alliance asserts that:

'... it is the way in which they propose to deal with these plants that is of concern, and needs attention. This law has little regard for the consequences of the mass destruction and removal of these plants. Trees bring rain, which in turn increases the natural water table. Southern Africa is dry with few water resources, and by eliminating plant life on such a large scale, there would be dire consequences for our water and land resources. Southern Africa is also losing large amounts of topsoil as a result of the encroaching desert and misuse of land. Without a well-controlled and well-coordinated endeavour to deal with the plants that have been designated as alien, there will be severe side effects to our environment, and indigenous plants will suffer too. The Earth Alliance proposes that the removal of these alien plants be done rather over a 20–40 year period, and that every plant that is removed should be replaced with another plant that is not on the list. This is the only way this can be achieved without adversely affecting our environment. (Earth Alliance, 2001: 1–2)

Clearly, the Working for Water Programme has generated much debate about the merits and problems associated with the massive clearance of alien species. In many ways it is an inspirational project, which is motivated by strong scientific evidence. The programme has apparently had a positive effect on both the livelihoods of poor communities and on the availability of water, in a country where water supply is a contentious issue at national, regional and local levels. But the programme is still only six years old, and it remains to be seen what medium- and long-term effects it will have on both people and environment. Sustainability, in both environmental and socio-economic terms, will undoubtedly be the key test of the Working for Water Programme's true success.

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