

Ecosystem services, efficiency, sustainability and equity: South Africa's Working for Water programme

Placing a value on ecosystem services is essential for making rational choices about competing forms of land use. In developing countries, where short-term economic growth and social delivery take precedence over conservation, placing a monetary value on ecosystem services is the only way of ensuring intervention¹. The challenge is to ensure that these interventions incorporate ecological sustainability and fairness, as well as efficiency. There are few such projects in the world, especially among the poorer nations in the developing 'south'. One example is South Africa's Working for Water programme, which maximizes an ecosystem service (the delivery of water), enhances sustainability by eliminating invading alien plants, and promotes social equity through jobs and training for economically marginalized people.

In South Africa, the introduction of hundreds of species of alien trees has led to many populations of aggressive invaders, which convert species-rich vegetation to single-species stands of trees, increasing biomass and decreasing streamflow dramatically². In response to a concern that commercial afforestation with alien trees would impact on water resources, a series of whole-catchment experiments was established in the Western Cape in 1936 and in other high-rainfall areas in the 1950s. The results were later used to illustrate the potential impact that invasions (as opposed to formal commercial forestry) could have on water, given that such invasions were comparable to afforestation³.

Although alien plant clearing programmes were initiated in the early 1970s, they later fell behind when funding declined in the face of other demands. However, when the cost of clearing was compared with that of developing additional water supply schemes², it was shown that such clearing was cost-effective – more water could be delivered at a lower cost when control operations were in place than if they were not. The sooner such operations were initiated the better, because alien plant spread resulted in exponential increases in clearing costs over time. Cost-benefit analysis had demonstrated that the removal of alien plants maximized the utility of an ecosystem service and was, therefore, an economically efficient intervention.

The studies were completed when South Africa had elected its first democratic government, and local scientists made

a conscious decision to communicate these results to the Minister of Water Affairs (Kader Asmal) in July 1995. They stressed economic efficiency, the advantages for ecosystem stability and biodiversity conservation, and the opportunities for job creation. Asmal's response was immediate; he could see that the cost-effective delivery of a crucial ecosystem service could be sustainably linked to socioeconomic development and biodiversity storage. A programme, dubbed Working for Water to capture the essence of job creation to secure an environmental goal, was launched with an initial budget of \$US five million. In its two-year existence, the programme has grown rapidly. Annual funding by the government rose to \$US 50 million by November 1997, with additional inputs from the private sector and foreign aid. The impact of the programme on job creation played a large part in securing funding. The initial grant created over 7000 jobs for previously unemployed people in the labour-intensive clearing projects, reaching over 35 000 jobs in March 1998.

A group of scientists from the CSIR Division of Water, Environment and Forestry Technology mapped the extent of invasion of all important species on 1:250 000 scale maps, using local experts' knowledge. These data were used to estimate potential water use and costs of clearing. The current invasion covers the equivalent of 1.7 million ha, and is estimated to be using 3300 million m³ of water (almost 7% of the runoff of the country). This is more than the estimate for the forest industry, which is subject to stringent controls to reduce its impact on water resources. About 15 species (including Australian *Acacia*, *Eucalyptus* and *Hakea* species, and European and American *Pinus* and *Prosopis* species) were responsible for 90% of the problem. The cost to clear the invasions would be around \$US two billion, or roughly \$US 100 million per year for the estimated 20 years that it would take to deal with the problem. However, this could be reduced in a number of ways. First, some species do not have a large impact on water resources. *Acacia cyclops*, an Australian tree that invades coastal dune areas, covers 300 000 ha but, by virtue of its coastal distribution away from upper watershed areas, it could be excluded from a programme aimed at securing water resources. Second, biological control (using species-

specific insects and pathogens from the invader's country of origin) offers hope for reducing clearing costs. By ignoring non-water users and introducing biological control, clearing costs could be reduced to \$US 800 million (or \$US 40 million per year), a far more manageable target.

Nonetheless, the programme faces significant challenges. These include uncertainties in the models used to estimate water use, especially where these have implications for the forest industry, which in essence farms with invasive trees and will have to avoid penalties for water use as a result of alien plant spread. The industry will also need to absorb the impacts of biological control agents should they be released and will thus remain very critical. Proponents that promote the establishment of forests to offset global CO₂ increases have fundamental problems with programmes that remove trees and thus biomass; however, the potential for carbon sequestration in this way in South Africa is small, whereas the potential for biodiversity loss is large.

There is little doubt that the monetary valuation of an ecosystem service, formalized in a cost-benefit analysis, was the major stimulus for the launch of the Working for Water programme. Cutting down water-demanding alien trees is a more efficient way of delivering water than building new dams, a fact that was readily appreciated by politicians operating in a cash-strapped economy. Of equal importance are the sustainable delivery of an ecosystem service, the restoration and conservation of biodiversity, and the contribution towards improving the quality of life amongst previously disadvantaged people. This is a promising start to probably the largest ecosystem management programme in Africa, and it demonstrates the potential value of placing a monetary estimate, initially at least, on an ecosystem service.

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