COMMISSION OF THE EUROPEAN COMMUNITIES,
BRUSSELS

AND

GOVERNMENT OF SOUTH AFRICA,
DEPARTMENT OF WATER AFFAIRS AND FORESTRY,
PRETORIA

WORKING FOR WATER PROGRAMME

EVALUATION REPORT

VOLUME 1

EXECUTIVE SUMMARY
AND
FINANCING PROPOSAL

December 1997

INGENIEURBÜRO FÜR LANDENTWICKLUNG
E.JELINEK, FLORSTADT, GERMANY

In association with

INSTITUTE OF NATURAL RESOURCES,
UNIVERSITY OF NATAL, PIETERMARITZBURG

PREFACE

Contracts for consulting services were awarded by the Technical Assistance Consultancy Programme (TACP), Pretoria, to Mr E Jelinek, Ingenieurbüro für Landentwicklung, Florstadt, and Professor C M Breen, Institute of Natural Resources, Natal University, Pietermaritzburg (Consultants). The objective of the technical assistance, supported by the Commission of the European Communities (EC), has been to carry out an evaluation of the Working for Water Programme, which is under implementation by the Department of Water Affairs and Forestry (DWAF). It was also intended to conduct an appraisal of projects and to prepare a project financing proposal (to be submitted to the EC) for the establishment of viable plant clearing projects.

Upon assessment of data quality and completion of field reconnaissance trips in Western Cape, Eastern Cape Provinces and KwaZulu Natal it became evident that the information available was not suitable for the appraisal of a project (leading to the decision to invest funds for implementation) within the short assignment period of five weeks in South Africa. The Consultant informed representatives of the EC, DWAF and TACP accordingly in a meeting held in the office of the EC on June 13, 1997, during which it was mutually agreed that it was not possible for the consultants to fulfil the requirements (appraisal) of the Terms of Reference. It was agreed (refer Appendix 2, Volume 2) that:

- the Consultants would review the programme
- a Logframe workshop would be held in Pietermaritzburg on June 18 and 19 to address strategic planning at national and provincial levels
- in the Consultants report the reasons why an appraisal was not possible would be clearly defined.

The results of the evaluation of the Programme and a financing proposal for the preparation of an alien plant control strategy are submitted in this summary report supported by appendices (volume 2).

This report is based on the findings of an interdisciplinary team of consultants, which consisted of Messrs C M Breen, J Erskine, E Jelinek, S Mbowa, N Quinn and M Salomon.

Designations employed and statements made in this report by the Consultant do not necessarily represent the view of the EC, DWAF or any other organisation or institution involved.

Acknowledgement

The consultants are indebted to the staff of the Department of Water Affairs and Forestry, Council for Scientific and Industrial Research (CSIR), project implementing agencies, NGOs and TACP for professional assistance and logistics provided during fieldwork.

1. PROGRAMME OVERVIEW

The Working for Water Programme (WFW), launched by the Department of Water Affairs and Forestry (DWAF) in September 1995 consists of 38 projects in various provinces of South Africa, mainly in Western and Eastern Cape. Its principal objectives are:

(a) To recover water presently being lost to invading alien plants and to prevent further losses;
(b) To create jobs, empower individuals and build communities;
(c) To conserve biological diversity, ecological integrity and catchment stability.

The control of invasive alien vegetation such as wattle, pines and eucalypts involves large scale removal of tree and shrub vegetation by recruiting people who were previously unemployed. The Programme, initiated and supported by Professor Kader Asmal, Minister of Water Affairs and Forestry, is being regarded as one of the successful efforts to create gainful employment opportunities for the underprivileged of the society in the context of the South African Reconstruction and Development Programme (RDP). Unemployment rates are high in the Eastern Cape (24%), Northern Province (25%) and KwaZulu/Natal (25%). And between provinces huge differences exist in per capita income. Only two thirds of South Africa's 40 million people have adequate access to water.

Total annual water usage in South Africa is quoted to be 20 billion m^3 (40% of runoff). It is dominated by irrigation (accounting for 54% of total use) followed by ecological requirements (19%), domestic use (11%), forestry (8%), mining and industry (8%). The annual shortage estimated to be 1.00 billion m^3 at present is expected to rise to almost 6 billion m^3 by the year 2030 affecting mainly the Northern Province, Gauteng, Western Cape and Free State. DWAF estimate that an area of 1.71 million ha appears to be affected by invasive alien plants the water consumption of which has been quoted to be 1.50 billion m^3 per year.

Alien invasive plants are regarded as one of the greatest threat to biodiversity, and are largely responsible for the high number of endangered and threatened taxa (1400 plant species) for the Cape Flora.

Expenditure on removal of alien invasive plants over the period 1995/97 (17 months) was R95.05 million by DWAF plus R11.07 million by the non-government sector. R88.70 million was allocated for the current fiscal year (1 April 1997 to 31 March 1998), which is an increase of 26% over last years budget. RDP funds have been allocated for this programme. The land cleared from October 1995 to December 1996 was estimated to be 59 000 ha.

2. REVIEW OF THE WORKING FOR WATER PROGRAMME

2.1 Institutional Aspects

The mission of the Programme, as defined by the DWAF, is to enhance water supplies by empowering local communities to carry out catchment management projects that focus on the control of alien invasive plants, most of which were imported from Australia over a hundred years ago. The director general under the Minister heads DWAF, the implementing agency of the Government. Dr G Preston who is a special advisor to the Minister provides leadership for the Programme. The programme manager is positioned at a relatively low level (deputy chief engineer) and within a region (Western Cape) of the DWAF. Project managers report to him. Concern has been expressed that the Programme does not have

more active involvement of a person at a senior level within the department and between the programme manager and the director general.

The Council for Scientific and Industrial Research (CSIR) provides scientific advice for the Programme and projects supplemented with advice from the Plant Protection Research Institute (PPRI) of the Agricultural Research Council. It occurs in the absence of a dedicated research programme set up to address priority research issues. Consequently, the Programme is founded on 'research capital' generated over the past ten and more years.

A national steering committee at programme level with members drawn from six government departments, NGOs, trade unions and civic organisations does not function as well as it should do. Concern expressed by project managers and implementing agents is that the steering committee does not give sufficient attention to strategic planning. This view was reinforced at a Logframe workshop held during the assessment of the consultants. Organisational features are presented in Figure 2.1a and 2.1b of the Appendix (Volume 2).

Various implementing agencies have been entrusted with the execution of the projects, Cape Nature Conservation having the greatest number of projects situated in the Western Cape Province. A project manager is usually supported by area managers each in charge of approx. 300 people subdivided into groups of 20 to 25 under a supervisor engaged in felling trees (see Figure 2.2a and 2.2b of Appendix). Each project has an advisory steering committee, drawn from local stakeholders, which promotes involvement and participation of the local communities in all decision–making. One of the most important functions of the advisory steering committees is assistance with the selection of job candidates with the objective of ensuring that the most needy in the community benefit from the Programme.

A performance contract and project business plan regulates project execution. Provision is made for independent monitoring. However, neither the ecological audit of 1996 nor the social audit of 1997 were comprehensive. The Programme has a clearly stated employment policy, which ensures equal opportunities for gender and which enables the poorest members of the community to benefit. Workloads are determined according to local conditions and fair labour practices are implemented. The Occupational Health and Safety Act is adhered to. Outside agencies are recruited to provide training in many fields.

A small team of enthusiastic, dedicated and highly qualified staff in DWAF and CSIR leads the Programme. However, the Programme, strongly driven by the need for employment has grown rapidly, it has outgrown the management capacity and system.

Recommendations

For the Programme to function efficiently it requires a greater degree of autonomy and financial security. Staff should be seconded to the Programme from government departments and the private sector. A Resource Conservation Directorate, reporting to the appropriate Minister, is envisaged. A management team should be assembled that contains the needed expertise. The private sector should participate more effectively in the Programme (e.g. consulting firms and University institutes) for project design and planning. Project implementing agents (including commercial forest companies) should be given projects on a 'turn key' basis thereby increasing capacity within the Programme.

2.2 Social Upliftment

The Programme has been very successful in job creation. Over 8 300 people have been employed of whom 53% are women. 20% are between 16-25 years. Long term unemployed and unemployed single parents are highly represented.

The selection procedure for workers is left to the steering committees and project managers. Some projects have been successful in bringing together different ethnic groups and breaking down barriers from the past. However, racial conflicts and political rivalry, drinking and drug problems, women abuse, AIDS/HIV, crime, traffic accidents and corruption do cause concern. Uncommunicated absence, a poor working attitude and disrespect for colleagues and superiors are managerial problems faced. The legacy of apartheid and the impact it has on the psychology of its people is an undeniable part of the problems faced by the projects.

One of the important goals of the Programme is to create teams of independent contractors who will be able to take over specific tasks on contractual basis. The initial process appears to be slow from the present stage of task work (finish daily set task) to piecework (finish area targets). All workers go through a course on basic occupational skills and environmental awareness. Supervisors are trained in management and entrepreneurial skills to prepare them for contract work. Training in life skills, financial management and first aid are also offered to enable employees to find employment outside the Programme. Increasingly, presentations and counseling are provided to address social problems like alcohol and drug abuse, women abuse and AIDS/HIV. NGOs and individuals are hired to provide the training required. Although the efforts made are impressive, an overall training strategy is still to be developed.

Referring to gender equity, the Programme has been remarkable in achieving the goal of 50% employment to women. The Programme successfully stimulates women to perform the same tasks as men for equal wages. Female team members are cutting trees, clearing bushes, carrying logs and sometimes operating a chainsaw. There are coloured and black African female supervisors and project managers, though highly underrepresented in leadership positions.

Project staff are dissatisfied with the quality of communication offered by programme management. Complaints about bureaucracy have been mentioned, and communication between workers and project managers is considered to be poor.

Recommendations

To enhance ownership of the projects, staff, supervisors and team members should be actively involved in design, implementation and monitoring of the projects. Expertise is needed in community development. Baseline studies are needed to assess the actual socio-economic situation of the communities the projects are working in. Coherent monitoring and evaluation systems need to be designed to assess the socio-economic impact of the Programme.

2.3 Technical Review

2.3.1 Planning and Design

The Programme is unique in the manner in which it sets out to simultaneously deliver water benefits, social welfare and environmental restoration. But this complicates programme planning and design. The sources of funds, particularly the start up funding, also moulded planning and design of the Programme. Funds drawn from the RDP are released against a business plan in the format required by the Department of State Expenditure, which is responsible for allocation of RDP funding. This format did not require that the usual planning process of DWAF was followed. Consequently, prefeasibility and feasibility studies were not conducted. Once launched the imperatives of 'spending the money efficiently, on time and within budget' gave the Programme an urgency and impetus in which strategic planning was perceived as a process that would result in delays which would fatally flaw the Programme. The process adopted by programme management resulted in minimal start up time and in a remarkably good stream of social benefits to the rural poor. However, there is widespread concern amongst project managers and implementing agencies with the inadequate level of strategic planning, feasibility assessment and with project prioritisation and initiation.

Referring to projects, in the same way as with programme planning, the imperative of getting projects going took precedence over planning. Thus projects were initiated at locations where management capacity was available and where there was sufficient awareness of alien plant invasives and social welfare needs. Consequences are that projects initiated do not have appropriate data that can be used to assess feasibility, to set measurable attainable goals in respect of water, social welfare and environmental rehabilitation. For instance, in most cases the area to be treated in a particular catchment is not known as it has not been mapped; hydrological studies to determine incremental water benefits have not been carried out; neither costs nor benefits have been quantified annually over a period of 25 years; the technical feasibility and economic viability of any project is not known.

Recommendations

It is urgently required to ensure a cost-effective programme that is defensible. That a national strategy, reflecting the most rational way of achieving water savings through control of alien invasive plants, should be developed, as stated in the Financing Proposal submitted in this report.

Feasibility studies should be carried out for any project prior to investment as per outlines of Terms of Reference for consulting firms submitted in the Appendix (Chapter 2.3.1). Protocols for prioritising selection of projects should be developed. The Logframe approach should be considered, as it would help to organise and structure the projects.

2.3.2 Water loss and alien invasives

DWAF estimated infestation levels of alien plants in the nine provinces of South Africa based on vegetation cover surveys and mapping operations recently carried out over the entire country. It is understood that 403 000 ha are affected by dense, 232 000 ha by medium and 1 074 000 ha by light infestation taking up approximately 1.50 billion m^3 of water per year. These calculations are based on the assumption that clearing a dense infestation will result in water savings of 3 000 m^3/ha/year, whereas clearing medium and light infestations will enhance runoff of by 800 and 100 m^3/ha/year respectively.

During the last 30 years a considerable body of information has been established, all of which indicates that vegetation of a larger stature will utilise a greater amount of water than smaller vegetation. For example, in the Western Cape Province water utilisation by mature

Fynbos appears to be of the order of 60 to 180 mm, whereas that of *Pinus radiata* is approximately 350 to 500 mm. Actual water utilisation is known to be related to both plant characteristics (e.g. rooting depth, canopy structure and area, leaf area and plant physiology) and site characteristics (e.g. available soil moisture, evaporative demand). Most, if not all, previous experiments were carried out in micro-catchments of less than 200 ha, mainly in higher rainfall areas, which were generally regarded as sites suitable for commercial afforestation with pines or eucalyptus. While the effect of afforestation (> 30%) with pines or eucalyptus on small, high rainfall catchments is relatively well understood, very little research has been conducted on water utilisation of indigenous vegetation and on riparian wattle vegetation. The absence of data from drier areas constitutes a serious problem.

The reliability of the catchment scale estimates of water saving increases as the total area occupied by alien vegetation increases. The greatest confidence may be placed in water saving estimates, which are determined for a high rainfall area to be cleared of eucalypts or pines and replaced by grassland. Less confidence exists for estimates in semi-arid areas to be cleared of alien invasives and which will be replaced by scrub or bushveld.

Recommendations

While the current approach to estimating the water saving benefits may be applicable in some areas, it does not have universal applicability and does not recognise the wide variation due to site specific characteristics. A high priority should be accorded to the development of a standardised procedure for determining the water saving benefits of the Programme and to better record keeping at the site scale. Intervention should proceed on a quaternary catchment basis as far as possible and appropriate performance indicators should be recorded. A directed research programme aimed at eliminating the uncertainties of estimation should support the Programme. Key research issues may include: regional vs local effects, benefits in arid areas, benefits in areas where wet season flows are not impounded, water use characteristics of alien species other than pines and eucalyptus, and riparian vegetation including wattles.

2.3.3 Environmental Restoration

The fynbos shrub land vegetation extending over an area of 70 000 km^2 in the South Western and Southern Cape is characterised by a very high species diversity with many species not found anywhere else in the world. Well over 8 500 species exist of which 68% are endemic. 1 326 taxa are rare and/or endangered. For instance the Cape Peninsula supports 2 500 plant species on an area of only 420 km^2 but New Zealand, which is 500 times larger, supports only 1992 species. A number of fynbos species are of commercial importance (ornamental flowers, medicinal species, herbal teas), and the value for 1993 of fynbos related enterprises was well over US$ 18 million providing a livelihood for 30 000 people. Much of the economic potential of this unique flora remains to be realised especially through ecotourism.

South Africa is a signatory of the Biodiversity Convention and has a responsibility to conserve biodiversity. The fynbos of the Cape is high on the priority list.
Invasive alien plants and afforestation present majors threat to plant biodiversity. Afforestation threatens biodiversity both by deliberate land transformation and insidious transformation as seeds spread into surrounding areas. Alien plants can be competitively superior to native plants with the result that when they ‘escape’ from planted areas they invade natural areas. Besides the fynbos, alien plant invasion was also perceived as an important threat to conservation in other provinces.

Failure to remedy and control alien plant invasion poses a real threat to terrestrial ecosystem structure and functioning, to water availability (ground water and river flow) and consequently

also to the integrity of aquatic systems. Historical evidence shows that removal of aliens leads to recovery of biodiversity and ecological functioning in the fynbos and other systems.

Absence of measurable achievable goals for ecological functioning and biological diversity conservation limits effectiveness of the projects and Programme.

Removal of aliens, particularly when dense thickets have developed and where they have colonised riverbanks, exposes the soil to increased erosion unless protective rehabilitation measures are carried out. Uncontrolled fires can do considerable damage to the soil where the fuel load is high. There does not appear to be a clear policy on the management of trash and logs, it is dealt with differently in different projects. The approach adopted to rehabilitation and erosion control is given in Table 2.12 of the Appendix.

Resprouting of cut alien plants is prevented through application of herbicides, which are occasionally mixed with diesel. Concern has been expressed about the heavy loads of diesel being applied. The wood rot fungus *Cylindrobasidium* is being tested as a control for resprouting from stumps. Biological control has been effective in a number of species (e.g. *Acacia saligna* and *Acacia longifolia*) and is being pursued actively by the Plant Protection Research Institute and within the Programme (see Tables 2.13 and 2.14 of the Appendix). However, there is considerable resistance from the forest industry to the use of biocontrol in commercial species, and there is concern that hardship may ensue for poor communities who depend on some of these species for fuelwood and construction timber.

Recommendations

Restoration of ecological functioning and biological diversity should remain a goal for the Programme and a strategic plan should be drawn up at national and provincial levels. Projects should have clearly stated achievable and quantifiable goals for restoring ecological functioning and biological diversity. The Department of Environmental Affairs and Tourism should be accountable for the restoration of biological diversity within the Programme. Research on biological control should continue to be promoted as this potentially provides the most cost-effective long-term solution to the problem of alien invasive plant species.

2.3.4 Entrepreneurial Development

53% of South Africa's total population of 40 million people live in 'non-urban' areas. Of these rural people, 85% live in the former homelands and the rest mainly in the large farm sector. The level of unemployment in rural areas is estimated to be 40% overall and 54% among the poorest 20% of households. All poor households seek to diversify their income sources, including local wage labour, migrant wage labour, farming and other entrepreneurial activities, and social welfare when it is available. A recent study, which includes the large scale farming sector, found that wages make up 41% of rural incomes, migrant workers remittances contributed 22%, pensions and social welfare made up 24%, agricultural production 6% and entrepreneurial activities 5%.

Development planning for rural areas must tackle the employment issues through creating opportunities for as wide a range of activities and training as possible. Great efforts will be required to build a local economy and links into it, based upon the exploitation of local resources through development of the small farm sector, agri-industries and other resource-based production, tourism and ecotourism, government programmes to develop local infrastructure in a labour intensive manner. Until now, agencies of all kinds have promoted production and people have tried to make a living through vegetable gardening, small trade and manufacturing. The failure rate has been so high that in many remote areas (best suited to ecotourism) over 80% of families have no value added activities.

The creation of viable secondary industries is described as being an important objective of the Programme. After a slow start, a few small scale secondary industries are getting off the ground; these include the production of charcoal and building materials, and the utilisation of wood for rehabilitation purposes (e.g. river bank stabilisation). To date, the development of secondary industries associated with the Programme has been insignificant, partly because of the short life span and partly because such development has not been looked at strategically and planned by entrepreneurial experts.

Recommendations

There is an urgent need for management and training plans to be drawn up and implemented by people with training and experience in business management and resource economics. Consideration might well be given to making use of the services of an experienced agent that specialises in enterprise development for promoting and managing the entrepreneurial development component of the Programme. The communication project within the Programme should give attention to the establishment of a comprehensive information distribution system for individuals working in the Programme, as well as for the communities from whence they come, that deals with the secondary benefits and entrepreneurial opportunities arising from involvement in the Programme.

2.3.5 Research

While the general relationship between expansion of alien plants and diminishing water supplies has been confirmed in a number of studies, there is reasonable cause for caution in its application within the Programme, as stated in Chapter 2.3.2 of this report. Projected water savings can be challenged. Applied research is urgently required to substantiate or refute claims on water saving.

Social upliftment and stability cannot be achieved under conditions of economic and environmental instability. The Programme provides a crucible for fusion and innovation. This requires people to have access to information and to be able to communicate. The communications project is too narrowly conceptualised and structured to achieve this. Research is necessary to understand the nature of the interactions and opportunities and to design appropriate support systems and training schemes.

For the control of invasive plants to be effective, the rate of clearing must substantially exceed the rate of spread. Understanding the dynamics of invasions is a prerequisite of being able to reliably estimate the likely rates of expansion. Research is required.

Considerable progress has been made in biological control in the past, and expertise is available in the country to resume research. Unfortunately, the momentum was lost in the 1980's and it has yet to be fully regained.

The audit for the alien plant control programme (Agricultural Research Council 1996) identified a number of issues where there was insufficient understanding to direct rehabilitation activities after clearing. These relate to the management of fuel load and disposal of felled timber, rehabilitation of riparian areas, stream bank stabilisation and dynamics of regenerating indigenous vegetation.

Recommendation

It is recommended that a transdisciplinary, inter-institutional research programme with a five-year time horizon is designed and implemented to develop the social, economic and environmental understanding necessary for sustainable rural development within the context of the Programme, as well as methods required to optimise development opportunities.

2.4 Economic Review

Direct labour is employed for clear felling trees and shrub vegetation in riparian zones and in the famous fynbos region of the Western Cape where eradication of invasive alien vegetation is absorbing well over 3000 workers at present. After the initial clearing several follow-up operations are required to get rid of regenerative growth. Total direct expenditure in 1996/97 was R70.34 million with over R50.00 million (71%) spent in the Western and Eastern Cape Provinces. The cost comprises labour, management, equipment, material (e.g. herbicides, grass seed for rehabilitation of cleared areas), fuel, transport, training and public relation expenses. Cost of programme management was only R1.78 million (2.53%), which is very low and rather symptomatic of managerial constraints prevailing in the Programme.

Records maintained by the Cape Nature Conservation, one of the major implementing agents of the Programme, reveal that in 1996/97 R40.22 million was spent to clear an area of 31 533 ha resulting in specific average costs (including overheads) of R1 275 per ha. Clearing costs range from R100 to R5000 per ha depending on species and density. Although the private estate sector claims much lower clearing costs, it should be borne in mind that a fairly large programme of this nature, operationalised in a very short time, cannot compete with commercial enterprises employing experienced staff and skilled labour in permanent positions.

The impression was gained during the evaluation that efforts are made by management to keep expenditure under control and to achieve a uniform output per unit area with the aim of lower clearing costs.

While the costs are well analysed and expenditure for the entire Programme and each project is projected in an annual budget for one year, no efforts are being made to quantify benefits. Important data, such as net incremental stream flow due to the project or recovery of indigenous vegetation, is not collected. Positive effects anticipated are described but not quantified. Besides removal of alien vegetation there are other options to save water, which may be more economical, but such options are not taken into consideration by programme management.

Considering that no attempt has been made by DWAF to estimate cost and benefits annually over a period of 20 to 25 years and to carry out a cost-benefit-analysis, the viability of various projects already under implementation seems to be a matter of speculation.

According to some model calculations of the consultants, presented in Chapter 2.4 of the Appendix, the Programme appears to be very sensitive to lags in accrual of benefits. Discounting cash flows at 8% results in negative Net Present Values (NPV) if domestic water benefits accrue after 10 years. It seems to be rather difficult to justify the investments made for generating incremental flows used for irrigation unless the water tariff is substantially increased. These model calculations simply serve the purpose of highlighting the need to assess and to evaluate each project prior to implementation.

It is important to distinguish between financial prices and economic prices. The former are the actual market prices and rates, as applied already. The resulting financial analyses are of considerable importance to DWAF.

Economic prices are the values that society would be willing to pay for a good or a service. Economic prices should also be applied and economic analyses conducted in future to determine the likelihood that a proposed project will contribute substantially to the development of the total economy of South Africa and that its contribution will be great enough to justify using the scarce resources required. A case in point here is the valuation of

labour covering 60% of the total cost. Considering that workers who are unemployed or under employed are recruited for the Programme, the amount they add to the national income is insignificant. Under such circumstances, it is a standard practice in project analysis to use shadow pricing i.e. to apply a conversion factor of 0.70 to 0.90 to the actual labour (market) wage rate. Appropriate conversion factors for labour and other items (e.g. exchange rates) to correct domestic distortions should be obtained from the Ministry of Finance prior to application in individual projects to enable the government to compare the results of the analyses with results obtained in other projects (economic internal rate of return, for instance). The minimum rate of return, assumed to be 8 to 10%, that is acceptable to government should also be obtained from the Ministry of Finance.

Recommendation

All existing projects should be reviewed, the economic viability determined and those that turn out to be negative should be phased out as soon as possible. The determination of feasibility and economic viability of new projects requires detailed studies, as recommended in the outline of terms of reference mentioned in Chapter 2.3.1 of the Appendix.

2.5 Financial Analysis

The projection of DWAF to clear all the areas of the country that are infested with invasive alien plants (approximately 1.71 million ha) appears to be on the higher side. Biological control may become a very significant factor in reducing infestation. There will be regions where population densities gradually build up and timber and firewood demands become high enough to take care of invasions. Production of charcoal for domestic use and for export could lead to large-scale use of alien plants, wattles in particular, once production and marketing is properly organised.

If we assume that clearing of invasive alien plants would be done by the public administration to the extent of 700 000 ha and 300 000 ha could be cleared by rural people to satisfy their timber and fire wood demands at zero cost within ten years, the gain in water could be as high as 1.00 billion m^3, which might be adequate to make up for the medium term water shortage envisaged. To bridge a critical period of three years before funds are available from increased water tariffs, financial assistance to the amount of R500 million may be required (see Table 2.20 of the Appendix). As costs are influenced substantially by site factors, this estimate is subject to modification when the result of strategic planning is available.

2.6 Sustainability

Alien invasive plants are widespread. Communities have an opportunity to benefit through engaging the Programme in controlling alien plants in their vicinity. A consequence of this is that opportunity to benefit will be short term – once cleared and stabilised there will be little further work.

Erosion has been cause for concern particularly where dense thickets have been cleared, where brush has been burned and protective vegetation has been removed from land with coarse textured soils, steeper slopes and where rainfall intensities are high. So far, there is no evidence in the Programme to suggest that the procedures being applied for alien plant control are reducing environmental sustainability in any significant way.

It is generally assumed that the rehabilitated system will be under effective and good management. Whilst this may be the outcome in certain areas (mountain catchments and private land) where ownership and responsibility are clear, difficulties may be expected in

communal areas. Here it could be that neither economic nor environmental sustainability is achieved. If the proposed link between this Programme and the Land Care initiative of the National Department of Agriculture is realised then prospects for economic and environmental sustainability would improve.

Maintaining fund flow to sustain efforts for long enough to bring alien invasives under control is a concern. At present, much of the funding is short term and grant based. The desire and need to distribute benefits is understood. But it does place all projects at risk of being unsustainable under present funding procedures.

2.7 Risks and Uncertainties

Knowledgeable hydrologists question the projected benefits of water savings and caution is urged, as stated in this report. If the benefits are 'over sold' and expectations are not met there will be loss of credibility in professional and public circles. The South African taxpayer will have to meet most of the costs of the Programme. As annual cost rises, expenditure will come under increasing scrutiny. The worst scenario is where costs are under estimated and benefits are over estimated.

There is an understandable wish to maximise the amount of clearing and the welfare benefits. Concern has been expressed that this has been at considerable personal cost to managers. Inefficiencies result from overextended staff. The hidden costs of internalising work instead of using efficient and effective consulting firms are underestimated. The Programme is at risk because although management is enthusiastic and dedicated it is not as efficient as it should be for a programme of this size.

The absence of planning is considered to be a serious deficiency probably leading to the implementation of projects for which investments of funds is not justified.

In communal areas, as they are presently structured and managed, it is not certain that removal of alien plants will result in more sustainable land use. Indeed it could be much worse. If it turns out that the consequences of clearing alien invasives leads to poorer land use practices or serious fuel wood shortages the Programme will be criticised.

DWAF implements the Programme. Ways and means have to be found to bring other departments into the Programme as equal partners. If departments feel marginalised they will not actively support the Programme and will expect the money to be raised totally from water tariffs. Since civil society sees wider benefits they may not support the notion that all funds should come from water sales. Also, while it is feasible to raise tariffs on domestic water consumption, it will be more difficult to increase the tariff of water used for irrigation of crops. This is particularly so where irrigation methods (e.g. surface irrigation) make inefficient use of water.

3. CONCLUSIONS

It is hoped that the findings and recommendations made in this report will enable decision-makers to adopt a target oriented planning approach. Priority should be given to formulate clear policies, to undertake multidisciplinary assessments leading to a national Strategy on Alien Plant Control, as stated in the Financing Proposal submitted in this report. A period of six months will be required for an experienced consulting firm to present the results of such a strategy study.

For individual projects or a set of hydrologically interrelated projects within a well defined quaternary catchment, proposed according to priorities chosen in the strategy paper, it will be advisable to carry out feasibility investigations which should provide firm, detailed and

reliable information upon which the government can base authorisation of the project for development and from which the lending agency can determine the desirability of financing the costs of development. All plans and estimates must be sufficiently firm to ensure that no major alternation of modification, which would significantly increase costs or otherwise impair the feasibility of the project, will be found necessary during the course of implementation. Since the projects are technically quite simple it should not take more than three to five months to complete a feasibility study by a team of experienced development planners. Scope of work is illustrated in Chapter 2.3.1, Planning and Design, of the Appendix.

COMMISSION OF THE EUROPEAN COMMUNITIES, BRUSSELS

AND

GOVERNMENT OF SOUTH AFRICA, DEPARTMENT OF WATER AFFAIRS AND FORESTRY, PRETORIA

WORKING FOR WATER PROGRAMME

EVALUATION REPORT

VOLUME 2

APPENDICES OF EXECUTIVE SUMMARY

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1.1 Introduction and background

The Working for Water Programme (WFW), launched by the Department of Water Affairs and Forestry (DWAF) in October 1995, presently covers eight provinces of South Africa. Its principal objectives may be summarised as follows:

- To recover water presently being lost to invading alien plants and to restrict further losses;
- To create jobs, empower individuals and build communities;
- To conserve biological diversity, ecological integrity and catchment stability.

WFW is an integral component of the National Water Conservation Campaign that addresses various issues such as water management, water tariff structures, research and education. The programme, initiated and supported by Professor Kader Asmal, Minister of Water Affairs and Forestry, is being regarded as one of the successful efforts to create gainful employment opportunities for the underprivileged of society in the context of the South African Reconstruction and Development Programme (RDP) and the governments macro-economic policy: Growth, Employment and Redistribution (GEAR).

Initial funds were provided by the RDP for the Programme to take off without delay. While it is anticipated by DWAF that funding may be secured through higher water tariffs under the new Water Law likely to become effective in 1998, it will be necessary to obtain bridging finance for at least three years.

At the time of writing this report, the WFW consists of 14 projects operating at 38 sites which are mainly located in KwaZulu-Natal, Western and Eastern Cape (Figure 1.1). Expenditure over the period 1995/97 (i.e. over 17 months) was R95.5 million versus budget allocations of R102 million for the WFW. For the current fiscal year (1 April 1997 to 31 March 1998) the amount of R 88.7 million was allocated which is equivalent to an increase of 26% over last years budget.

INSERT FIG. 1.1

DWAF reports that over 8 300 jobs have been created through WFW, more than 53% of which are held by women. 20% of the jobs were found to be held by people between 16 to 25 years of age. The area cleared from October 1995 to December 1996 was estimated to be 59 000 ha of land infested with invasive alien plants (mainly pines, eucalypts and wattle trees).

1.2 Problem analysis

The WFW is addressing various problems, some of which are interrelated. It is quite obvious that excessive water consumption by alien invasive plants is one of the causes responsible for water shortages but there are also other causes, economically unjustifiable water consumption by low value crops under irrigation, for example. For the purpose of this report, the analysis is mainly concerned with water consumption of invasive alien plants.

Water shortage

Total surface runoff, estimated to be about 50 billion m^3 per annum for the entire country, is subject to a high variability of rainfall. This is especially pronounced in the semi-arid areas where unpredictable droughts cause serious problems. Although large dams have been constructed holding 27 billion m^3 and several impressive inter-basin transfer schemes implemented, there are various regions where water requirements exceed natural availability of water.

Total water usage in South Africa (SA) is estimated to be 20 billion m^3 per annum (40% of runoff). Water use is dominated by irrigation representing approximately 54% of the total water use in the country, followed by ecological requirements (19%), domestic and general urban use (11%), forestry (8%), mining and industry (8%).

The water resource potential versus demand situation prevailing in each of the seven major drainage regions of the country that have similar hydro-meteorological characteristics is given in Table 1.1 for the years 1996 and 2030. A water balance diagram (Figure 1.2) and an overall location map of major hydrological regions (Figure 1.3) support this. The water deficit projected in 2030 for the Northern, South Western and Central Regions affecting the Northern Province, Gauteng, Western Cape and Free State respectively amounts to a total of approximately 6 billion m^3 per annum.

TABLE 1.1: Water resource potential versus annual water requirements by region in South Africa (million cubic metres). Negative values indicate excess of requirement over yield.

Name of Region Size of Catchment	Max. Yield	Requirement		Balance available	
		Year 1996	Year 2030	Year 1996	Year 2030
Northern Region (183 146 km^2)	2 566	3 373	5 562	-807	-2 996
Eastern Inland (62 554 km^2)	4 834	2 320	3 168	2 514	1 666
Eastern Coastal (150 275 km^2)	13 199	5 604	8 860	7 595	4 339
Southern Coastal (147 184 km^2)	1 793	1 768	2 442	25	649
South Western (118 199 km^2)	3 095	2 396	3 884	699	-789
Karoo (409 621 km^2)	6 014	2 555	2 669	3 459	3 345
Central (196 438 km^2)	1 789	2 029	3 830	-240	-2 041

Source : Department of Water Affairs and Forestry 1997

INSERT FIG. 1.2

INSERT
FIG. 1.3

It is imperative to find ways and means of utilising water in the most economic manner reducing wastage and sub-optimal use as soon as possible. Prior to the implementation of highly capital intensive alternatives already under discussion such as sea water desalination, shipping of fresh water from the Zambezi or Zaire Rivers in tanker ships or tapping of icebergs for freshwater, various other options are worth considering, viz. water conservation measures, re-use of water, reallocation of water.

Effective control of alien invasive plants responsible for the loss of significant amounts of water could contribute towards a better utilisation of water in catchments. According to preliminary surveys and mapping operations carried out by DWAF 1.71 million ha of land appear to be affected by alien plant infestation throughout the country of which 403 000 ha have dense, 232 000 ha medium and 1 074 000 ha light levels of infestation. Calculations tentatively made indicate annual water consumption levels due to transpiration, evaporation and interception to be about 1.50 billion m^3. Should no clearing take place, the infestation would cover 2.12 million ha in 15 years time with water losses of 2.44 billion m^3. Although these data may be regarded as a first approximation with a certain margin of error due to lack of research support, there is little doubt about the negative effect of undesirable vegetation on water consumption. Evidence supports the notion that removal of woody aliens and their replacement by low growing indigenous vegetation does increase low flows.

Unemployment and poverty

The new South African constitution provides for nine provinces (Gauteng, North West, Eastern Cape, Western Cape, Mpumalanga, KwaZulu/Natal, Free State, Northern Cape and Northern Province), and these provinces provide the basis for future economic planning. The profile on provinces presented in this report (Table 1.2) provides baseline information to show the differences in development across SA in terms of economic and social attributes, and how such variations in development affect the standard of living in individual provinces.

South Africa's population is estimated to be 40.7 million, with large variation in distribution across the country (Development Bank of Southern Africa, 1994). The literacy rate in South Africa is about 61.4%. The lowest is in Northern Province (52.7%), the highest is in Western Cape (71.9%), followed by Gauteng (69%). Such differences in literacy rates and educational levels of the population affect the productive capacity of regional economies, and hence the ability to remove backlogs

in the provinces (Luus and Oberholzer, 1995). Predominantly rural provinces in SA have the lowest labour absorption capacity (percentage of labour force employed in the formal sector); Northern Province (40.3%), Eastern Cape (44.8%), and KwaZulu/Natal (44.8%). Consequently, these provinces record the highest unemployment rates; Eastern Cape (23.6%), Northern Province (24.8%) and KwaZulu/Natal (25.2%). Between provinces, huge differences exist in average *per capita* incomes. Gauteng has the highest personal income *per capita*, followed by the Western and Northern Cape. The lowest is in the Northern Province followed by Eastern Cape, North-West and KwaZulu/Natal. This further illustrates that mainly rural provinces of SA lead a relatively lower standard of living compared to the rest of the country.

In the provision of social services, water in particular, according to the Development Bank of Southern Africa (DBSA 1994), only around two-thirds on average of the rural population of the country has adequate access to water. However, unlike the rural population, in most provinces four in five urban households have adequate access to water. Exceptions are North West, with around two thirds, and Northern Province, around one-third.

A comparison of social and economic indicators between provinces shows unequal development of South Africa. As a result of this disparity, the Reconstruction and Development Programme (RDP) was launched to integrate growth, development reconstruction, redistribution and reconciliation into a unified programme (South African Foundation, 1995). Therefore job creation by the WFW will be important in provinces where the unemployment rates are high. Nationally or regionally, the anticipated job creation capacity might be insignificant, but it is very important for those communities that have very little.

It was realised one hundred years ago that invasive alien plants pose serious threats to ecological functioning in South Africa. But it has only been in the last 30 years that the problem was regarded as serious enough to warrant concerted action. Research was initiated on a systematic basis and large-scale clearing operations were carried out in the 1970s. The mountain catchments vegetated with fynbos are home to a major part of the Cape flora, one of only six plant kingdoms of the world, and the only one contained exclusively within the borders of a single country. The Cape flora consists of 8 574 species of vascular plants of which over two thirds are endemic making it the worlds most unique spot of endemic biodiversity. Alien trees (mainly *Pinus* and *Hakea* species in the

Western Cape) are regarded as the greatest threat to biodiversity, and are largely responsible for the high number of endangered and threatened taxa (1 400 plant species) for the Cape flora. Alien species out compete indigenous species. The invasion of catchments under fynbos by alien plants increases the biomass considerably and in turn increases fuel load and fire intensity. The economic value of natural fynbos flora is considered to be substantial. Plants are harvested for flowers, food and pharmaceutical purposes. Foreign exchange is earned from exports and tourism.

1.3 **Target group**

The direct beneficiaries are thousands of male and female workers employed by WFW, the majority of whom were previously unemployed. The whole community benefits from the increase in the water supply to dams and rivers utilised for domestic, industrial and agricultural needs. Community structures such as creches, community halls and sporting facilities are supported, and training is envisaged to stimulate the development of entrepreneurship.

TABLE 1.2: Key socio-economic indicators in South Africa's provinces

Indicator	Western Cape	Northern Cape	Free State	Eastern Cape	KwaZulu/ Natal	Mpumalanga	Nor Pro		
Area (km^2)	129386 (4)	363 389 (1)	129 437 (3)	170 616 (2)	91 481 (7)	81 816 (8)	119 (5)		
Population (000) 1993	3 620.2 (5)	763.6 (9)	2 804.6 (8)	6 665.4 (3)	8 549 (1)	2 838.5 (7)	5 1 (4)		
Density (person /km^2)	28 (7)	2.1 (9)	21.7 (8)	39.1 (4)	93.5 (2)	34.7 (5)	42.8 (3)		
Literacy rate % (1991)	71.9 (1)	67.6 (3)	60 (4)	59 (5)	58.7 (6)	54.6 (8)	52.7 (9)		
Labour absorption capacity	56.9 (1)	52.9 (4)	55.3 (2)	44.8 (7)	44.8 (7)	51.8 (5)	40.3 (8)		
Unemployment rate (%)	13.3 (9)	16.7 (5)	15.3 (8)	25.2 (2)	25.2 (1)	16.3 (7)	24.8 (2)		
Contribution to GDP (%)	13.2 (3)	2.2 (9)	7.1 (6)	14.7 (2)	14.7 (2)	8.3 (4)	3.1 (8)		
Personal income *per capita* ®	4 188 (2)	2 865 (3)	2 419 (4)	1 910 (6)	1 910 (6)	2 164 (5)	725 (9)		
Rank[1]	1	3	2	5	5	4	6		

Source: The Development Bank of Southern Africa (1994).
Figures in parenthesis represent a rank score of a province (ranging from one signifying the highest, and nine, lowest) on a particular socio-economic indicator.

[1] The ranking accorded to each province is based on the mean score of; literacy rate, labour absorption capacity, unemployment rate, and *per capita* income.

2. REVIEW OF THE WORKING FOR WATER PROGRAMME

2.1 INSTITUTIONAL ASPECTS

The mission of the Programme is to enhance water supplies by empowering local communities to carry out catchment management projects that focus on the control of alien invasive plants (Department of Water Affairs and Forestry Business Plan 1997/8). Logically therefore the Department of Water Affairs and Forestry is the implementing agent. The WFW is a sectoral activity within the National Water Conservation Campaign of which the State President is the Patron. Many influential individuals have aligned themselves with the Campaign. The Minister of Water Affairs and Forestry champions the WFW.

The Director General of the Department has ultimate responsibility for the Programme (Figure 2.1a and b). The programme manager is positioned at a relatively low level (Deputy Chief Engineer) and within a region (Western Cape) of the Department. Project managers report to the programme manager. Concern has been expressed that the Programme does not have more active involvement of a person at a senior level within the Department and between the programme manager and the director general.

Dr Guy Preston who is a special adviser to the Minister provides leadership for the Programme. The separation of leadership and management is a source of concern because of the manner in which it influences pioritisation of the projects and because it drives expansion of the programme at the expense of strategic planning and baseline data gathering.

The CSIR provides scientific advice for the Programme and projects. This is supplemented with advice from the Plant Protection Research Institute (PPRI). It occurs in the absence of a dedicated research programme set up to address priority research issues. Consequently the Programme is founded on 'research capital' generated over the past ten and more years.

Steering Committees have been established at programme and project level. Since the Programme sets out to achieve social and environmental goals broad participation is promoted.

The Programme Steering Committee meets regularly. Its function is to help the Department of Water Affairs and Forestry set policy and prioritises projects. Membership is drawn from: -

- The Department of Water Affairs and Forestry and its consultants
- The Reconstruction and Development Programme Office
- The Department of Public Works
- The Department of Agriculture
- The Department of Labour
- The Department of Environmental Affairs and Tourism
- Non-Government Organisations
- Trade Unions
- Civic Organisations

Indications are that the Steering Committee does not function as well as it should do. Evidently there is little active participation from most government departments and seemingly the Department of Environmental Affairs and Tourism has yet to have a representative at a meeting. Given the multiple nature of the intended outcomes of the Programme (social welfare, environmental sustainability and water) it is central to the long-term success of the Programme that ways and means are found to secure active and committed participation. Routing funds to departments may help to achieve involvement.

Another concern expressed by project managers and implementing agents is that the Steering Committee does not give sufficient attention to strategic planning. One private sector agency indicated that it was no longer attending meetings because of this. This view was reinforced at a Logframe workshop held during the assessment (Box 2.1).

Comment [J1]:

BOX 2.1: Comments from the Logframe Workshop, which illustrate concerns about programme, planning and design

- Problems identified in the programme and can now move forward
- Good to have time to think strategically
- Best management meeting so far
- Recognise need to have more structure in planning
- Enjoyed small group discussions

Each project has an advisory steering committee, drawn from local stakeholders, which promotes involvement and participation of the local communities in all decision-making. One of the most important functions of the advisory steering committee is assistance with the selection of job candidates with the objective of ensuring that the most needy in the community benefit from the programme. The steering committees also function: -

- To evaluate and direct projects in order to maximise effectiveness
- To provide advice on how the project should be implemented so that maximum benefits accrue to local communities in terms of employment and empowerment
- To provide advice on local needs and problems and on ways in which such needs can be accommodated and problems resolved, and
- To communicate the aims of the project to local stakeholders, and to bring the concerns of local stakeholders to the attention of the project leader.

Typically a Project Steering Committee will comprise representatives of the following organisations: -

- The Department of Water Affairs and Forestry and its consultants
- The Local Implementing Agent
- Community Representatives
- Provincial Government RDP Coordinators
- The Nature Conservation Authority (if not the Implementing Agent)
- Local Government Representatives
- Non-Government Organisations
- Affected Land Owners
- Contractors (if applicable).

Sub-committees are established where a need exists. An example is the technical committee providing advice on the use of herbicides in KwaZulu/Natal (Figure 2.2a).

Organisational and management capacity is essential for project execution. The department does implement projects but where capacity exists outside of the department this responsibility is delegated (Figure 2.1b and 2.2a and b). A performance contract and project business plan regulates project execution. The implementing agent appoints the project manager who is responsible for progress with the work programme. The project manager reports to the programme manager. The organisational system for project management is illustrated in Figures 2.2a and b.

Project managers report monthly to the programme manager. Key performance indicators used are shown in Box 2.2.

BOX 2.2: Key performance indicators for the WFW

- Jobs and structure
- Piecework/taskwork
- Area cleared
- Follow-up area
- Training
- Monitoring
- Purchases
- Salarie
- Running costs
- Cashflow, hidden cost and income
- Protective clothing
- Meals
- Creches
- Injuries on duty/safety
- Secondary industries
- Steering committee meetings
- Communication
- General: highlights, problems, lessons learnt

Provision is made for independent monitoring. An independent ecological audit was performed on the first six months of the operation (Agricultural Research Council 1996). This audit was not comprehensive. Key Performance Indicators for ecological performance are not specified (Box 2.2). Criteria used in the audit are shown in Box 2.3.

A social audit (Department of Water Affairs and Forestry 1997) was conducted during the period December – January 1996/7. This audit was also limited in scope.

The Programme is supported by a communications project. It is located in Pretoria and focuses mainly on informing and creating awareness among the general public. Much more is required if this project is to contribute meaningfully. People, and particularly disadvantaged rural people, are at the centre of the Programme. They are situated in the nexus of social, economic and environmental instability. Information and communication are crucial in their endeavour to promote their own welfare. The communications project should be emphasising this much more than it is.

The Programme has a clearly stated employment policy which ensures equal opportunities for gender and which enables the poorest members of the community to benefit. Work loads are determined according to local conditions and fair labour practices are implemented. The Occupational Health and Safety Act is adhered to. This is an important element of the education

training and capacity building activities within the Programme. Outside agencies are recruited to provide specialist training. A typical training programme is shown in Table 2.1.

BOX 2.3: Abridged versions of issues identified for the 'Ecological Audit'. From Agricultural Research Council 1996.

- Are operations being conducted in approved areas?
- Does extent of clearing reflect reports on clearing and labour deployment?
- Have appropriate methods been used?
- Have methods been used competently?
- What are likely impacts on biodiversity and catchment stability?
- What is the implication for future follow up operations?
- Provide an overall assessment of ecological impact.

Recommendations

1. For the Programme to function efficiently it requires a greater degree of autonomy and financial security. Staff should be seconded to the Programme from government departments and the private sector. A Resource Conservation Directorate, reporting to the appropriate Minister, is envisaged.

2. Considering the Programme overall, it is recommended that a management team be assembled that contains the needed expertise and that includes at the very least:

    - Resource economist. Required to place a value on natural resources and ecosystem services.
    - Business economist (with knowledge of the dynamics of small business operations). Required to advise on how to get the projects running as 'businesses'.
    - Entrepreneurial development specialist (with knowledge of how to motivate people to take on the risks of entrepreneurial activity). Required to overcome the entrepreneurial development 'block'.
    - Environmental specialist (with knowledge on how to plan and implement a strategically directed transdiciplinary programme).
    - Training specialist (with knowledge of curriculum development and computer based systems of training in a developing world situation). Required to design and introduce needed training courses.
    - Information systems specialist (with knowledge of how to communicate with people and network development agents in a developing world situation). Required to design and implement a means of reaching people with the information they need.

- General Manager (with knowledge of how to prepare dynamic programme strategies and how to get these strategies implemented). Required to place the Programme on the right track.

3. The private sector should participate more effectively in the Programme (e.g. consulting firms and university institutes) for project design and planning. Project implementing agents should be given projects on a 'turn key' basis thereby increasing capacity within the programme.

   It is highly unlikely that any of the people required for these positions will come from scientific or academic institutions; they will probably have to be recruited or seconded from the private sector.

INSERT Fig. 2.1a

INSERT Fig. 2.1 b

INSERT Fig.2.2a

INSERT Fig.2.2b

TABLE 2.1: Training for Fynbos Working for Water Project from April 1996 to December 1996

Type of training	Man-days
Supervisor	2621
First aid & safety	824
Environmental education	2567
Project awareness	3796
Mountaineering skills	668
Workers committees	861
Chemical training	182
Vehicle maintenance	12
Culture & sport	2252
Machine operators	527
Life skills	1885
Fire management	1378
Economics	25
Sustainable utilisation	0
Administration	7
Computer raining	12
Conflict resolution	796
Financial management	1
Literacy	64
Occupation, Labour & Health Act	91
Secondary industries	9
Eco-tourism	37
Planning	118
Community development	772
Management training	106
Total	**19611**

2.2 SOCIAL UPLIFTMENT

Introduction

Job creation, training and investments in community facilities are at the core of the Programme. In that, it has been quite successful. Over 8 300 jobs have been created, training provided in work-related and social skills, and creches, community halls and sports fields have been established and/or improved. The Programme thrives on enthusiasm and dedication of staff at different levels. Workers provided positive feedback about the work. Besides strengths of the Programme, weaknesses have been observed also. Both will be elaborated upon in the following.

Evaluation

The Programme has been very successful in job creation. Over 8 300 people have been employed of which 53% are women. 20% are between 16-25 years and 24 are disabled people. Long-term unemployed and unemployed single parents are highly represented. No gender disaggregation is given for youth and disabled. The Programme plans to give more attention to both groups (Annual Report 1996/1997).

BOX 2.4: Number of people employed (1996/7) and days allocated to training. Annual Report 1996/7.

People employed	8 386
Number of women	4 483 (53%)
Aged 16-25	1 677
Number of disabled	24
Training – person days	30 901

The fact that jobs are created in a community has led to interest and support from communities. Team members expressed that working for the project enabled them to support their family, that they gained self-esteem, and learned skills and knowledge which can and have already opened up job opportunities outside the Programme. One team member said he wanted to start a business in garden servicing or woodwork and that he didn't want to stay with the project for years because other people should benefit as well. Two team members joined the project to get a secure income. They earned more in the fruit packing industry, but it was seasonal work. For some team members working for the project is just a job.

It is expected that in future, not all teams will find employment as contractors. More attention should be paid to establishing secondary industries. It is also important to explore opportunities for other relevant income-generating activities.

Team Selection

The selection procedure for workers is left to the steering committees and project managers. This has not been without problems. It was mentioned that one project manager tended to appoint people from his own community only. In some projects, the criterion of employing a young person over an older person was not considered as it would have distorted social relations (Department of Water Affairs & Forestry Social Audit 1997). Obviously, not all unemployed can be employed by the Programme. The capacity to employ people is limited and individuals had to be selected from each community. Under pressure of inhabitants one project had to employ a higher number of people from two squatter camps (informal settlements).

Working conditions

Uncommunicated absence, a poor working attitude, and disrespect for colleagues and superiors were mentioned as major problems in projects. Some project managers blame this on the lack of working experience and the legacy of the apartheid era. The basic training that all workers have to attend focuses on work ethic.

BOX 2.5: Problems experienced by managers and workers complaints

Managers' problems
- Selection of workers
- Uncommunicated absence
- Poor working attitude
- Disrespect for colleagues and supervisors
- Racial conflicts
- Political rivalry
- Transport

Worker complaints and problems
- Low wages
- Travel costs
- Temporary employment
- Substance abuse
- Corruption
- Women abuse

An ultimate goal of the Programme is to create teams of independent contractors. However, the shift from task work (finish daily set tasks) to piece work (finish area targets) develops at a slower pace than expected. Four projects have entered piece work. Five projects have made the shift

to the final stage of contract work. The project manager of Kouga expressed his concern that not all teams will survive competition on the free market once they enter contract work. It is of great interest to explore the reasons for poor performance of those teams and to ensure that team members are capable enough to enter jobs in other sectors.

In the draft progress report it is mentioned that workers increasingly complain about low wages, low rates for travel costs, and demand more permanent work opportunities.

The project in Somerset West has been successful in bringing together different ethnic groups and breaking down barriers from the past. However, racial conflicts and political rivalry are still on the list of problems project managers are facing. Other problems mentioned about workers are serious drinking problems and drug abuse after payday, crime, traffic accidents and corruption.

Project managers are very enthusiastic about and dedicated to their work. They consider it more than a 'nine to five' job. The other side of the coin, however, is that they face a heavy workload and personal stress. Bureaucracy and lack of leadership skills experienced by project managers contribute to this (Department of Water Affairs and Forestry 1997, Social Audit; Logframe Workshop 1997).

It is obvious that problems in society also play a role in the Programme like crime, AIDS, women abuse, alcohol and drug abuse, and corruption. The legacy of apartheid and the impact it has on the psychology of its people, is an undeniable part of the problems faced by the projects. These issues are addressed partly through the training programme under the heading work ethics and social responsibility. Furthermore, it seems to depend on project managers' own initiative to discuss these matters with their teams. The draft progress report proposes more workshops for workers on conflict resolution and improved communication between workers and managers.

Community Involvement

In all projects community involvement is arranged through the steering committees, which was a RDP requirement. They comprise community representatives, (semi)-government, NGOs and the corporate sector. Composition and number of members vary among the different projects. Also, the status and actual involvement varies according to the project vision. In some projects the steering committee plays a very active role in managing the project, while others play a more advisory role when necessary. The project manager of Kylemore stated that the steering committee was indispensable to her work, especially for taking disciplinary measures towards

team members. She felt it is important to have backing because she is part of the community in which the project is working. The steering committees are expected to provide feedback to the people they represent. It is not clear whether this is left to the individual (project manager) or if the project plays an active role in ensuring that it does take place.

In all projects investments have been made to establish and/or improve creches, community halls, and sport fields. The benefits of these investments are clearly visible to the community. The Programme rule is not to invest if communities are not willing to take responsibility for these facilities. However, the large financial contribution of the Programme to training of creche teachers and maintenance of creches as found in Umkhomaas, raises the question what will happen if the Programme stops.

It is impossible at this stage to assess the long-term impact of the Programme on improving the living conditions of individuals and communities involved. A coherent monitoring system for community development is lacking. Key-performance indicators, which touch on development issues, are limited to numbers of jobs created, training days provided, number of creches established and secondary industries invested in. Baseline surveys on the socio-economic situation in the areas of operation are generally lacking. Most business plans only mention rates for population and unemployment, and a listing of economic activities in the area. The business plan of KwaZulu/Natal is the only one which provides relatively extensive socio-economic data on population, density, growth, labour participation, dependency ratio, male absenteeism, illiteracy rate, household composition, (un)employment, education, household income and expenditure.

The enthusiasm of the programme and project managers was observed also among supervisors and team members. However, it seems as if real ownership is lacking at team level. Decision-making is highly centralised and complaints have been voiced about bureaucratic procedures. A project manager complained that it took three months to acquire boots and trousers for staff. Furthermore, management staff fulfils multiple tasks for which they sometimes are not qualified and lack time to do it properly.

Programme management acknowledged that the ‘community development leg’ is weak and needs to be strengthened. Expertise in this field is limited within the Programme. A social audit has been undertaken among project managers. An in-depth study among workers is planned to get to grips with their experiences and to assess the impact the Programme has in improving their living conditions. Appointing social scientists or hiring development consultants could improve the quality of the work and give the process a boost. These issues were discussed also during the Logframe workshop.

Gender Equity

The programme has been remarkable in achieving the goal of 50% employment to women. Gender equity has been achieved in most of the projects, as well as race equity. The programme successfully stimulates women to perform the same tasks as men, thus challenging a gender division labour found elsewhere. Female team members are cutting trees, clearing bushes, carrying logs and sometimes operating a chainsaw. There are coloured and black African female supervisors and project managers. They provide role models for other women and their presence challenges convictions that women are physically less strong than men or incapable as leaders.

However, there are weaknesses in the Programme that have to be mentioned here. Women are underrepresented in leadership positions. There are few female supervisors and project managers. In the teams women are underrepresented in chainsaw operation and in high altitude access teams (one third is female in the Western Cape, no females in Kouga). In Kouga, women are a small minority in the teams because of 'the nature of work and the outdoor camping' (Draft progress report).

It is said that in the Kouga project (Eastern Cape) women shy away from heavy physical work. There is a distinct gender division of labour: men cut trees, operate the chainsaw and are part of the high altitude team, while women collect branches and apply herbicides. One woman said she would be interested in chainsaw work if it was smaller. It might well be that male unemployment is high in this area, which hinders women to participate. The dominant conviction about women's working attitude may be a mere argument to perpetuate the existing situation. In the Umkhomaas project (KwaZulu/Natal), for instance, women form a vast majority in the teams, which was said to be caused by male migration to urban areas. There might also be a link with the fact that in this project only manual labour is used. It is important to take into account which factors influence the presence or absence of women in the projects. A gender analysis is needed to get to grips to gender issues in order to address them more adequately.

The draft progress report recommends to train more women in business and financial management and leadership skills to enable them to enter higher job categories. Furthermore, experiences elsewhere have shown that a conducive environment and support structure must be in place for women to develop their potential in management positions. A female project manager stated that she felt that she had to prove herself to male team members because she was young, coloured and a woman. She said that through time and clear, consequent

management decisions she has succeeded in gaining respect and trust. The programme manager always supported her, which was essential to her.

Male and female team members said they didn't have a problem with working together. They expressed that all are suitable for the job and there is no difference in production. Two women said the work was physically very heavy and didn't want to increase the burden by working with a chain saw. Another woman who is going to be trained soon said she was looking forward to operate the chain saw. The increase in wage that it brings may well be the most important incentive.

One of the side effects of working in mixed teams is the occurrence of pregnancy among young women, especially in the high altitude teams, where workers have to sleep in the mountains for a few nights. As a result sex education is organised in some projects. No mention was made about sexual harassment at work. Problems of women abuse do occur in communities, which leads to female absenteeism, especially after the weekends. In Kylemore the problem has been addressed by inviting a local counselor to give a presentation to start discussions and offer counselling to team members. Alcohol abuse is a problem and the programme arranges counselling. The benefits of counselling are evident, particularly in the Imlemwle project.

It is clear that the income women gain from working in the project enables them to provide (additional) income to their families. One project manager mentioned how excited women were about their first salary. They said they were going to take their children to school and buy clothing. Toddlers are enabled to go to creches, which has proved to improve their performance in primary school.

BOX 2.6: Project needs

- Baseline survey
- Expertise in community development
- Efficient management (less bureaucracy)
- Gender equity in leadership
- Improved communication

However, it is not possible at this stage to assess what the actual and long-term impact of the Programme is on gender equity. Many questions are still left open. Who benefits from the income that women bring into the household? Are they bread winners or do they contribute to existing income? How is the money spent and who decides on that? In how far has women's income led to improving living conditions of the household, better nutrition, health, education,

access to water, electricity and other services? In how far is the division of labour within the household affected? How do women combine work for the project with work in household and childcare? In how far are social relations between husband and wife, children and/or other relatives affected? In how far have women's bargaining power increased within the household and in the wider community?

Youth and disabled

Little information is available about the strategy followed to appoint youth and disabled. Only 24 disabled people have been employed so far. Some jobs have been identified as suitable for disabled persons e.g. administration and tool maintenance. Project managers reason that they are physically not fit for the job. Plans are in the making to involve them in producing the WFW T-shirts. 20% of all employees are between 16-25 years. For many of them this is their first working experience which enables them to access other sectors in future. The only problem mentioned was the occurrence of pregnancy among young female workers. No other specific problems have been mentioned about young employees.

Further investigation is needed to identify whether young employees and future employees need extra attention and guidance. As is the case in society, youngsters may be dominant in drug and alcohol abuse, lack of respect for superiors, crime etc. The introduction of sport activities has had important positive effects in some projects.

Training and Education

Training is another core element of the Programmes community development work. This involves work-related skills, social skills and awareness creation. Training is organised by project management, local organisations in community development, health care and education, and private training consultants.

All workers go through a course on basic occupational skills and environmental awareness. Some receive training in specialised tasks such as chain saw operation, or mountaineering. Supervisors are trained in management and entrepreneurial skills to prepare them for contract work. Training in life skills, financial management and first aid, are offered also, to enable employees to find employment outside the programme. Increasingly, presentations and

counselling is provided to address social problems like alcohol and drug abuse, women abuse and AIDS/HIV.

Since the start of the programme all employees have received training in work-related skills, and the majority also in social skills (project managers guideline to training and development). It was observed that there is no overall training strategy. Guidelines are currently being developed to coordinate training throughout the Programme and assist new implementing agents in setting up training in their projects. The guidelines organise training in four phases:

- Recruitment of workers.
- Recruitment of workers for specialist tasks.
- Specialist training, and
- Social and development training.

Social developmental training involves the following topics: family planning, NICRO (an NGO) training (harassment of women, gender equity), personal finance, work ethics, social responsibility, life skills, health training, and AIDS awareness. This training is meant for all workers. The intention is that key workers will be trained in safety, first aid, labour relations, management principles, entrepreneurship (communication project), emergency planning and legal information.

More attention could be given to training for establishing secondary industries and possibilities for other relevant income-generating activities explored.

Communication

Internal communication is organised through meetings and monthly reports from the projects. Programme management meets bi-weekly. Management and national steering committee meet three times a year. Project managers and steering committee meet regularly, sometimes bi-weekly. Project managers in the Fynbos project meet once a month. Managers of all projects meet every three months. However, project staff is dissatisfied with the quality of communication with programme management. Complaints about bureaucracy have been mentioned. Communication between workers and project managers is considered to be poor.

At project level, a conscious communication strategy to inform local communities seems to be lacking. Different initiatives are undertaken by projects, but this seems to depend solely on interest and creativity of project management. In Umkhomaas field days and open days were

held to inform local communities about the project. In Languedoc, school children were taken to clearing sites. During rainy days team members are cleaning rivers and streets, to use their time usefully and to create goodwill among the community. Local media are used also to inform the public. Teams wear the yellow Working for Water T-shirts. The Kouga and Somerset West projects gain reputation after team's assistant with flood rescue and fire control operations. However, the name of the Working for Water Programme does not seem to be widely spread among local communities. Offices and sites have no signs of the programme. In an article on clearing hakea, the name of the implementing agent was mentioned and not the programme. In one project, the community called the project 'RDP'. Some project managers said they were too busy with their work, and had no time for public relations.

The communication project based in Pretoria, focuses mainly on informing and creating awareness among the general public. They publish the annual report, a newsletter and organise events. Their main sources of information are programme management and project managers. They also visit projects.

It seems that the potential for internal and external communication is not exploited to its potential by the programme. Improved communication between projects will lead to learning better as an organisation. More investments in external communication at project level can stimulate interest and support of communities for the Programme.

Recommendations

Staff members at different levels of the programme have confirmed most strengths and weaknesses mentioned above. Some are already being addressed, others need to be tackled in future. The following recommendations focus on the latter.

- To enhance ownership of the projects and secure sustainability of the Programme, project staff, supervisors and team members should be actively involved in design, implementation, monitoring and evaluation of the projects. This requires a new division of tasks and responsibilities at different levels of the Programme, and new staff or consultants to facilitate this. Delegation and decentralising of certain tasks and responsibilities to projects needs to be considered. Training is needed to facilitate this.
- Expertise is needed in community development. Expertise in participatory approaches is required, such as Participatory Rural Appraisal (PRA) and Rapid Appraisal of Agricultural

Knowledge Systems (RAAKS), to facilitate active involvement of staff at project level and other stakeholders in all stages of the project cycle (Chamber 1994; Engel & Salomon in press).

- Baseline studies are needed to assess the actual socio-economic situation of the communities the projects are working in. PRA and RAAKS are recommended as appropriate research methodologies.
- Baseline studies should also include a thorough gender analysis. This has to be done at three levels: gender analysis in projects, household and wider community. Core-questions for gender analysis are:
    - Who is doing what (gender division of labour)
    - Who benefits from women's participation
    - Who had access to and control of resources? (Jiggins & Simms Feldstein 1994)
- Students in social sciences, community work etc. from colleges and universities could be involved in undertaking studies.
- More room should be provided to allow workers and other project staff to voice problems and expectations. It is important to get to the roots of these problems and work together towards solutions, rather than programme management imposing their views of a solution. This could be done through workshops at project level and between projects.
- Project activities directed towards communities as a whole, such as investments in communities and addresssing social problems such as alcohol and drug abuse, women abuse and crime should be developed in close collboration with local institutions and community representatives.
- Coherent monitoring and evalution systems need to be designed to assess the socio-economic impact of the programme, with specific indicates to assess gender equity.
- Experiences of projects with informing local communities could be used by other projects to develop tailor-made communication strategies. Employees should play an active role is designing and implementing this. The communication project could facilitate this. Collaboration should be sought with local institutions.

2.3 **TECHNICAL REVIEW**

2.3.1 **Planning and design**

Introduction

MacDonald, Clark and Taylor (1989 in van Wilgen *et al* 1997) observed that in the Cape of Good Hope Nature Reserve 'the erratic control efforts (of alien invasive plants), which began in 1941, were almost totally ineffective for at least the first 35 years'. This trend was reversed by a well-coordinated and well-funded plan in 1975. This stresses the imperative of good project planning, design and implementation – if alien invasive control is to be achieved cost-effectively.

The 1995/6 Working for Water Programme Business Plan indicated that 'between 15 and 20 years will be required to clear the backlog of invaded areas at a cost of approximately 2.2 billion rand'. This may be a conservative estimate since the extent and intensity of invasives is not well known. It is essential that effective planning and design should precede such an investment of public money.

The Programme is unique in the manner in which it sets out to simultaneously deliver water benefits, social welfare and environmental restortation. But this complicates programme planning and design.

The sources of funds, particularly the start up funding, also moulded planning and design of the Programme. Funds drawn from the RDP are released against a Business Plan in the format required by the Department of State Expenditure which is responsible for allocation of RDP funding. This format did not require that the usual planning process of the Department of Water Affairs and Forestry was followed. Consequently Prefeasibility and Feasibility studies were not conducted. Instead the Programme was launched on ideas conceptualised over a number of years, which indicated economic and environmental benefits of controlling alien plant invasives. Once launched the imperatives of 'spending the money efficiently, on time and within budget' gave the Programme an urgency and impetus in which strategic planning was perceived as a process that would result in delays which would fatally flaw the Programme. The example of Umgeni Water (MBB 1997), who after several months of planning have yet to implement a project, was used to illustrate delays which would be inacceptable in an RDP funded project, and to defend the approach adopted.

The process adopted by programme management resulted in minimal 'start up' time and in a remarkably good stream of social benefits to rural poor. Notwithstanding the success, there is widespread concern amongst project managers and implementing agencies with the inadequate level of strategic planning, feasibility assessment and with project prioritisation and initiation.

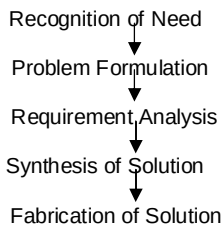
Programme planning

Planning as system design involves a general sequence of actions. In very simplified form five steps are envisaged in Box 2.6.

In the Working for Water Programme the need for control of alien invasive plants was recognised and established over many years. Problem formulation, however, was superficial. There were insufficient data at appropriate scales on the distribution of alien invasive plants and urgency to get the programme underway precluded both gathering of new data and analysis of existing information, particularly in respect of need for social welfare, for enhancement of water supply and for environmental restoration. This had important consequences. The problem could not be quantified on a national scale; a requirement analysis could not be conducted and a national solution (strategy) could not be developed. The feasibility of achieving effective control of alien invasive plants could not be assessed.

These deficiencies in programme planning are reflected in the business plans (Department of Water Affairs and Forestry 1996/7 and 1997/8). The Tables of Contents (Table 2.2) illustrates the recognition of need (Introduction) and the solution (Section 2 onwards). Problem formulation, requirement analysis and synthesis of solution are omitted.

BOX 2.6: Simplified system design process (from Rouse, 1991)



Project Planning

Once funds became available in October 1995 there was an urgency to initiate projects. In the same way as with programme planning the imperative of getting projects going took precedence over planning. Thus projects were initiated at locations where management capacity was available and where there was sufficient awareness of alien plant invasives and social welfare needs to justify a project. Delays in project implementation, which would have been occasioned by following the conventional procedure (Box 2.6), were considered unacceptable.

Consequences are that projects initiated do not have appropriate data which can be used to assess feasibility; to set measurable attainable goals in respect of water, social welfare and environmental rehabilitation. The business plans (example in Table 2.3) typically address implementation and management. The objectives for which targets are set are either or both job creation and area to be cleared (Box 2.7). Where objectives are set for hydrology, social welfare and environment there are few targets and key performance indicators (Box 2.8 and Table 2.4).

The Programme is working towards development of more comprehensive business plans (e.g. Management Plan for the Upper Riviersonderend Catchment, CSIR 1997). But, in the absence of a strategy at national and provincial level and without a systematic approach to planning (Box 2.7) the business plans are likely to have severe limitations.

BOX 2.7:	**Business plans for projects typically set targets for numbers of jobs and/or area to be cleared and not for any of the other Key Performance Indicators**
KwaZulu/Natal	'… creation of 2000 low-income jobs…'
Kouga	'… create more than 400 jobs'

Recommendations

- A strategy reflecting the most rational way of achieving water savings through control of alien invasive plants should be developed. Refer to Executive Summary – financing Proposal.
- Feasibility studies should be made prior to investment as per outline Terms of Reference which follow.
- Projects should have clearly stated measurable and achievable goals in respect of water, social welfare and environment restoration.
- A concerted effort should be made to gather and synthesize data at appropriate scales to support the Programme and projects.
- Protocols for prioritising selection of projects should be developed.

- The Logframe approach should be considered as it would help to organise and structure the projects.

BOX 2.8: Objectives and key performance indicators (Table 2) of the Tstitsikamma project. Source Department of Water Affairs & Forestry Business Plan 1996/7. A target of '… 100 jobs for local people (20 – 30% women) and 'an increase in water yield of 15 – 20% is set. Targets for other objectives are not quantifiable as expressed.

The main objectives of the Tsitsikamma Working for Water Project are :-

- The provision of additional water on a sustainable basis for domestic use
- The creation of employment opportunties, and
- The improvement of the conservation status of the natural environment

Hydrological Objectives
The hydrological benefits are to increase streamflow in the Palmiet River which supplies greater Plettenberg Bay with water. Clearing will also increase streamflow in the Keurbooms River which is being considered to augment water supplies to Plettenberg Bay.

The project is expected to result in an increase in water yield of 15 – 20% of mean annual run-off after the removal of alien vegetation.

Social Objectives
- to create employment opportunities, in particular for women and the youth
- to establish training and capacity building programmes through the project
- to promote awareness of the negative impacts of exotic plants on the environment and on water supply.

Ecological Objectives
- to restore natural biodiversity of the area
- to improve ecological integrity of catchment areas
- to prevent siltation occurring in the Keurbooms estuary and the closure of the river mouth which would impact negatively on the intertidal flora and fauna
- to eliminate the danger of erosion of riverbanks and the danger of intense fires as a result of the excessive fuel loads

TABLE 2.2: Working for Water Programme Business Plan 1997/8

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Insert Table 2.3 (Originally 2.4 – Change Heading)

INSERT TABLE 2.3

Outline Terms of Reference: Feasibility Study for Water Conservation Project

Purpose

To carry out inventories of resources, to design a work programme and to plan development on an annual basis over a period of 25 years in order to establish the technical feasibility and economic viability of a particular project designed for the control of invasive alien plants.

Result

Feasibility of project is established and contemplated investment of public funds is justified as per comprehensive study submitted by a consulting firm.

Activities

1. *Review development planning and work done by DWAF, other government agencies, NGOs and the private sector in the region and in the project area as far as water and land resource related matters are concerned. Establish institutional capacity and linkages to optimise development efforts in an efficient and pragmatic manner, if required. Special attention is to be paid to activities taken up by the Department of Agriculture and its implementing agencies in the field of agro-forestry, soil and water conservation.*
2. *Define the project area on watershed basis and identify strategic points of major water demand such as storage dams, diversion weirs, central pumping schemes and tunnel intake structures for trans-basin diversion schemes. Use existing topographic map (1:50 000) to delineate catchment and sub-catchment. Catchment at the quarternary level should be consistent with those of DWAF (1986).*
3. *Interview major water user organisations such as municipalities, water boards, irrigation boards, mining companies, plantation companies and conduct water demand and supply studies to identify water shortages experienced in the past. Undertake future projections up to the year 2030 for the defined project area and its consumers located therein.*
4. *Investigate various options for resolving water shortage problems e.g. Re-use of water, reallocation of water, water saving devices in households, tariff modifications, modern irrigation methods achieving higher irrigation efficiencies, control of alien plants.*
5. *Provide clear evidence about the need and justification of alien plant control to save water. Provide interim report on this particular issue.*

6. *The consultant shall proceed with further studies and investigations provided evidence has been submitted about the need for the project of alien plant control being the most effective option to achieve substantial water saving benefits.*
7. *Conduct reconnaissance missions to obtain clear impression of cover of alien invasive plants in each of the sub-catchments identified prior to commissioning an aerial survey.*
8. *Carry out an airborne survey assuring a high resolution on the ground to provide sufficient detail of the vegetation and present land use. Use geo-referenced digital topographic maps. The survey and mapping operations (scale 1 : 50 000 for the feasibility assessment) must be accurate and suitable for the installation of a geographic information system (GIS) and the preparation of a detailed catchment management map (scale 1:10 000) for the implementation of the project at a later stage, i.e. after the project has been sanctioned for implementation by the Government of South Africa.*
9. *Carry out ground truthing to identify type, composition and density of alien vegetation. Use four density classes for invasions: >75% (dense), 25-75% (medium), 5-24% (occasional), <5% (scattered).*
10. *Prepare land use map of the catchment selected with details on alien plant invasions for the areas of intervention. For the latter quantify in each subcatchment the area under alien vegetation (by density class in ha and percent) with an accuracy assessment level of at least 90%. Submit results on maps 1:25 000 to 1:50 000 (depending on size of project) with an overall map 1:250 000.*
11. *In the event of a great number of different land owners within the project, results of cadastral surveys should be superimposed on land use maps to show, inter alia, private land, communal land, state land (provincial reserves, national parks, state forests), municipal land and other residential areas.*
12. *Collect, screen an evaluate basic data required for hydrological simulations such as the following: daily precipitation, evaporation, temperature, physical properties of soils, values of vegetation variables (interception loss, effective root distribution, evapotranspiration), irrigation practices, variables to quantify reservoir characteristics as well as any additions or abstractions occurring within each sub-catchment.*
13. *Use the ACRU agrohydrological simulation model (or equivalent) to quantify the reduction in stream flow due to an alien vegetation. Illustrate various conditions of flow, impacts under varying assumptions (no clearing, instant clearing, delaying by 5 and 10 years).*
14. *Compare options and select the most appropriate option of clearing invasive alien plants. Discuss the selected option with representatives of the public to obtain consent on the most important interventions envisaged. Make adequate provision, including*

management guidelines, for timber and firewood required by the local inhabitants, and provide for a limited portion of aliens to remain for the supporting insect populations essential for biological control.

15. *Develop clearing, operation and maintenance schedules on an annual basis over a period of about 20 years or such time span as may be appropriate.*
16. *Development human resource deployment and training schedules aiming at upliftment of disadvantaged communities (unemployed and underemployed people below poverty line) with a female participation rate of at least 50%.*
17. *Prepare project implementation schedule (Gantt chart).*
18. *Estimate clearing, operation, maintenance and training cost on an annual basis over a period of about 20 years.*
19. *Estimate direct and indirect benefits likely to accrue every year over a period of about 20 years.*
20. *Quantify the impact of the project by computing the internal financial rate of return (FRR), internal economic rate of return (ERR) and net present value (NPV) for comparison of various development options. Carry out sensitivity tests (benefits decreased, cost increased, clearing delayed etc.) to see how strong or weak the assumptions are – in quantifying incremental costs and incremental benefits to the country, shadow pricing is to be applied.*
21. *Carry out socio-economic assessments and income analyses to find out how the target group will benefit under the project. Make proposals for impact monitoring.*
22. *Comment on the sustainability of specific measures proposed and in particular sustained income opportunities for the workers engaged.*
23. *Analyse environmental impacts and risks involved, e.g. loss of soil due to water and wind erosion after removal of alien vegetation, shortage of fuel wood and timber required by the local community, contamination of surface and ground water by herbicides and diesel used for killing trees.*
24. *Analyse the additional environmental benefits, which may accrue as a consequence of alien plant control.*
25. *Identify where research can most usefully contribute to improving and achieving cost-effective, efficient and sustainable control of alien invasive species.*

Actions by the Implementing Agency

The implementing agency DWAF will assist the consulting firm by providing all available data free of charge in particular topographic maps, meteorological and hydrometric data, GIS, operating

and maintenance rules for reservoirs and trans-basin diversion schemes, short and long term water balance studies (supply versus demand projections), and access to data stored by other agencies. DWAF will provide a liaison officer over the duration of the consultant's assignment period to provide assistance.

Upon receipt of the draft feasibility report, DWAF will hold discussions with the consultant's team to clarify certain matters. It might be appropriate, however, to initiate a Logframe workshop before the final recommendations are submitted by the consultant. It should be borne in mind that five days is considered the minimum required for such a workshop to yield useful result, and the number of participants should be restricted to 15 professionals including senior executive staff empowered to make decisions on an ad hoc basis.

2.3.2 **Water loss and alien invasives**

Introduction

It is estimated that the 33 229 ha cleared during the previous financial year will result in an additional 17.5 million m^3 of runoff annually (Department of Water Affairs and Forestry 1996). The estimated potential water saving benefit of the programme, assuming all aliens are removed is summarised in Table 2.4 below.

TABLE 2.4: **Estimated infestation level of alien plants in the nine provinces, the associatedcosts of clearing and consequent savings in water (*after* Department of Water Affairs and Forestry 1996)**

PROVINCE	INFESTATION LEVEL (ha X 10^3)			WATER SAVING (million m^3)	COST TO CLEAR (R million)
	DENSE	MEDIUM	LIGHT		
Western Cape	90	45	520	358	520
Eastern Cape	80	30	200	284	440
KwaZulu-Natal	40	60	200	188	260
Mpumalanga	40	10	50	133	210
Northern Province	40	20	30	139	215
Gauteng	3	1	2	10	15
Northwest Province	5	1	2	16	25
Free State	25	5	10	80	130
Northern Cape	80	60	60	294	450
TOTAL	403	232	1074	1502	2265

The basis for these calculations in water saving are the assumptions that clearing a dense infestation will result in a water saving of 3 000 m^3 ha yr, whereas medium and light infestations will result in increases in runoff of 800 and 100 m^3 ha yr respectively (Department of Water Affairs and Forestry 1996). The total estimated water saving of 1 502 million m^3 is approximately equivalent to the total runoff from the catchments between East London and Port Elizabeth (Department of Water Affairs 1986). The Programme has also estimated that water loss due to invasive alien vegetation will rise to 2 439 million m^3 within 15 years if these aliens are not removed immediately, and would represent a loss of 4.5 % of the nations water resources.

In calculating these estimates the Programme recognises that although the assumptions have been applied uniformly, there is in fact great variability in actual water use. For example, invasions in dry areas may have less absolute impact on water resources than those in wetter areas. As the Programme also suggests that as the majority of the area which has been invaded is riparian, the mean estimate of 3 000 m^3 ha yr is considered to be conservative.

As the Programme grows to use an increasingly greater amount of public funds, it is likely that estimation of the water saving benefits of the programme will be subject to increasing scrutiny. It is therefore reasonable to question how reliable the estimates of water saving are and to consider whether the Programme is addressing any deficiencies or uncertainties in their estimation.

Estimating water use by invasive aliens

Concerns that exotic timber plantations were having a detrimental effect on regional water resources were already being expressed prior to the 1930's. Indeed criticism of the afforestation policy had become so serious by 1935 that the Government requested the British Empire Forestry Conference held in South Africa that year to report on the effects of forests on climate (Wicht 1965). The Conference recommended that a comprehensive investigation of the effects of afforestation on local water supplies should be undertaken, and the South African Government responded with the immediate establishment of the Jonkershoek Forest Hydrological Research Station and the establishment of Cathedral Peak Forest Hydrological Research Station the following year (Wicht 1965). It is from these research stations that much of the current information and understanding relating to the effects of land use change on water resources is derived. This Chapter briefly reviews the available information and data according to the methods by which the information or estimates were obtained.

(i) Linear regressions of paired catchment responses

Bosch (1979) reports on the effects of various treatments on annual and dry period streamflow in ten catchments at Cathedral Peak. The catchments are considered closely comparable in geology, topography and soil and are assumed to be similarly affected by climatic influences, as simultaneous streamflow responses of adjacent catchments are usually strongly correlated. Data from an untreated grassland catchment thus represents a portion of a stationary time series against which the records from the treated catchments are compared. Linear regressions of treated catchment streamflow are calculated and are used to compute adjusted values of records from treated catchments, permitting subsequent examination for trend (Bosch 1979). Results are summarised in Table 2.5. According to Bosch (1979), the influence of the trees became evident eight years after planting, whereupon streamflow diminished markedly until about the nineteenth year when the trend apparently weakened and streamflow appeared to rise. Silvicultural treatments of the pine stands showed no discernable effects on streamflow.

Van Lill, Kruger and Van Wyk (1980) adopted a similar approach in the assessment of the effect of afforestation with *Euclyptus grandis* and *Pinus patula* on streamflow from experimental catchments in Mpumalanga. Results are likewise summarised in Table 2.5. In this case, *Eucalyptus* appeared to exert an observable influence from the third year onwards. Conclusions from the planting of *Pinus patula* were very tentative but suggested that the effects of afforestation are apparently delayed by one year relative to that of *Eucalyptus grandis*, and streamflow reduction appeared to be smaller.

Van Wyk (1987) reports on the effects of afforestation on multiple catchments in the Western Cape based on 40 years of observed streamflow. All catchments showed a highly significant reduction in streamflow after afforestation, and reductions in streamflow were highest during high rainfall years. According to van Wyk ' in the case where 98% of the catchment was afforested streamflow decreased by 313 mm from an initial 663 mm to an average of 350 mm/yr over a period between 12 and 32 years after afforestation. Streamflow stabilised at this level. In the catchment with 57% afforestation, streamflow declined by 200 mm/yr from an initial 593 mm/yr over the period 16 to 40 years after afforestation. Here streamflow stabilised at about 20 years. Percentage of area afforested, total biomass and rainfall appear to have influenced the magnitude of reductions in streamflow.'

Smith and Scott (1992) analyse five afforestation catchment experiments by the paired catchment method to determine the reductions in both total annual and dry season flows. In this analysis the percentage reduction in flow after afforestation with both eucalypts and pines was determined for each post-treatment year relative to the expected flow based on a calibration relationship with an untreated (control) catchment. Curves were then fitted to the data points to predict the effects of afforestation under optimal and sub-optimal growing conditions. Eucalypts were found to deplete both total and low flows sooner and in larger quantities than pine stands. As found in other studies, larger flow reductions were measured in wet years, while in dry years reductions are small, and considerable variability between absolute flow reductions in successive years were noted.

TABLE 2.5: Summary of results of paired experiment catchments analysed by means of linear regression (Bosch 1979; van Lill, Kruger & van Wyk 1980; van Wyk 1987)

SOURCE	SITE	AREA (ha)	MEAN ANNUAL RAINFALL	MEAN REDUCTION IN STREAMFLOW	SEASONAL REDUCTION	TREATMENT
Bosch (1979)	Cathedral Peak (CII)	190	1680 mm/yr	257 mm/yr	15 mm during 15/07 to 2/09	• 74% afforestation of grassland with *Pinus patula.* • 27 years data
Van Lil, Kruger & van Wyk (1980)	Mokobulaan (A)	26.2	1154 mm/yr	300 to 380 mm/yr	200 to 260 mm/yr in summer 100 to 130 mm/yr in winter	• 100% planted to Eucalyptus grandis after 12 years of calibration
Van Wyk (1987)	Bosboukloof	200.9	1296 mm/yr	200 mm/yr		• 57% afforested with *Pinus radiata*
	Biesievlei	27.2	1427.4 mm/yr	313 mm/yr		• 98% afforested with *Pinus radiata*
	Lambrechtsbos A	31.2	1413.9 mm/yr	168 mm/yr		• 89% afforested with *Pinus radiata*
	Lambrechtsbos B	65.5	1472.6 mm/yr	185 mm/yr		• 82% afforested with *Pinus radiata*
	Tierkloof	157.2	1809.7 mm/yr	171 mm/yr		• 36% afforested with *Pinus radiata*

In one of the most comprehensive reviews of catchment experiments, Bosch and Hewlett (1982) assessed the findings of 94 experiments from various parts of the globe. Pine and eucalypt forest types appear to cause on average a 40 mm change in water yield per 10% change in cover and deciduous hardwood and scrub are thought to result in a 25 mm and 10 mm change in water yield per 10% in cover respectively. However Bosch and Hewlett (1982) suggest that reductions in forest cover of less than 20 % apparently cannot be detected by measuring streamflow, and consequently one should assume that 'ever smaller percentage reductions in forest cover will produce effects approaching zero increases in water yield'. Scott and Smith's (1992) treatment of Van Wyk's (1987) data, as shown in Figure 2.3 below perhaps support this observation.

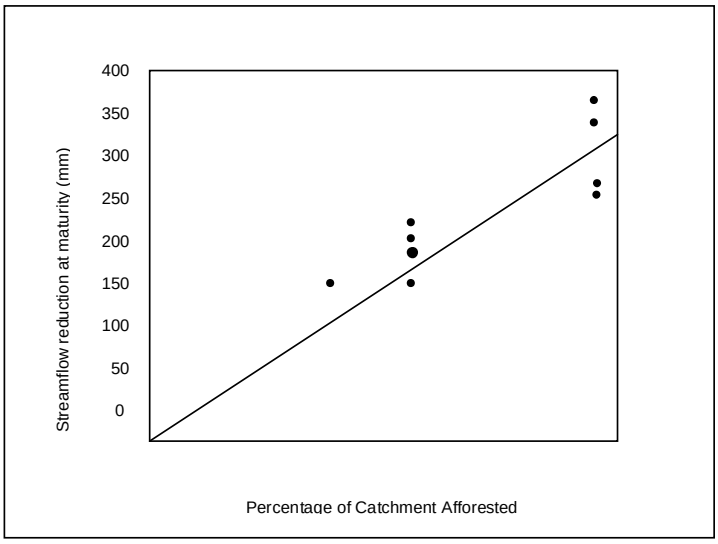

FIGURE 2.3: Averaged streamflow reductions plotted against the proportion of the catchment that is afforested (Redrawn from Scott & Smith 1992)

BOX 2.9: Cautions

- 'The reasons for the flattening out of the decline in streamflow yield are not yet understood, but it is clear that decrease in flow is not necessarily proportional to the age of the tree stands' (Bosch 1979)
- 'The unchanged yield in Catchment IX is also inexplicable and the results apparently contradict generally held views on the relationship between increased biomass, increased site utilisation and water yield' (Bosch 1979)
- 'The results in this paper apply to specific catchments with specific characteristics' (Bosch 1979)
- 'To place the results in the right perspective we need to clarify the relationship between plantation stand age and the magnitude of its 'consumptive use', and that between the magnitude of evapotranspiration losses and total rainfall' (van Lil, Kruger and van Wyk 1980)
- 'It is clear that the mean apparent reduction in flow of around 340 mm/yr is just one estimate of the hydrological influence of *Eucalyptus grandis* stands in this type of bioclimate. A complex model is required to relate species physiology, stand parameters and the usual climatic variables to evapotranspiration (van Lill, Kruger and van Wyk 1980)
- 'The models presented in this paper are based on accurate data from one of the most comprehensive hydrological studies of plantation forestry. But the models remain empirical and their use in zones outside of the research areas where they were developed will constitute an extrapolation' (Scott & Smith 1995)
- 'The absence of real data from these drier forestry zones (MAP<900mm) is a serious problem. Any attempt to model forest water use in the lower range of forestry will remain speculative until catchment experiments are laid out in these regions' (Scott & Smith 1995)

ii) Measured responses to riparian clearfelling

Two recent experiments have provided evidence of the extent of water use by vegetation in the riparian zone. Dye and Poulter (1995) used portable weirs to quantify changes in streamflow following clearfelling of a dense stand of self-sown *Pinus patula* and *Acacia mearnsii* in a riparian area in Mpumalanga. The weirs were set out 500 m apart and were used to measure streamflow levels before and after clearfelling of all trees between the weirs to an average distance of 25m from the stream. Analysis of the streamflow data indicated a 120% increase in streamflow at the lower weir, amounting to an additional 30.5 m^3 of water per day. The study concluded 'that streamflow in afforested catchments is sensitive to the presence or absence of invasive, exotic trees in riparian zone, and that significant increases in streamflow may be expected where dense thickets of such trees are removed.'

Scott and Lesch (1995) investigated the consequences of riparian clearfelling in three paired catchment experiments in Mpumalanga and in the Western Cape, based on relatively short periods of observation. They conclude that riparian vegetation is an 'extravagant' user of water, suggesting that there are large water yield gains to be obtained from managing riparian zones to keep them clear of woody weeds and under short vegetation. Evidence from the Biesievlei catchment indicated that water use by pines from the riparian zone was roughly three times that of pines (same age and density) on non-riparian sites.

BOX 2.10: Cautions

- 'It is important to remember that the largely herbaceous indigenous vegetation which will be allowed to replace the felled trees will transpire and therefore have some influences on streamflow' (Dye & Poulter 1995)
- There is a need for a broader body of information to assess the effects of species, density and age distribution, as well as catchment characteristics, on streamflow responses to clearing invasive trees' (Dye & Poulter 1995)
- 'The water use characteristics of indigenous forest are poorly understood and deserve further investigation. Despite their apparent similarities, the riparian vegetation at Wesfalia and Witklip, which have a similar climate, responded quite differently in these experiments' (Scott & Lesch 1995)
- 'The clearing of a large riparian zone of indigenous forest at Westfalia led to increases in streamflow in the first year which were reversed in the second year. This suggests that (a) short but vigorously growing vegetation can have water use in excess of that of older taller vegetation, and (b) that clearing mature indigenous riparian forest in a riparian zone to increase streamflows is not worthwhile unless an alternative short vegetation can be maintained in its place' (Scott & Lesch 1995)

(iii) Simulation modelling of riparian water use

A recent study (MBB 1997) has estimated the impacts of riparian zone alien vegetation on the hydrological response of Midmar Dam in KwaZulu-Natal. In order to undertake the study the ACRU model (Schulze 1995) was modified to model riparian water use more realistically. The results of the study indicated the following :

- The effects of current land use in the catchment can be quantified as a reduction in runoff of approximately 32 million cubic metres per annum
- The effects of the present day riparian zone alien plants on the catchment water resources can be quantified at approximately 11 million cubic metres per annum when compared to the option of a cleared and rehabilitated riparian zone
- If no clearing of alien plants in the riparian zone occurs a reduction of runoff of approximately 21 million cubic metres may be expected in the future.

Review of the Programme

(i) Do we have sufficient understanding of alien water use to justify the programme ?

During the last 30 years a considerably body of information has been established, all of which indicates that vegetation of a larger stature will utilise a greater proportion of water than smaller vegetation. This concept is embodied in the relationship presented by Le Maitre, van Wilgen, Chapman and McKelly (1996), showing that greater increases in streamflow reduction are generally associated with higher above-ground biomass (Figure 2.4). The data utilised in the formulation of this relationship are indicated in Table 2.6, some of which have been referred to previously in this paper.

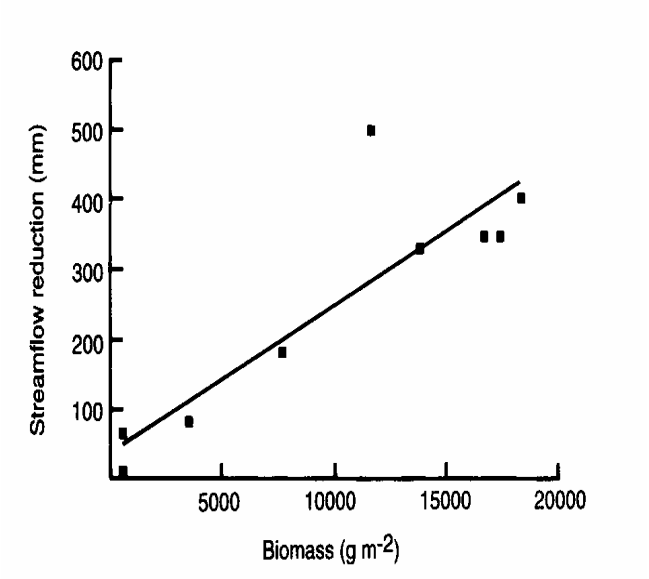

Figure 2.4 **Relationship between biomass and reduction in streamflow from nine gauged catchments in the Western Cape (Le Maitre, van Wilgen, Chapman & McKelly, 1996). Data are from Table 2.6 overleaf.**

Catchment	Treatment	Length of data record (years)	Mean annual rainfall (mm)	Runoff (mm)	Estimated above-ground biomass ($g\ m^{-2}$)	Streamflow reduction (mm)	Source
Langrivier	Fynbos protected from fire for 25 years	33	1820	1360	7600	180	van der Zel & Kruger (1975); van Wilgen (1982)
Jakkalsrivier A	Fynbos protected from fire for 16 years	20	1210	544	1540	no data	Kruger (1977)
Jakkalsrivier B	Fynbos protected from fire for 16 years	20	1070	421	1540	no data	Kruger (1977)
Zachariashoek	Fynbos burnt on a 12-year cycle	14	781	290	560	0	van Wilgen & Kruger (1985); Lindley, Bosch & van Wyk (1988)
Bosboukloof	Fynbos afforested (57%) with *Pinus radiata* for 23 years	40	1300	no data	13800	330	van Laar & van Lill (1978); van Wyk (1987)
Tierkloof	Fynbos afforested (36%) with *Pinus radiata* for 16 years	40	1660	937	11500	500	van Wyk (1987)
Biesievlei	Fynbos afforested (98%) with *Pinus radiata* for 15 years	40	1310	472	18600	400	van Wyk (1987)
Lambrechtsbos A	Fynbos afforested (89%) with *Pinus radiata* for 8 years	37	1140	341	17300	350	van Wyk (1987)
Lambrechtsbos B	Fynbos afforested (84%) with *Pinus radiata* for 16 years	37	1270	399	16700	350	van Wyk (1987)
Swartboskloof	Fynbos burnt at a post-fire age of 29 years	6	2190	1060	3500	79	van Wilgen, Higgins & Bellstedt (1990); Scott & van Wyk (1992)
Kasteelkloof	Fynbos burnt on a 6-year cycle	14	1010	495	540	60	van Wilgen & Kruger (1985);Lindley, Bosch & van Wyk (1988)

TABLE 2.6: Mean annual rainfall and run-off under conditions of minimum vegetation cover, and above ground biomass under mature conditions with associated reductions in streamflow, in 11 gauged catchments in the Western Cape Province. Streamflow reduction is the difference between conditions of minimum vegetation (after fire) and mature vegetation.

Thus in the Western Cape water utilisation by mature fynbos appears to be of the order of 60 to 180 mm, whereas that of *Pinus radiata* appears to be of the order of 350 to 500 mm. Although plant-water utilisation functions have been approximated by the biomass relationship shown in Figure 2.4, actual water utilisation is known to be related to both plant characteristics (e.g. rooting depth, canopy structure and area, leaf area and plant physiology) and site characteristics (e.g. available soil moisture, evaporative demand) (Schulze 1995). Are the findings reported above sufficiently robust to provide a basis for calculating water savings as a result of the actions of the Programme, and if so what are the assumptions ?

Most, if not all, the paired and multiple catchment experiments referred to above are micro-catchments usually considerably less than 200 ha. Furthermore, they are all located in higher rainfall areas which are generally regarded as sites suitable for commercial afforestation, and are consequently associated with afforestation by either pines or eucalypts. The effects of afforestation (> 30%) with pines or eucalypts on small, high rainfall catchments is thus relatively well understood. Understanding of the water utilisation of indigenous vegetation is confined to relatively fewer catchments of comparable size and characteristics, and a cover of either grassland or fynbos. It is also important to note that these long term experiments were designed with the primary objective of determining the effects of extensive afforestation on the water yield of small mountain catchments, and not to evaluate the effects of alien invasion on regional water supplies. The first question that arises is thus to what extent can small catchment responses to afforestation be extrapolated to a regional scale?

Every attention appears to have been directed at examining the issue of scale effects. As mentioned earlier however, Bosch and Hewlett (1982) suggest that reductions in forest cover of less than 20% are difficult to detect by measuring streamflow and that one should assume that ‘ever smaller percentage reductions in forest cover will produce effects approaching zero increases in water yield’. This opinion appears to be supported in part by the analysis of Scott and Smith (1995) (Figure 2.3). Both Quinn and Cluer (1996) and Kienzle and Schulze (1992) provide evidence based on simulation studies which shows that while the impacts of eucalypt afforestation may be severe at a localised scale, they are also significantly ameliorated by the water use of grassland vegetation at a more regional scale.

Perhaps the most appropriate answer to the question raised above is that the reliability of the catchment scale estimates of water saving increase as the total area occupied by alien vegetation increases. The reliability of the water saving estimates also increases if estimates are being determined for comparable changes. Thus the greatest confidence may be placed in water saving estimates, which are determined for a high rainfall area to be cleared of eucalypts, or

pines and replaced by grassland, than for a semi-arid area which is to be cleared and which will be replaced by scrub or bushveld. As noted by Scott and Smith (1995) the absence of data from drier areas constitutes a serious problem. In addition to the fact that there is a lack of comparable studies in drier areas, several studies have shown, larger water savings are incurred during wet years as opposed to dry years (van Wyk 1987; Scott & Smith 1992). This also suggests that Programme estimates for drier areas may be optimistic.

In comparison with small catchment experiments, very few studies have set out to measure the water savings, which could be attributed to removal of alien vegetation in riparian zones. Initial indications are that riparian alien vegetation uses considerably more water than the adjacent non-riparian vegetation (Dye & Poulter 1995; Scott & Lesch 1995). Evidence from one experimental catchment suggests that water use by pines from the riparian zone was roughly three times that of pines of the same age and stand density on non-riparian slopes (Scott & Lesch 1995). However these experiments have also indicated that the savings are only likely to be sustainable in the long term if trees are replaced with alternative short vegetation.

In general terms it appears as if there is sufficient evidence of water savings to justify the Programme. Nevertheless cognisance should be taken of the assumptions inherent in these estimates and the likely range of their applicability. Although water savings may be overestimated by the Programme for drier areas, it is likely that the water savings attributable to clearing in riparian zones may be underestimated. This is illustrated by means of the example, based on the case study undertaken by MBB (1997) in the Midmar Dam catchment (Table 2.7).

TABLE 2.7: Hypothetical estimates of water savings, using input values for water consumption from WFW, and assuming all alien vegetation was cleared from the Midmar Catchment (areas obtained from MBB 1997)

Infestation	River length (m)	Riparian width (m)	Total area (ha)	Unit area water saving ($m^3.ha^{-1}.yr^{-1}$)	Total water saving ($m^3.yr^{-1}$)
Sparse	393 063 (19.1%)	60	2 358	100	235 800
Medium	277 965 (13.5 %)	60	1 668	800	1 334 400
Dense	156 690 (7.6 %)	60	940	3 000	2 820 000
TOTAL					4 390 200
Average riparian			4966	3000	14 898 000

If these were non-riparian areas the programme would have calculated a water savings of approximately 4.4 million cubic metres of water per annum. However the programme also suggests that a water saving of 3 000 m^3 ha yr may be considered a conservative estimate for riparian areas. If this were the case the water savings would be calculated as nearly 15 million

cubic metres of water per annum. As the effect of infestation by wattle has been investigated by means of a modified ACRU simulation, we have in this case, a long-term estimate of water saving currently available. MBB (1997) found that a total additional volume of approximately 11 million cubic metres would be available if all wattles were removed from the riparian areas of the Midmar Dam catchment. Thus for this species in this location the density related programme estimates represent a significant underestimation of the water saving benefits while the riparian associated estimates represent an overestimate, which may be more appropriate for a species with a higher consumption such as eucalyptus.

(ii) Can estimates of water saving be improved?

As is illustrated by the forgoing discussion, water use by alien invasive species is highly variable, being related to both species and site characteristics. Furthermore riparian and non-riparian water use (all else being equal) appears to be significantly different. To what extent is this information recorded during Programme operations?, given that it is likely to be critical in conducting a subsequent audit of the site specific water savings. During this review no evidence was obtained which suggested that key information pertaining to each site is recorded. This is considered a serious weakness in the programme which can be remedied at low cost with high benefit as and when more refined techniques for water savings estimation are available. Site specific information that should be recorded includes:

- species present (densities)
- age or size
- slope
- soil characteristics (depth and texture)
- riparian area cleared vs non riparian area

(iii) Additional observations emerging from this review

- If water saving targets or goals were specified for each site total water savings by the programme may increase as there would be greater incentive to prioritise areas which would result in greater water savings (such as riparian areas invaded by eucalypts) per unit effort. This is in contrast to much of the Programme activities in the Western Cape which appear to be focussed on non-riparian areas.
- The only current indicators of performance from a hydrological perspective are the number of hectares cleared in a given time period, and the number of hectares subject to follow up operations. Number of quaternary catchments cleared and followed up is suggested as an additional performance measure and has the added benefit of introducing the concepts of Integrated Catchment Management to the workforce. As far as possible individual clearing operations should proceed on the basis of a catchment operation rather that a patchwork

system which appears to have occurred in the past. While there may be valid reasons why this is not possible at some sites, workers should be aware of this rationale.

Recommendations

(i) While the current approach to estimating the water saving benefits may be applicable in some areas, this approach does not have universal applicability and certainly does not recognise the wide variation due to site specific characteristics. A high priority should be accorded to the development of a standardised procedure for determining the water saving benefits of the programme. Such a methodology should be developed by consensus of experts and would make the programme amenable to an audit of performance.

(ii) Water saving benefits of the programme would be increased if the programme was targeted to a greater extent in areas where demand is reaching supply levels, and within these areas where intervention will result in greater water savings per unit effort. Explict water saving objectives expressed in volumes per annum may assist in improving the performance of the programme.

(iii) Greater attention needs to be directed at better record keeping at the site scale. Prior to intervention records of the characteristics of the site and of the invasion should be maintained. Water saving benefits should be calculated at the site level and should be assessed in the context of the regional pattern of supply and demand.

(iv) Intervention should proceed on a quaternary catchment basis as far as possible and appropriate performance indicators such as % of quaternary catchment cleared or number of quaternary catchments cleared should be introduced.

(v) A directed research programme aimed at eliminating the uncertainties of estimation should support the programme. Key issues may include:

- regional vs local effects
- benefits in arid areas
- benefits in areas where wet season flows are not impounded
- water use characteristics of alien species other than pines and eucalypts
- water use characteristics of larger stature indigenous riparian vegetation and emergent macrophytes

2.3.3 **Environmental restoration**

Introduction: rationale for restoration

Seven centres of plant biodiversity have been recognised in southern Africa (Davis and Heywood 1994). Six of these occur in South Africa: Cape, Succulent Karoo, Albany, Eastern Mountain, Pondoland, Maputaland and Wolkberg. Southern Africa also has a very high level of species endemism Table 2.8.

TABLE 2.8: **Global patterns of vascular plant species endemism. From Cowling and Hilton-Taylor 1994**

Country	Endemism (%)	Country	Endemism (%)
New Zealand	82	Ecuador	21
Southern Africa	80	United States	21
Australia	80	Costa Rica	15
New Caledonia	80	Greece	15
Madagascar	68	Mexico	14
Indonesia	67	Panama	14
China	56	Algeria	8
Papua New Guinea	55	Mozambique	4
Chile	51	Nigeria	4
Zaire	29	Zambia	4
Sri Lanka	28	Zimbabwe	2
Argentina	25	Germany	<1
Angola	24	Sweden	<1

Source: World Conservation Monitoring Centre (1992)

The Cape Floral Kingdom is the smallest of the world's floral kingdoms (Cowling and Richardson, 1995). It occupies less than 1% of the land surface. The major part of the kingdom is made up of fynbos[1]. It has a very high species diversity with many species restricted to the fynbos.

[1] Fynbos is a term applied to the fire-prone shrubland vegetation characteristic of the areas of the Western Cape Province of South Africa with a mediterranean climate

BOX 2.11: Some characteristics of the Fynbos biome in South Africa. From Hilton-Taylor and Le Roux (1989) and Higgins *et al* (in press)

- Area ca 70 000 km^2, 5.72% of South Africa
- Almost exclusively in the South Western and Southern Cape
- Includes 5 veld types
- Diversity higher than any other biogeographic zones except possibly tropical rain forest
- 8 574 species exist within 90 000km^2 many of which are confined to the biome
- 7 endemic families, 989 genera of plants of which 19.5% are endemic
- About 68% of the species are endemic
- 1 326 taxa are rare and/or endangered

An area of 470 km^2 of the Cape Penninsula supports 2 500 plant species. New Zealand is 500 times larger and supports only 1992 species.

A number of fynbos species have commercial value. These include ornamental species (e.g. *Protea*), medicinal species (e.g. *Agathosma*) and a commercial tea (*Aspalathus linearis*, rooibos). The combined value for 1993 of fynbos related enterprises, much of which was made up of export earnings was $18 – 19.5 million and provided a livelihood for 20 000 to 30 000 people (Cowling and Richardson, 1995). Much of the economic potential of this unique flora remains to be realised.

BOX 2.12: Fynbos ecosystem services. From Higgins *et al* (in press)

- Mountain fynbos ecosystems provide the following services: water production; wildflower harvest; hiker visitation; ecotourist visitation; endemic species and genetic storage**.**
- The cost of clearing plants under proactive management is a tiny (0.6 – 5 percent) proportion of the value of mountain fynbos ecosystems.

South Africa is a signatory of the Biodiversity Convention and has a responsibility to conserve biodiversity. The fynbos of the Cape is high on the priority list. The South African flora has a very high level of endemism amongst its plant species (Table 2.8).

There is therefore compelling reason and an obligation to conserve the Cape Floral Kingdom, in particular, and biodiversity in general in South Africa. Conservation of biodiversity is central to the notion of environmental restoration.

Threats to biodiversity and ecosystem integrity

Alien species, particularly pines, gums and acacias were introduced to South Africa for commercial production of timber products (wood and bark) and for stabilising sandy substrata.

The first concern expressed about large-scale afforestation in South Africa concerned its impact on water supply. Afforestation policy was under such attack that the Government requested the 1935 British Empire Forestry Conference 'to report on the effects of forests on climate, water conservation and erosion with special reference to South Africa' (Wicht, 1965).

With the exception of the Succulent Karoo invasive plants and afforestation present a major threat to plant biodiversity (Table 2.9). Afforestation threatens biodiversity both by deliberate land transformation and insidious transformation as seeds spread into surrounding areas.

Alien plants can be competitively superior to native plants (Witkowski, 1991; Musil, 1993) with the result that when they 'escape' from planted areas they invade natural areas.

The threat of alien plant colonisation in fynbos was recognised by the Department of Forestry and in the 1970's and early 1980's the Department instituted alien control to restore ecological integrity and promote conservation of natural areas.

TABLE 2.9: Major threats to southern African biodiversity hot spots. From Cowling and Hilton-Taylor, 1994.

Hot-spot	Threats
Wolkberg	Afforestation, invasive plants, overgrazing
Maputaland	Agriculture, afforestation, urbanisation, overgrazing, plant harvesting, invasive plants, mining, tourism
Eastern Mountain	Overgrazing, agriculture, afforestation, plant harvesting, invasive plants
Pondoland	Overgrazing, veld burning, plant harvesting, agriculture, population growth
Albany	Overgrazing, agriculture, invasive plants, urbanisation
Succulent Karoo	Overgrazing, mining, agriculture, plant harvesting
Cape	Invasive plants, agriculture (lowlands), urbanisation, plant harvesting
Kaokoveld	Overgrazing, plant harvesting, tourism

Plant harvesting includes fuel wood, building materials, wild food and beverage crops, medicinal plants, wild flowers and succulents.
Source: Davis & Heywood (1994)

Concurrently the 1972 Forest Act required timber growers to apply for permits to establish commercial plantations on new or sections of land, which had not been planted to trees for a period exceeding five years.

The two concerns of nature and water conservation became inseparably linked to alien species and their invasive potential.

In the 1980's the Department of Forestry's functions in catchment management were relinquished to conservation authorities – National Parks Board and Provincial Nature Conservation Authorities, Department of Nature Conservation in the Cape Provincial Government. Funding for alien plant control declined and invasion was increasing. Current estimates (Department of Water Affairs and Forestry Business Plan 1996/7) indicated about 1 719 000 ha infested. This is projected to increase to 2 124 000 ha in 15 years and to become more dense should no clearing take place (Tables 2.10 and 2.11). Recent information is that this is an underestimate.

During the late 1970's and 1980's a National Scientific Programme on the fynbos biome provided considerable insight into the composition structure and functioning of the fynbos. It fuelled concern about the threat to biodiversity resulting from alien plant invasions.

TABLE 2.10: Estimated infestation levels of alien plants in nine provinces and associated losses of water and costs of clearing (Department of Water Affairs & Forestry, Business Plan 1996/7)

Province	Infestation Level (ha x 10^3)			Water Loss (million m^3)	Cost to clear (R million)
	Dense	Medium	Light		
Western Cape	90	45	520	358	520
Eastern Cape	80	30	200	284	440
KwaZulu/Natal	40	60	200	188	260
Mpumalanga	40	10	50	133	210
Northern Province	40	20	30	139	215
Gauteng	3	1	2	10	15
Northwest Province	5	1	2	16	25
Free State	25	5	10	80	130
Northern Cape	80	60	60	294	450
Total	**403**	**232**	**1 074**	**1 502**	**2 265**

Notes

– These estimates exclude aquatic weeds.

– They assume average clearing costs of R5 000 per hectare for dense infestations, R700 per hectare for medium infestations, and R80 per hectare for light infestations. (*These costs are lower than those, which were used during the past financial year, but are taken as realistic targets for productivity if using a piecework approach)*.

– These estimates assume average increases in runoff of 3 000 cubic metres per hectare per annum for dense infestations; 800 cubic metres per hectare per annum for medium infestations and 100 cubic metres per hectare per annum for light infestations. These values are applied uniformly, although it is recognised that there is great variability in actual water use and that invasions in dry areas may have less absolute impact on water resources than in high rainfall areas. Given that the bulk of the invaded area is riparian, the mean figure taken of a decrease of 3 000 cubic metres of water per hectare per annum is probably conservative in all instances.

TABLE 2.11: Estimated infestation levels of alien plants in 15 years time (should no clearing take place immediately), with associated losses of water and the costs of clearing (Department of Water Affairs & Forestry Business Plan 1996/7)

Province	Infestation Level (ha x 10^3)			Water Loss (million m^3)	Cost to clear (R million)
	Dense	Medium	Light		
Western Cape	135	260	400	653	890
Eastern Cape	110	100	250	445	640
KwaZulu/Natal	100	100	175	397	600
Mpumalanga	540	25	80	178	270
Northern Province	60	15	20	194	310
Gauteng	4	1	1	13	20
Northwest Province	6	1	1	19	30
Free State	30	5	5	94	150
Northern Cape	140	30	20	446	720
Total	**635**	**537**	**952**	**2 439**	**R3 630**

BOX 2.13: Perceived threats to natural ecosystems of afforestation and alien plant species invasion. From MacDonald 1989.

- 30% of the rare and endangered plants of the Transvaal occur in habitats subject to afforestation.
- In 1984 some 1 254 km^2 of natural vegetation of fynbos became densely infested by *Hakea* and *Pinus* spp. Analogous estimate for *Acacia* spp was 2 890 km^2.
- In Natal 8 000 km^2 invaded by *Chromalaena odarata.*

In 1994 the Fynbos Forum funded by the Foundation for Research Development gave a presentation to the Minister of Water Affairs and Forestry, Professor Kader Asmal. The threat of alien plant invasion to natural systems and biodiversity (particularly in the fynbos), and to water supplies was accepted.

Alien plant invasion was also perceived as an important threat to conservation in other provinces. The Natal Parks Board regards it as second only to land transformation (e.g. roads, towns)[1]. Both the Natal Parks Board and the National Parks Board have alien plant control programmes but these are largely restricted to action within conserved areas. Their problem has been

[1] Personal Communication P Le Roux, Natal Parks Board

aggravated by the rapid expansion of the timber industry (*Pinus* spp, *Eucalyptus* spp and *Acacia* spp), invasion of adjoining land, and transport of seeds along water courses.

Ever increasing demand for water has had dramatic consequences for the biota of rivers and estuaries. The structure and functioning of these ecosystems is under such threat that the Department of Water Affairs and Forestry is currently revising the Water Law to make provision for an environmental water reserve to sustain ecological functioning. Water 'freed up' through alien plant control can help meet environmental requirements.

Box 2.14: The threat and the Programme

- Alien plant invasion is a real threat to biodiversity and ecological functioning in South Africa.
- Historical evidence shows that removal of aliens leads to recovery of biodiversity and ecological functioning in the fynbos and other systems.
- Absence of measurable achievable goals for ecological functioning and biological diversity conservation limits effectiveness of the projects and Programme.

Failure to remedy and control alien plant invasion poses a real threat to terrestrial ecosystem structure and functioning, to water availability (ground water and river flow) and consequently also to the integrity of aquatic systems.

A study of the Mgeni River shows that there are signficant benefits of early control of invasive aliens (MBB 1997).

Combatting the threat

The system of protected areas in South African is 'not optimally located with regard to the region's hot-spots of plant diversity and endemism' (Cowling and Hilton-Taylor, 1994). Of particular concern is the conservation of the lowlands of the Cape Floristic Region. It is therefore unrealistic to envisage that plant diversity conservation in South Africa (and therefore also natural systems) is assured in the network of protected areas. Management of alien plant invasion on other land, in public and private ownership, will have to incorporate practices directed towards biodiversity conservation if success is to be achieved.

A critical assumption is that biodiversity and ecosystems structure and functioning can be reinstated subsequent to removal of alien invasive species. Clearly the greatest test of this

assumption is where invasives have formed dense thickets over a number of years. Here most of the natural flora and fauna has been replaced.

Removal of aliens, particularly when dense thickets have developed and where they have colonised river banks, exposes the soil to increased erosion (Agricultural Research Council 1996). Three possibilities exist to protect the system : protection of the soil surface, natural recolonisation and rehabilitation. Where dense thickets are cleared considerable trash remains on the ground which helps to reduce erosive forces. Uncontrolled fires can, however, do considerable damage where the fuel load is high (Agricultural Research Council 1996). Fire protection is particularly important in such situations during the first two years after clearing. There does not appear to be a clear policy on the management of trash and it is dealt with differently in different projects.

Plant succession to climax vegetation is a slow process. However where invasion has taken place some indigenous species persist and become revitalised after removal of the alien vegetation. Others sprout from seeds in the depleted seed bank (Agricultural Research Council 1996). Recruitment from adjacent areas is slow.

Studies of fynbos ecology indicate that because of the mix of species survival strategies it recovers well after removal of alien vegetation (Cowling and Richardson, 1995). In other areas exposed soil can erode thereby restricting rates of rehabilitation. In parts of KwaZulu reseeding is practised. [1]

Loss of seed currently dictates the use of an exotic species *Eragrotis curvula* which has been used for many years without evidence of becoming invasive. Natural colonisation and succession from undisturbed areas is relied upon to reinstate biodiversity. The approaches adopted to promote rehabilitation and control erosion are shown in Table 2.12.

Resprouting of cut alien plants is prevented through application of herbicides (Garlon) which may or may not be applied in a mixture with diesel. Concern has been expressed about the heavy loads of diesel being applied. The consequences are, however, not known. The wood rot fungus *Cylindrobasidium* is being tested as a control for resprouting from large stumps.

Biological control is considered to present the most cost-effective long term solution to alien plant invasion (Cowling and Hilton-Taylor, 1994). It has been effective in a number of species eg *Acacia saligna* and *Acacia longifolia*. There is considerable resistance from the forest industry to

the use of biocontrol in commercial species and there is concern that hardship may ensure for poor communities who depend on some of these species for fuelwood and construction timber. Nevertheless biological control is being pursued actively by the Plant Protection Research Institute and within the Programme (Tables 2.13 and 2.14). Their research programme is under-resourced given the potential significance of biological control in the long term[1]

Biological control may offer the only real prospect for control of species which are widespread at relatively low densities. *Prosopis* which colonises water courses in the arid parts of South Africa is an example.

By the end of the 1996/7 programme year 71 289 hectares had been cleared and 12 046 ha had had follow up treatment. With over 1.7 million hectares to clear the programme will have to be 'geared up' to be really effective; and it is clearly a long-term initiative.

From an ecological functioning and biodiversity perspective it is essential to identify the areas where action is most urgently required. At present the programme may be said to have a broad vision – 'to conserve ecological functioning and biological diversity' (Annual Report 1996/7). Nowhere are clearly stated, quantifiable, achievable goals set for this vision. The project rests on the reasonable assumption that wherever aliens are removed ecological functioning and biological diversity will be enhanced.

Whilst this is probably true the question must be asked whether effort is being directed to where greatest ecological benefit can be achieved – to where the threat is most critical. Failure to do so could result in the most significant sites being lost before the programme gets to address them.

Some projects are located in biodiversity hot-spots e.g. Cape (fynbos) and Maputaland (St Lucia) but there is little evidence to indicate that they are planned and structured to optimise enhancement of biodiversity conservation and restoration of ecosystem structure and functioning. The involvement of ecologists and conservation personnel (as managers) does, however, bring with it a focus on biodiversity.

[1] Pitchford – personal communication
[1] van Wilgen and Zimmerman – personal communication

TABLE 2.12: Approach to rehabilitation and erosion control adopted in the project. In Mpumalanga the expertise in the programme is being used to assist with rehabilitation of mine dumps. Gelderblom personal communication.

Location	Current Problems	Potential Problems	Approach used	Monitoring
Fynbos (W Cape)	Not seen as a serious problem at this stage.	Riverbanks and areas where wildfires burn a heavy fuel load on granite soils.	Stellenbosch gabions will be used and if necessary grasses will be sown to further stabilise the soil. Guidelines from Charlie Boucher's book "Rehabilitations of Rivers Banks" are applied.	Monitoring of vegetation regeneration undertaken by Dr Pat Holmes of UCT to determine which species of functional groups are particularly badly affected by invasion. Streamflow is also being monitored at two sites.
Tsitsikamma (W Cape)	No current erosion. May need to do some rehabilitation.	Fuel load increased may cause damage if wildfires get in.	Dead wood stacked in windrows against the contours	Eleven plots monitor vegetation regrowth. Runoff was also evaluated for sediment content and none was found.
Kouga (E Cape)	Concern about rehabilitation of dense stands, particularly in rivers.	Particularly riverine areas.	Indigenous grasses – a mixture of annual and longer lived species.	Permanent plots – photographs
Keiskammahoek	Steep areas	Steep areas particularly where they have been burnt.	Used sacking and re-seeding of grasses	Fixed point photographic monitoring
Mpumalanga	No action necessary as natural regeneration good in current operations	May be a problem when move into highveld areas.	Will use indigenous grass mixture.	40 plots along Sabie River. - Biodiversity - Succession - Seedbank Also changes in indicator species in streams. Weirs in Eucalypt, Pine and Wattle clearing operations measure streamflow after clearing and past experiments were performed by Dye and Poulter (1995).
Levuvhu	Not a problem as regeneration in this moist area is very rapid; particularly if the area was previously natural vegetation.	Potentially a problem in the drier rivers to the north or in old lands or very disturbed sites.	NA at present	Monitoring plots done by Professor Pablo Weisser of University of north to monitor species diversity and succession.

TABLE 2.13: Projects participating actively in the release of biological control agents. Prime candidates for biological control are considered to be Mauritius thorn, Eucalypts, Pinus and Wattles.

	Activities/disease	**Species**
Fynbos (W Cape)	Rust Wasp Trichalogaster Seed feeding beetle Fungus Gummosis	Acacia saligna Acacia longifolia Acacia cyclops Hakea Sesbania
Tsitsikamma (W Cape)	Gummosis has achieved 100% infection of Hakea Fungus painted on stumps used to prevent regrowth but not very successful	Hakea Black Wattle
Kouga (E Cape)	Gummosis Rust	Hakea Acacia saligna
Keiskammahoek	Are local trials with fungus for black wattle which will be evaluated before implemented	Black wattle
Mpumalanga	Agents for Lantana released at 6 sites in collaboration with Sabie River Coordinating committee Trails of fungus used to prevent regrowth	Lantana Opuntia Sesbania Black Wattle
KwaZulu-Natal	Trials of fungus used to prevent regrowth	Black Wattle
Levuvhu & Great Letaba	Biocontrol for Lantana to be released in consultation with PPRI	Lantana

TABLE 2.14: Some important life history attributes of alien plant invaders. Control options are briefly described for each species. Gelderblom personal communication.

	LIFE HISTORY ATTRIBUTES			CONTROL OPTIONS
SPECIES	**RESPROUT (YES/NO)**	**SEEDBANK LONGEVITY (SHORT/LONG)**	**FIRE STIMULATED SEED GERMINATION (YES/NO)**	
Acacia cyclops	No	Short	No	Cut and leave isolated. Individuals. Release biocontrol – seed feeding beetle – available in 1998.
Acacia longifolia	No	Long	Yes	Bio-control agent effective wasp (*Trichalogaster)*, mechanical control optional, need biocontrol reserve.
Acacia mearnsii	Yes	Long	Yes	Primarily riparian. Cut & apply poison or fungus to stumps; remove wood; biocontrol release in 2000
Acacia melanoxylon	Yes	Long	Yes	Mostly riparian; cut & apply poison; remove wood; release biocontrol; biocontrol reserve needed.
Acacia pycnantha	Yes	Long	Yes	Cut & apply poison or stump fungus. Release biocontrol. Biocontrol reserve needed.
Acacia saligna	Yes	Long	Yes	Biocontrol effective causing outbreaks of rust, mechanical control optional, biocontrol reserve optional.
Hakea sericea	No	Short	Yes	Biocontrols effective, mechanical control optional (cut & burn – fuel load/soil erosion caution), careful planning of biocontrol reserves required.
Hakea gibbous	No	Short	Yes	Cut & burn – fuel load/soil erosion caution. Biocontrol currently ineffective.
Hakea suaveness	No	Short	Yes	Cut & burn – fuel load/soil erosion caution. Biocontrol currently ineffective.
Paraserianthes lophantha	No	Long	Yes	Associated with riparian habitats; cut & leave; release biocontrol; biocontrol reserve needed.
Pinus spp.	No	Short	Yes	Cut & burn (fuel load/soil erosion caution). No biocontrol.
Sesbania punicea	Yes	Long	No	Biocontrol effective; release biocontrol; No mechanical control.
Populus X Canescens	Yes	N.A.	N.A.	Cut & poison
Eucalyptus spp.	Yes	Long	N.A	Cut & poison
Arundo donax	Yes			Cut & poison
Quercus robur	No	Long	No	Cut & poison
Lantana camara	Yes			Cut & poison. Biocontrol ineffective.
Opuntia				Biocontrol effective if correct species is applied.

There is currently no strategic planning at either programme or project level for achieving the vision of conserving ecological functioning and biological diversity. The 1996/7 and 1997/8 Business Plans do not set targets in the context of ecological functioning and biological diversity and the corresponding Annual Report includes little of consequence in the context goal attainment and monitoring (other than hectares cleared). Monitoring seems to rest predominantly on fixed point photography. This, on its own, is a method for recording change. Directing change requires that goals be set.

It can be inferred from the many years of control of alien invasives in the Western Cape prior to the programme and to the experience of conservation authorities, that restoration has been successful. It is, however, difficult to assess the extent to which alien invasive control in the programme is contributing meaningfully to ecological functioning and biodiversity conservation. There is no doubt that the Programme has the potential to contribute meaningfully. The issue is whether the contribution is optimised within the context of the other legs of the programme i.e. job creation, building communities and improving quality of life, and enhancing water supply and water security.

Evaluation

There can be no doubt that invasive alien species have had a considerable impact on both terrestrial and aquatic ecosystems. They pose a real threat to the integrity of natural system in South Africa. The unique fynbos of the Cape is particularly threatened although every province is affected. Nature conservation authorities are obliged to continuously allocate significant parts of their annual budget to combating alien plant colonisation. This weakens their ability to address other pressing needs.

A combination of tactics, physical removal and biological control is being employed. This provides for both short and long-term benefits. A dedicated research programme is required if biological control is to be effective in the long-term.

There are insufficient data at appropriate scales to allow projects to set goals. Research and monitoring is required to direct and support the programme in its attempts to restore ecological functioning and biological diversity. At present the impression is that research and monitoring lacks coordination and planning. An independent research and monitoring function is envisaged.

Projects seem to derive their focus from the need and urgency for social upliftment. Implementation is not planned to optimise ecological and biological diversity conservation within the context of social upliftment.

Recommendations

It is recommended that:

- Restoration of ecological functioning and biological diversity should remain a goal for the Working for Water Programme.
- A strategic plan for restoring ecological functioning and biological diversity within the context of the Programme should be drawn up at national and provincial level.
- Projects should have clearly stated achievable and quantifiable goals for restoring ecological functioning and biological diversity.
- The Department of Environmental Affairs and Tourism should be accountable for the restoration of ecological functioning and biological diversity within the Programme.
- A wide network from government and private sector agencies with defined roles and responsibilities should be harnessed to contribute to the restoration of ecological functioning and biological diversity within the programme.
- Research on biological control should be promoted as this potentially provides the most cost-effective long-term solution to the problem of alien invasive plant species.

2.3.4 Entrepreneurial development

The imperatives of sustainable rural enterprise development

Two of the greatest challenges facing South Africa at the present time are unemployment, particularly in the rural areas of the country, and the lack of support services and information for those impoverished people who would like to help themselves and engage in entrepreneurial activities.

The recently completed Rural Development Strategy that forms part of the RDP lists some major objectives for rural development as follows:

- Raising incomes of both men and women

- Putting rural people in charge of setting the priorities for developments in their own localities (both for government funding and non-governmental funding in promoting local economic development)
- Increasing production, both agricultural and entrepreneurial.

These objectives have been established against the background that roughly 53% of South Africa's total population of 40,6 million people live in "non-urban" areas. Of these rural people, 85,5% live in the former homelands and the rest mainly in the large farm sector. Much of the country's deepest poverty is located in the rural areas; women-headed households are particularly disadvantaged and three quarters of the children growing up in rural areas are living in households with incomes below the minimum subsistence level. The level of unemployment in the rural areas is estimated to be 40% overall and 54% among the poorest 20% of households. The poorest households not only have very low incomes, but also live under a burden of poor living conditions, low levels of literacy and education, difficult and time consuming access to water, fuel and other services, and few opportunities for gainful employment. Two results of this stand out : one is the high rate of population growth in rural areas; another is the very high levels of undernutrition, morbidity and mortality of children.

BOX 2.15: The need for rural enterprises

- 53% of South Africa's population live in 'non-urban' areas
- 85% live in former homelands
- Much of the deepest poverty is located in rural areas
- Women-headed households are particularly disadvantaged
- Unemployment in rural areas is estimated at 40%
- Unemployment is 54% amongst the poorest 20% of households

Unemployment levels are likely to get higher in the rural areas as service delivery improves in these areas and women in particular are released from the long hours of collection of water and fuelwood, and start seeking income generating opportunities. Hand in hand with the potential of electrification and water reticulation will come the need to increase income to pay for services. Affordability of services in rural areas will depend crucially on increasing access to incomes. All poor households seek to diversify their income sources, including local wage labour, migrant wage labour, farming and other entrepreneurial activity, and social welfare when it is available. A recent study, which includes the large scale farming sector, found that wages make up 41% of

rural incomes, migrant worker remittances contributed 22%, pensions and social welfare made up 24%, agricultural production 6% and entrepreneurial activities 5%. The one area within this group of income generators that offers the possibility of a really significant increase is that of entrepreneurial activity. The wider the range of jobs and activities that are created in an area, the more people can provide services to each other, and the more markets will be created and money will circulate. This is in direct contrast to the present pattern in the rural areas of cash being brought back periodically (weekends and/or holidays) by migrant workers, and being largely spent by household members in the nearest urban shopping complex (operated by the large chains) so that it quickly circulates back to the major metropolitan areas.

Thus, development planning for a rural area must tackle broadly the employment issues through creating opportunities for as wide a range of activities and training as possible. This will allow many households to benefit from increases in productivity in at least some of their activities, and create increased access to the market economy (local, regional, national - and even international with quality products). Great efforts will be required to build a local economy, and links into it, based upon the exploitation of local resources through development of:

- The small farm sector
- Agri-industries and other resource-based production (brick making, small mines, etc)
- Tourism and ecotourism
- Government programmes to develop local infrastructure in a labour intensive manner

All of the paths mentioned above will be enhanced if active steps are taken to increase access to information (particularly about markets), encourage community organisation, and develop a social compact around coherent, widely agreed development plans.

BOX 2.16: Cautions

- The failure rate of rural enterprises has been so high that over 80% of families have no value added activities
- There is practically no cash circulation in rural areas. Cash leaks quickly back to major metropolitan areas
- There is a lack of cash in rural communities
- Great efforts will be required to build a local economy

Market opportunities (including tourism/ecotourism) call for production/enterprise development. Until now agencies of all kinds have promoted production and people have tried to make a living

through vegetable gardens, small trade and manufacturing (sewing, knitting, etc). The failure rate has been so high that in many remote areas (best suited to ecotourism) over 80% of families have no value added activity. Such areas spend remittances and pensions largely in the old white towns. The main reason for the regular failure of small initiatives to be productive and survive is that there is practically no cash circulation. After a few months of production, the dependence on local markets and lack of cash in the community cause them to stop. Markets, such as an influx of tourists who bring cash into the area (the availability of which, in turn, stimulates local production and marketing), tackle these fundamental flaws.

Three factors will be crucial in allowing rural people to progress beyond `survivalist' production : these are (a) information on costs and sources of inputs, and on market opportunities for selling products, attracting tourists, etc; (b) aggressive pursuit of these markets; and (c) financial services (access to credit, savings facilities, transmission facilities, etc).

Only 14% of rural African households claim to have some level of savings; to date, access to credit for agricultural or entrepreneurial development has been very limited. The introduction of financial services to the rural poor is thus essential for the development of significant entrepreneurial activity.

BOX 2.17: Three crucial factors

- Information
- Aggressive pursuit of markets
- Financial services

The RDP Rural Development Strategy document maintains that in addition to the limited access to credit, other restrictions on entrepreneurial development in the former homelands emanate from the limited opportunities for education and training, the limited agricultural base, the monopolistic ownership of marketing chains and industry, and the quick loss to those areas of funds sent home by labour migrants through chain stores. This leaves little spending power to encourage the development of the formal and informal sectors. All the restrictions on entrepreneurial activity apply in greater force on women. They have had restricted access to land, finance, information, training and markets. They face most of the drudgery from the collection of water and fuelwood, from childcare and care of the old and infirm, and from difficult to access services like clinics; they have lower literacy. Nevertheless, it has been established by

the Department of Trade and Industry that the great bulk of small-scale enterprises are run by women. Thus, the greatest challenge and opportunity in rural development comes from the empowerment of women; their involvement in ecotourism ventures is one way of achieving this. There is a need to release and support rural entrepreneurship in general and, in the context of sustainable development, ecotourism in particular.

The Programme could be used to effectively show how impoverished rural communities can be encouraged and helped to make use of a natural environment which they inhabit (that is, land outside proclaimed nature reserves) for the purpose of generating needed income whilst at the same time conserving the valuable components (wildlife, natural vegetation, soils, water, etc) of that environment so that future generations may enjoy it and continue to use it for the creation of wealth. It is an exercise that must have research, demonstration, training and practical economic development components combined into a systematic and integrated approach to tackling (testing and learning from field experience) two of the most critical problems (environmental destruction and debilitating poverty) presently facing less developed communities throughout South Africa. Very importantly, the programme should focus on learning and demonstrating the potential for meaningful innovation, and its widespread replication, in respect of natural resource based rural enterprise development through the setting up of site-specific demonstrations.

Promoting entrepreneurial development through the Programme

It is recorded in the 1996/1997 annual report on the programme, assembled by DWAF, that over 8 300 jobs had been created through the Programme at the time the report was written. One of the most important objectives of the Programme is stated to be to go beyond merely creating jobs to a situation of empowering people with the skills needed for them to become independent contractors. This is being achieved by a progression through a number of clearly defined stages from daily wages, through piece-work, to open contracts. Four projects have already progressed to the contract work stage, while a further five projects are at the piece-work stage. It is apparently intended to implement piece-work in all the projects in the next financial year.

The creation of viable secondary industries is described as being an important objective of the Programme. After a slow start, a few small-scale secondary industries are getting off the ground; these include the production of charcoal and building materials, and the utilisation of wood for rehabilitation purposes (for example, in the stabilisation of river banks).

TABLE 2.15: Secondary Industries initiated through the Programme. F van der Heyden – personal communication

	Firewood	Charcoal	Building & Other
Fynbos (W Cape)	R76 247 (588 881 pieces)	-	DroppersR1 360 – 1000 poles Poles R15 155 – 146 m^3 Saw timber R19 125 – 516 tons Pulp R466 – 7 tons
Tsitsikamma (W Cape)	Produced and taken out with trucks	Investigating the potential For a kiln	Used for building local shelters
Kouga (E Cape)	Firewood used by community (R120/tonne)	Charcoal is produced by this project	Droppers and poles Woodchips supplied by CTC who export for manufacture of polyester
Keiskammahoek	Community uses wood	-	-
Mpumalanga	1000 bags/month @ R4/bag	2 000 bags/months @ R4/bag	Pole yard supports 3 people, portable saw currently being investigated
KwaZulu/Natal	Firewood used by community	Related charcoal Industry at Dukuduku, Attempt within project Not successful	-
Levuvhu	-	-	Large trees used as saw-wood by landowners – rest of material mostly weeds

A really significant effort is being made to establish secondary entrepreneurial activities as part of the Programme in the Eastern Cape in the Kouga Project. The reason for this seemed to be that the Project Manager is not only well versed in conservation matters but also in the principles of business management.

In response to the question as to whether the expenditure on the Programme is justified in terms of the socio-economic return (discounting that obtained from water conservation and biodiversity enhancement) being obtained in terms of actual jobs created and future employment opportunities being developed, it can be argued that there is a short-term benefit in so far as that money is trickling into rural communities.

Quite clearly, creating jobs through wage labour is not nearly enough, particularly when, as is the case in the Programme, the work available is essentially of a short-term nature; when the alien vegetation has been cleared, the jobs will no longer exist.

For the social benefits to be significantly enhanced, there is a need for the Programme to provide training for the development of, for example, entrepreneurs who (a) cut down trees in gardens and municipalities, and (b) manage small-scale agricultural and forestry projects. Entrepreneurial training is emphasised in the Kouga and Mpumalanga projects.

There is a need to re-emphasise initiatives within the Programme that can lead to disadvantaged people employed in the Programme finding long-term employment. Such initiatives include, for example:

- Support (training - including adult literacy classes, institutional development, distribution of information, etc) for those servicing the programme through the provision of equipment, transport, food, day-care for young children, training programmes, administration, and the maintenance of equipment and roads.
- Support for those utilising the wood for charcoal (for export), crafts, furniture, building materials, erosion control, fuel-wood and road-side sales.
- Support for the industries (owned and managed by local people) that can develop as a result of the removal of the aliens, such as trading in wild flowers (veld picking as well as the cultivation of flowers on land cleared of invading aliens - the flower component of the fynbos in the Cape presently has a value of R65m), herbs, thatching materials and medicinal plants, as well as making land and water available for agricultural options, such as grazing for livestock and vegetable production. The Agricultural Research Council can help wild flower growers by rooting cuttings from the veld and then returning these to small growers.
- Support for the potential ecotourism and land care components of the Programme, for example, the building of hiking trails and erosion works, and possible work as guides/interpretation officers, as well as extension work.
- Extension of activities that are now becoming additional parts of the Programme. Thus, the 'high altitude teams' used for eliminating aliens in inaccessible places could be trained for mountain rescue work and for fighting fires.

There is a need for a rural enterprise development strategy to be compiled for the Programme overall as well as for each individual project, and such strategies must dovetail with national and provincial initiatives in this vitally important economic development sector. Such strategies should give attention to:

- The development of secondary employment opportunities through entrepreneurial development.
- Training (provided by qualified trainers, preferably from commercial training bodies).

- Information distribution through local information (business development) centres that could be run as income generating enterprises by local people.
- Effective networking of all bodies (government, non-government and private sector) that should be involved in rural enterprise development.

Conclusions

To date, the development of secondary industries associated with the Programme has been insignificant, partly because of its short life span and partly because such development has not been looked at strategically and planned by entrepreneurial development experts. Those industries that have been established or are in the process of being established appear to be offering opportunities for business people from elsewhere to make profits through their association with the Programme, which could have provided opportunities for local people to own and manage the enterprises. Several examples were encountered in the project areas of individuals who had already or were about to move into full-time jobs elsewhere in which they were going to utilise the skills they had acquired in their work with the Programme; this is a very encouraging development and just what the Programme wants to achieve in terms of socio-economic advancement of the people that it aims to help.

Recommendations

There is an urgent need for a Programme strategy and management plan to be drawn up by people with training and experience in business management and resource economics (with a knowledge of ecological economics - the valuation of natural resources and ecosystem services - and common property resources management in a developing world situation).

Consideration should be given to drawing on the experiences of common property resources management in other countries, for examples, in Nepal, where, with the assistance of Australian expertise, forest areas have been handed over to local communities to manage, conserve and benefit from on a sustained use basis.

Consideration might well be given to making use of the services of an agent that specialises in enterprise development for promoting and managing the entrepreneurial development component of the programme. The Triple Trust Organisation, with its Headquarters in Mowbray, Cape Town, is an organisation that has achieved considerable success in the area of empowering people through enterprise development.

An in-depth feasibility study should be conducted, by entrepreneurial development consultants who have a good understanding of the dynamics of rural enterprise development in the South African situation, into ways and means of integrating the Programme in, and thereby contributing more meaningfully to, a comprehensive rural enterprise development programme in South Africa.

BOX 2.18: Recommendations

- Develop Programme strategy and management plan
- Make use of services of an agent that specialises in enterprise development
- Develop community management systems for common property resource areas (eg State Property)
- Augment felling of alien invasives with land rehabilitation particularly in areas of need
- Establish Information Centres to promote social upliftment and entrepreneurial development
- Develop holistic training programme.

Consideration should be given to the possibility of directing some of the available funds to a programme of planting appropriate vegetation in the highly populated rural areas of the former homelands wherein there is a desperate need to create employment opportunities, conserve the soil through covering bare land with vegetation, and make available water to communities that often struggle to find any water at all.

The Communications project within the Programme should give attention to the establishment of a comprehensive information distribution system for individuals working in the Programme, as well as for the communities from whence they come, that deals with all aspects of the Programme itself and, most importantly, with the secondary benefits and entrepreneurial opportunities arising from involvement in the programme. This might best be achieved through the establishment of Information Centres equipped with modern information technology equipment and software so that people can access needed information directly and quickly and communicate with the outside world via telephones, fax machines and E-mail. Training could also be provided at these centres, making use of computer based training methods where appropriate. Significant investment in a comprehensive, multi-faceted information distribution and training programme would be a cost effective means of promoting the social upliftment objectives of the Programme.

Training courses that will provide the staff of project implementing agents with needed skills, particularly with regard to business management, should be identified so that all project promoters can be equipped with the necessary skills to run the projects.

2.3.5 **Research**

Introduction

The threat posed by alien invasive plants was recognised as long ago as 1888 (MacOwen in Stirton 1978). Much of the early motivation for removal of alien invasive plants was directed towards conservation of indigenous flora, particularly the fynbos. It was only later that the effects of afforestation and colonisation of the landscape by invasive species were acknowledged as a threat to security of water supplies (Wicht, 1945). Even more recent is the growing awareness of the declining flow of goods and services to the rural poor consequent upon transformation of already pressured land by alien invasives.

Water Loss

The relationship between expansion of alien invasive plants and water supplies lies at the heart of the Working for Water Programme. Research, world wide, on the effects of afforestation on water supplies has demonstrated convincingly that replacement of low canopy vegetation with more dense taller vegetation causes a reduction in stream flow (Bosch and Hewlett 1982). A logical extrapolation of this finding is that where alien tree species invade vegetation of lower, less dense character, reduced stream flow will result. Kruger (1977) reported that invasions of fynbos by alien tree species would probably reduce runoff (expressed as rainfall equivalent) by 350mm in catchments at Jonkershoek (Stellenbosch).

Whilst the general relationship has been confirmed in a number of studies there is reasonable cause for caution (Box 2.19) in its application within the Working for Water Programme (Water Loss and Alien Invasives, this volume). Projected water savings can be challenged. Research is urgently required to substantiate or refute claims on water saving.

BOX 2.19: Reasons for caution when extrapolating water savings in the Working for Water Programme (Water Loss and Alien Invasives, this volume)

- The approach to estimating water saving benefits
  - does not have universal applicability
  - does not recognise wide variation in site characteristics

- Key issues
  - scale effects : regional versus local
  - benefits in arid areas
  - benefits in wet season where flows are not impounded
  - water use characteristics of different species
  -
  - water use characteristics of large riparian species

Social Upliftment

A primary concern in the social upliftment sector of the programme is that it is not yet making effective use of existing knowledge and understanding in respect of both human development and business development. The Programme provides unique opportunities to develop national awareness and understanding of how these can be achieved cost-effectively and efficiently.

Social upliftment and stability cannot be achieved under conditions of economic and environmental instability. The WFW operates at the nexus of these three imperatives for sustainable development. It is arguably the only national endeavour that attempts to do so. If therefore provides a crucible for fusion and innovation. This can only happen when people have access to information and are enabled (support systems and expertise) to communicate. The Communications project is too narrowly conceptualised and structured to achieve this. Research is necessary to understand the nature of the interactions and opportunities and to design appropriate support systems and training programmes (refer Chapter 2.2 and 2.3.4).

Environmental restoration

Alien Plant Ecology

For the control of invasive plants to be effective the rate of clearing must substantially exceed the rate of spread. Understanding the dynamics of invasions is a prerequisite of being able to reliably estimate the likely rates of expansion.

Global concern for the impacts of biological invasions led to the United Nations Special Committee on Problems of the Environment (SCOPE) to initiate research on the subject. South African scientists produced a synthesis (MacDonald, Kruger and Ferrar 1986) entitled 'The ecology and control of biological invasions in southern Africa'. This synthesis, heightened awareness and the Department of Environment Affairs funded further research on the effects of alien plants on water use in the Cape region. In this study a model was developed to simulate the growth, spread and water use of alien plants in a fire-prone landscape (Le Maitre *et al* 1996). Key findings are shown in Box 2.20.

The extent to which the assumptions inherent in this study have general applicability is unknown. Consequently, extrapolations to a national scale are uncertain. Rates of spread are important inputs into strategy development and feasibility analysis. Further research is required.

BOX 2.20: Simulated invasion of the Kogelberg area by alien species (Le Maitre *et al* 1996)

- Alien plants invaded about 40% of the grid cells within 50 years.
- Cover of alien plants increased from an initial estimate of 2.4% to 62.4% after 100 years.
- Invasion of catchment areas would result in an average decrease of 347m□ of water per hectare per year over 100 years resulting in average losses of 30% of the water supply to the City of Cape Town.

Biological Control

The need for an integrated approach to control of alien plant invasion was acknowledged in the 1970's and 1980's. 'Integrated control aims to combine mechanical removal of trees with chemical methods to ensure that felled trees are killed. At the same time, biological control insects or pathogens are introduced to the sites to ensure that the invasive abilities of surviving

plants is reduced' (van Wilgen *et al* 1997). Considerable progress has been made (Chapter 2.3.3, Table 2.1.3) and expertise is available in the country. Unfortunately the momentum was lost in the late 1980's and it has yet to be fully regained.

It is widely appreciated that biological control offers considerable promise for cost-effective long-term solutions to control of alien plant invasives. Given concerns expressed by the timber industry that biological control could have disastrous consequences it is evident that careful attention will have to be given to the design of research and implementation of biological control.

Rehabilitation

The audit for the alien plant control programme (Agricultural Research Council 1996) identified a number of issues where there was insufficient understanding to direct rehabilitation activities. These relate to the management of fuel load and disposal of felled timber; rehabilitation of riparian areas; stream bank stabilisation; and dynamics of regenerating indigenous vegetation. Of these river bank stabilisation probably has the greatest need for research.

Conclusion and Recommendation

Achieving sustainable development requires that social, economic and environmental issues are addressed simultaneously. This cannot be achieved with the conventional approach to funding and design of research projects and programmes. Increasingly we appreciate that our greatest deficiencies in understanding, and the greatest urgency to become informed about, are the interactions between social, economic and environmental issues. Experience gained from the WFW could have wide application in other projects in South and Southern Africa.

It is recommended that a transdisciplinary, inter-institutional research programme with a five-year time horizon should be designed and implemented. Its purpose might be three-fold:

- develop the social, economic and environmental understanding necessary to promote sustainable rural development within the context of WFW
- develop the understanding and methods necessary to optimise sustainable development opportunities within the context of the WFW
- develop the understanding the methods necessary to bring alien invasive plant species under cost-effective and efficient control.

2.4 ECONOMIC REVIEW

Costs

Direct labour is employed for clear felling trees and shrub vegetation either in selected riparian zones (about 30 m on either side of a river) or in the famous fynbos region where control of invasive alien vegetation is absorbing well over 3000 workers at present. After the initial clearing several follow-up operations are required to get rid of regenerative growth the duration of which is well established in pines (4 to 5 years) but not in wattle infested areas where seedbanks in the soil are considered a serious threat for 15 to 20 years after clearing. Workers are provided with protective helmets, clothes and boots. First aid kits and mobile telephones are available on site. Hand tools, motor-driven chainsaws and brush-cutting tools are used by a crew of 20 with one headman or headwoman. Mountaineering equipment is given to the high altitude teams who climb the steepest peak to cut down any alien tree in the fynbos region to avoid seed infestation. Specialist training is provided to ensure compliance with the Occupational Health and Safety Act.

The cost comprises labour, management, equipment, material (e.g. herbicides, seed for rehabilitation of cleared areas), fuel, transport, training, public relation expenses. Total expenditure in 1996/97 was R 70.34 million with over R 50.00 million (71 %) spent in the Western and Eastern Cape Provinces. Cost of programme management was R 1.78 million (2.53 %), which is very low and rather symptomatic of managerial constraints prevailing in the Programme.

Records maintained by the Cape Nature Conservation, one of the major implementing agents of the Programme, reveal that in 1996/97 R 40.22 million was spent to clear an area of 31,533 ha resulting in specific costs (incl. overheads) of R 1 275 per ha. Well over 407 000 labour days were considered to be productive and over 25 000 labour days allocated for training, which is rather high but apparently justified as people still have to acquire basic skills. Stoppages due to adverse weather conditions, some of which are allocated to training, are included in this figure.

Specific clearing costs range from R 100 to R 5000 per ha depending on species and density. Although the use of crawler tractors with bushclearing equipment might be appropriate for dense vegetation on fairly flat land when manual clearing operations are very demanding, this option is not under consideration as it would replace labour and cause damage to the soil and the indigenous flora remaining in such thickets.

The impression was gained during the evaluation that efforts are made by management to keep expenditure under control and to achieve a uniform output per unit area with the aim of lower

clearing costs. Contract work will be more economical in future. Although the private estate sector (e.g. SAPPI) claims much lower clearing costs, it should be borne in mind that a fairly large programme of this nature, operationalised in a very short time, cannot compete with commercial enterprises employing experienced staff and skilled labour in permanent positions. The wide variation in basic wages for unskilled labour, ranging from R 16.00 to R 30.00 per day is remarkable. It reflects the variation of opportunity costs of labour across the country.

Benefits

While the costs are well analysed and expenditure for the entire Programme and each project is projected in an annual budget for one year, no efforts are being made to quantify benefits. Important data, such as incremental stream flow due to the project or recovery of indigenous vegetation, is hardly collected. Positive effects anticipated are described but not quantified. Reference is made quite frequently to experiments carried out in the past but the results ought to be screened and applied. In the opinion of the evaluation team, the quantification of direct benefits is urgently required to justify the investments made, as indicated below. There is no doubt that substantial benefits accrue to the poor, as stated in Chapter 2.2 (Social Review). These are combined with intangible efforts of social significance.

It is rather difficult to determine the value of water for irrigation to quantify incremental benefits because water is one of the input factors leading to a specific output. Other contributing factors are quality of seed or plant material, fertiliser application rates and timing, pest control, weed control. The effect will be much greater in, for example, well managed orchards under drip-irrigation with, say, a gross diversion requirement of 8000 m^3/ha than in general food crops (cereals, pulses) where inefficient surface irrigation schemes might use twice as much water.

The value of water for domestic use is well-established in urban demand centres. For instance, Umgeni Water, the leading public utility in KwaZulu/Natal in charge of large storage dams and treatment plants, recently quoted R 0.66 per m^3 of raw water.

Restoring biodiversity could either be a secondary benefit or even the primary benefit depending on specific objectives of a particular project. Its value may be assessed by estimating the quantities of flowers and herbs extracted for domestic use and export from a specific area in the fynbos region. An attempt has been made to value the goods and services gained by society from fynbos (Higgins *et al* 1997).

Economic Justification

Few attempts have been made by DWAF to estimate costs and benefits on an annual basis over a period of say 20 years, and to carry out a cost-benefit- analysis, which is surprising. Given the amount of money so far invested and with more being expected from national and international donors, sound development planning and economic justification may be an issue for some agencies considering providing financial assistance.

It is believed that various projects are under implementation where no immediate water shortage has been identified. To **demonstrate** the effects of prompt and delayed accrual of incremental water benefits, model calculations are presented below. It is assumed that within a quaternary catchment of 80 000 ha, riparian wattle vegetation extending over an area of 10 000 ha would be cleared within 4 years (2 500 ha per year). Specific cost per ha is taken as R 1200 for initial clearing and rehabilitation, R 450 for first follow-up and R 220 for subsequent follow-ups. The increment in stream flow is assumed to be 100 mm net (1000 m^3/ha) only, taking into account that after removing the invasive alien trees, the grass vegetation that is to be established also has a specific evapotranspiration requirement. The value of water to be used for domestic consumption is R 0.66 / m^3. In Table 2.16, four scenarios are presented, Case " A" being the base case with immediate accrual of benefits from the area cleared. In Cases "B", "C", and "D" the delays are projected to be 5, 10 and 15 years respectively. The cash flows (benefits minus cost) were discounted at 8% to arrive at Net Present Values (NPV). NPV for "A" is R 33 million, for "B" 15 million but for "C" and "D" the benefits are negative.

BOX 2.21: Caution

- The Programme is very sensitive to lags in accrual of benefits
- Irrigation tariffs need to be reviewed to determine economic thresholds, i.e. maximum payment capacity of farmers
- Water tariffs for domestic use may be too low in rural areas to cover clearing cost
- Reliable assessment of net incremental water yield is urgently required
- Clearing and follow-up costs need constant attention

The same model is applied to irrigation to determine if water used for crops is a paying proposition. If water were valued at R. 0.10 per m^3 it would be equal to a tariff of R 800 per ha for an application rate of 8000 m^3/ha. Such a tariff seems to be on the high side if we compare it with the highest tariff apparently in force (R 726 per ha) for water from Albasini Dam in Northern Province. The results presented in Table 2.17 show that NPV is negative in all cases studied. Given the clearing costs (R 1200 /ha), follow-up and management costs and a net incremental water yield of 1000 m^3/ha as stated, the value of water for irrigation would have to be increased to R 0.30 per m^3 to arrive at a positive NPV for Case "A". "B" to "D" would still be negative (see Table 2.18). Such an increase of 200 % would badly affect farm incomes and the viability of crop production under irrigation.

It is important to distinguish between financial prices and economic prices. The formers are the actual market prices and rates, as applied already. The resulting financial analyses are of considerable importance to DWAF.

Economic prices are the values that society would be willing to pay for a good or a service. Economic prices should be applied in future if one has to determine economic efficiency, i.e. conditions under which the value of a society's consumption will be maximised over time.

Recommendation

It is recommended that all projects should be reviewed and screened to determine their economic viability. Project design, planning and impact assessment must be given top priority. Various activities involved (Outline Terms of Reference) are mentioned in Chapter 2.3.1 of this report.

INSERT TABLE 2.16

INSERT TABLE 2.17

INSERT TABLE 2.18

2.5 **FINANCIAL ANALYSIS**

Nowhere in the information made available to the Consultant, with the exception of the MBB Study on the Midmar dam, was a financial analysis of costs over time presented. In the absence of strategic planning and without proper targets set and goals quantified over a period of 20 years, it is rather premature to estimate the expenditure likely to be incurred, and to construct funding models as required by the terms of reference.

The projection of DWAF to clear all the areas of the country that are infested with invasive alien plants (approximately 1.71 million ha) would absorb capital to the extent of well over two billion Rand for clearing only, excluding follow-up, management expenses, physical and price contingencies. The worst scenario presented by DWAF assumes delay in clearing for 15 years during which 2.12 million ha of infested areas would have to be cleared at the cost of almost four billion Rand.

The need to clear areas on such an extraordinary large scale has yet to be established. Biological control may become a very significant factor in reducing infestation. There will be regions where population densities gradually build up and timber and firewood demands become high enough to take care of invasions. Production of charcoal for domestic use and for export could lead to large-scale use of alien plants, once production and marketing is properly organised. It is acknowledged that land, particularly in areas of rural poverty should be productively utilised. There is no support system in place to ensure that land from which alien plants have been removed will be managed for productive and sustainable use.

Water shortage in South Africa is currently estimated to be one billion cubic metres (see Chapter 1). With an annual increase in demand of 3%, the shortage could theoretically reach 1.34 billion cubic metres ten years from now. On the other hand, higher water tariffs and other interventions might reduce consumption levels considerably. If we assume that clearing of invasive alien plants would be done by the public administration to the extent of 700 000 ha and 300 000 ha could be cleared by rural deforestation at zero cost within ten years, the gain in water could be as high as 1.00 billion m^3, which might be adequate to make up for the water shortage envisaged.

Two scenarios are presented in Tables 2.19 and 2.20. High clearing target for 1 million ha within ten years, for which total cost would be R3.65 billion and a low clearing target for
700 000 ha estimated to cost R2.48 billion. The latter corresponds to the presence performance level.

To bridge three years before funds are available from increased water tariffs in 2001, R500 to 600 million would be required. As costs are influenced substantially by site factors, these estimates are subject to modification when the result of strategic planning is available.

INSERT TABLE 2.19

INSERT TABLE 2.20

2.6 **SUSTAINABILITY**

'Sustainable development should integrate social, environmental and economic sustainability and use these three to start to make development sustainable' (Goodland 1995). It is useful therefore to consider sustainability of the Working for Water Programme in these three inter-related contexts. However, before doing so it is informative to consider whether the 'do nothing' option is sustainable.

'Do nothing' Option

South Africa presently has high levels of unemployment and poverty, particularly in rural areas. There can be no sustainable use of natural resources under such conditions of social and economic instability.

The urgency is such that all reasonable options should be carefully considered. The consequences of alien plant invasions and poverty-driven land degradation provide opportunities to create employment, promote social upliftment and environmental restoration.

Current estimates (Department of Water Affairs & Forestry Business Plan 1997/8) indicate that approximately 1 709 000 ha of land is invaded to varying degrees with alien plants. If no control is exerted this is expected to increase to 2 124 000 ha. These invasions are largely restricted to those parts of South Africa where extensive land uses are practised (e.g. mountain catchments, range lands and communal lands). The consequences for land degradation are therefore disproportionately large. In much of the country the rural poor will suffer most from the reduced agricultural productivity and water security associated with invasions. The poor will get poorer as the flow of goods and services decreases with expansion of invasive species.

South Africa is a water poor country. Surface water is distributed unevenly in time and space and access to water is unequal – '12 million people do not have access to an adequate supply of potable water' (Department of Water Affairs and Forestry 1994). The implications are that every effort should be made to reduce water wastage to a minimum, and to minimise the risks of water shortage. This is particularly true for the millions of rural people still dependent on springs, streams and rivers for water. Small savings can make a meaningful contribution to alleviation of hardship amongst rural people with meagre demands for water.

There is poor coincidence between centres of biodiversity and conserved areas (Cowling and Hilton-Taylor 1994). Invasion is taking place in places where it poses the greatest threats to biodiversity. Environmental integrity is being compromised and the government is not able to discharge its responsibilities in the context of the Convention on Biodiversity.

The Department of Water Affairs and Forestry (1994) is promoting environmental integrity of river ecosystems through allocation of water to sustain natural processes. In unregulated streams and rivers even relatively small increases in flow and longer periods of flow can contribute in a meaningful way. Typically instream flow required to sustain the natural environment of river systems is of the order of 10 - 15% of mean annual runoff. The projected savings of water through control of alien invasives if realised, can make a meaningful contribution to meeting instream flow requirements and alleviating environmental stress, which prevails at this time.

Indications are that for social welfare and environmental reasons the 'do nothing' option is undesirable. The Programme has demonstrated that removal of aliens can deliver social welfare benefits at a time when they are desperately needed. There is compelling reason to implement a programme to bring alien invasives under control. Evidence (e.g. MBB 1997) indicates that under certain circumstances it can be cost-effective to act now rather than later.

It has been suggested that 'between 15 and 20 years will be needed to clear the backlog of invaded areas at a cost of approximately 2.2 billion rand' (Department of Water Affairs & Forestry Business Plan 1997/8). An alien invasive control programme can therefore invest substantial money over at least 20 years into rural economies with little or no adverse consequences. If it is accepted that alien species must be brought under control the question remaining is how best to do it.

Social Sustainability

Goodland (1995) stresses that social sustainability is 'achieved only by systematic community participation and strong civil society'. The Working for Water Programme places strong emphasis on community participation and enhancing capacity to strengthen civil society (Social evaluation, this report). The issue is not so much whether the Programme is doing the 'right things' as to whether it is able to address them for long enough for them to be effectively internalised and thereby bring about long term benefits.

Alien invasive plants are widespread. The intention is to spread the social welfare benefits deriving from the programme widely. Communities have an opportunity to benefit through

engaging the Programme in controlling alien plants in their vicinity. A consequence of this is that opportunity to benefit will be short term – once cleared and stabilised there will be little further work.

With the information available it is not realistic to project either the number of jobs and the duration of a job. It is also not practical to project training and entrepreneurial development.

There is good cause for concern that unless the Programme links 'the communities, with whom it will have short association, to social upliftment initiatives with longer term horizons, it may well leave behind a legacy of disillusionment and frustration.

If the Programme is to optimise its contribution to social sustainability more attention will have to be devoted to identifying and addressing those issues which will have the greatest long-term beneficial impact on sustainability. Research and strategic planning are necessary.

Environmental Sustainability

The stream of goods and services to society is reduced through alien plant invasion. And, the less diverse ecosystem that results decreases environmental sustainability. In general terms, therefore, bringing invasive alien plants under control enhances environmental sustainability.

Two concerns arise: can potentially negative impacts during removal of aliens be effectively mitigated; and can alien invasive species be controlled in the long-term in an affordable way. The latter concern is addressed under economic sustainability.

The process of alien plant removal involves the use of small teams. A consequence is that relatively small areas can be cleared at any time. And, the method of control (cutting/clearfelling) does not breach the integrity of the soil surface to any significant degree. The combination of relatively small cleared areas, undisturbed soil and trash accumulating on the surface mitigates against soil erosion.

There is however instances, particularly where dense thickets have been cleared, where brush has been burned and on riverbanks, where erosion has been cause for concern (Agricultural Research Council 1996). Rehabilitation procedures are applied (Biodiversity and rehabilitation this report) but research is necessary to improve and develop new procedures for particular situations (Agricultural Research Council 1996). There is no evidence in the Programme to

suggest that the procedures being applied for alien plant control are reducing environmental sustainability in any significant way.

The follow up procedures accord with standard forestry practices. Considerably fewer disturbances result during follow-up and there is no evidence that environmental sustainability is compromised (Agricultural Research Council 1996). Biological control offers considerable potential for sustainable control of alien invasive plants. Research is required before these can be achieved.

It can be concluded that control of alien invasives substantially improves maintenance of 'natural capital' (Goodland 1995) and thereby contributes to environmental sustainability.

Economic sustainability

The analysis of Higgins *et al* (1997) indicates that well managed fynbos systems provide many valuable ecosystem services. The value of these services substantially exceeds those accruing from degraded mountain fynbos. They conclude further that 'since the cost of management is so small relative to the value that these services provide it is clear that proactive and effective management of these ecosystems is justified'.

There are no similar studies from other parts of South Africa. Caution should attend extrapolation from the fynbos to other natural ecosystems. But, even if the stream of benefits was substantially less, it seems reasonable to assume that they would be greater when managed (aliens removed). This gains some credibility from the fifteen-fold difference between fynbos under poor management and low valuation to that under good management and high valuation.

It is important to draw attention to the assumption that the rehabilitated system will be under effective and good management. Whilst this may be the outcome in certain areas (mountain catchments and private land) where ownership and responsibility are clear. In other parts of the country, particularly in communal areas, achieving effective and good management is fraught with difficulty. Here it could be that neither economic nor environmental sustainability is achieved at least in the short-term. If the proposed link between the Working for Water Programme and the Land Care initiative of the National Department of Agriculture[2] is realised then prospects for economic and environmental sustainability would improve.

[2] Dr G Preston Personal Communication

Maintaining cash flow to sustain effort for long enough to bring alien invasives under control is a concern. At present much of the funding is short term and grant based. These funds are allocated to projects spread over the country with no attempt to project and secure the cash flow required to achieve a stated goal (e.g. alien invasive plants under effective control in sub-catchments). Thus there is no certainty of sustained control of alien invasive plants being established in most if not all, of the projects.

The desire and need to distribute benefits widely is understood. But, it does place all projects at risk of being unsustainable under present funding procedures.

The benefits of the Programme are wider than water supply. Consequently the Programme should have a broad funding base. The move towards raising funds from a levy on water use will contribute very significantly to sustainability of the Programme. This would be enhanced if other government departments contributed.

Recommendations

Successful implementation of the Programme will contribute in a meaningful way to environmental, social and economic sustainability.
It is recommended that:

- Ways should be sought of optimising the contribution of the programme to social sustainability.
- Research is required to improve rehabilitation and to advance the use of biological control.
- Research is also required to improve understanding of the value of natural systems.
- Ways and means have to be found to promote sustainability in cleared areas under communal ownership.
- The programme should strive for broadly based funding and active participation for affected government departments and non-government organisations.

2.7 RISKS AND UNCERTAINTIES

The Programme has a very high profile in government and society. It is championed by the Minister of Water Affairs and Forestry Kader Asmal, and it has been the recipient of a number of awards. There is considerable individual and corporate credibility at stake.

Expectations

If expectations of the Programme are not met there will be significant loss of credibility. Probably the two most important expectations are that additional water will become available and that meaningful social welfare benefits will accrue to marginalised communities.

The projected benefits of water savings are questioned by knowledgeable hydrologists and caution is urged (this report). If the benefits are 'over sold' and expectations are not met there will be a loss of credibility in professional and public circles.

The Programme has raised expectations in communities. It is very important that these expectations are realistic given the context of the Programme and that decommissioning of projects is carefully planned and implemented in a considerate manner.

Cost

The South African taxpayer will have to meet most of the costs of the Programme. As annual cost rises expenditure will come under increasing scrutiny. The worst case scenario is where costs are under estimated and benefits are over estimated. At present costs are estimated on very weak information. Urgent attention should be directed towards strategic planning and feasibility analysis.

Management

There is an understandable wish to maximise the amount of clearing and the welfare benefits. Concern has been expressed that this has been at considerable personal costs to managers. Inefficiencies result from overextended staff. The hidden costs of internalising work instead of using efficient and effective consultants are underestimated.

The Programme is at risk because although management is enthusiastic and dedicated it is not as efficient and effective, as it should be for a programme of this size.

Planning

Partly because of the origins of the Programme and partly because of management style, planning is a serious deficiency. This has repercussions right through the programme down to project level. Although daily and weekly work schedules in projects are well planned and managed, projects generally lack planning that will take them to a logical end goal. Since this makes it impossible to estimate costs and benefits and to assess feasibility it is difficult for project managers to convincingly market their projects. If they cannot effectively lobby the programme at a local scale it will be easily discredited.

In communal areas as they are presently structured and managed it is not certain that removal of alien invasives will result in more sustainable land use. Indeed it could be much worse. If it turns out that the consequences of clearing alien invasives leads to poorer land use practices the Programme will be criticised.

Funding

The Department of Water Affairs and Forestry implements the Programme. Ways and means have to be found to bring other departments into the Programme as almost if not totally equal partners. If departments feel marginalised they will not actively support the Programme and they will expect the money to be raised totally from water tariffs. Since civil society sees wider benefits they may not support the notion that all funds should come from water sales.

Conclusion

Important risks attend the Programme in its present form. All of them can, however, be reduced significantly by improved planning and management and adequate funding.

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WORKING FOR WATER PROGRAMME

LOGFRAME WORKSHOP
18th &19th of June 1997

Pietermaritzburg
Kwazulu Natal

Final workshop report by
Tegan Brophy

Table of Contents

1.) Workshop Objectives and Process

1.1) Objectives

The Work for Water Programme is currently being appraised by an independent team of consultants appointed by the European Union (EU) as the preliminary step towards potential funding. The logframe workshop was intended to be a consolidating process resulting in specific project plans, which could be submitted in a proposal to the EU. However, on recommendation by the appraisal team, the format of the workshop was revised to better suit the more immediate needs of the programme.

The revised objectives for the Day one were intended to address the need for the appraisal team to give feedback to the programme members and to allow greater discussion around issues raised. The objectives for the workshop on Day one were to achieve:

1 - a common understanding of the issues/problems and deficiencies in the design and implementation of the Working for Water Programme

2 - practical solutions and guidance on how to improve the current structure and implementation procedure

3 - an outline of a strategic plan for the programme including proposed project objectives (logframe)

4 - a clear understanding of the way forward

At the end of day one the objectives were reviewed and revised. The participants decided to spend additional time addressing some of the core issues raised in discussion. Rather than applying the logframe to their programme, they felt a greater need to gain an understanding of the general methodology. For these reasons objectives 3 and 4 were changed to:

3 - participants receive a brief overview of the logframe methodology

4 - participants have the opportunity to work towards the restructuring of the programme management and implementation procedure

1.2) Process

The appraisal team and eleven Working for Water delegates attended the workshop. The Working for Water delegates represented both the programme management team as well as project management from 3 provinces.

On the first day, the appraisal team presented a brief review of their findings. A discussion of the results was held in plenary. Key issues raised were grouped
into clusters for further discussion in working groups. These included Strategic Planning for the Programme, Measurable Goals and Monitoring, Feasibility and Project Justification and Management Structure and Implementation. The groups were tasked with detailing the problems, identifying and developing solutions to the key problems and providing recommendations on immediate actions and methods of integration into the current programme. Only three of the identified key areas were discussed. It was decided by the group to omit Management Structure and Implementation in the first round of discussion but to return to it on day 2. Group results were presented.

At the end of day 1 the objectives were reviewed and revised in the light of the results of the discussion.

During the first session of day 2 the facilitator presented an overview of the logframe methodology to the group. Questions were answered in plenary. Following this the group returned to a discussion of Management Structure and Implementation. The programme leader presented an outline of the major issues and then entered into a task of identifying advantages and disadvantages of possible options. This was held in the plenary. The discussion was expanded to address other additional pressing issues. At the end of the day an evaluation of the workshop was conducted.

1.3) Outcomes

The workshop largely achieved the revised objectives.

Objective 1: Participants received feedback from the appraisal team and were given the forum for discussion. This allowed the common identification and clarification of the major issues, problems and deficiencies. The thorough results of the working groups lead to a common understanding of these issues.

Objective 2: Similarly the issues discussed in working groups allowed solutions to the key issues to be formulated and recommendations to be made. The participants felt that more practical guidance could have been forthcoming.

Objective 3: An overview of the logframe was presented to the group. The ensuing discussion demonstrated that the group had some understanding of the main concepts and recognised its applicability to their programme.

Objective 4: The large portion of day 2 was spent discussing the Management issue. Possible options of management were identified and their advantages and disadvantages discussed. No clear solution was reached on the issue of restructuring, however numerous recommendations were forthcoming on how to proceed in the short term. In general the discussion was thought to be useful despite its lack of structure at times.

1.4) Concluding Remarks and Recommendations

Late changes to the general workshop objective resulted in a large number of participants arriving with the expectation of conducting a logframe analysis of the programme. This led to some confusion in the initial stages as to the purpose of the workshop and what was to be achieved in the two days. There was a certain misconception that the workshop was being held to assist the appraisal team. The appraisal team, on the other hand felt that the time could be better used addressing key issues of the programme i.e. their need for strategic planning.

Given the time constraints it was extremely difficult to design the workshop to address the need for feedback, problem analysis, and to give a meaningful introduction into the logframe methodology. For this reason no attempt was made at generating programme outputs in logframe format. Aspects and problems relating to the programme's current objectives were however discussed with reference to the logframe methodology. The appraisal team found the workshop to be extremely useful in gaining a greater insight into various elements of the programme, which would assist them in compiling their review.

As no real practical work was done using logframe, it is recommended that an additional workshop be held should the programme wish to pursue its planning using this format.

Tegan Brophy
19 June 1997

2.) Workshop Results

2.1) Review of Findings of the Appraisal Team (by Prof. Breen)

Positives:
- convincing evidence of water/aliens
- addresses water/biodiversity/welfare/holistic - new learning
- championed by the Ministry of Water Affairs and Forestry
- led by highly qualified/motivated staff
- links between government and private sector
- steering committees play major role in decision making - correct action accountability
- NGOs are contributing meaningfully
- large number of jobs in period of time
- programme's capacity has been developed
- impressed by welfare benefits, nature and response/distribution
- evident empowerment
- women well represented
- can continue towards ecological factors, water/biodiversity
- no evidence of soilerosion problems
- biological control an effective long term method of control

Issues/Problems
- outgrown management systems and capacity for current rate of growth
- independent research and monitoring function not evident
- further research needed (biological control)
- not sufficient use of independent consultants and services
- difficult to come to terms with all objectives and how action was prioritised (and how they link/synchronise)
- lack of evidence of strategic planning at programme and project level
- goals are short term
- no clear explanation of measurement
- business plans not in format required for international appraisal (progress vs. measurable goals)
- no quantifiable, measurable goals and monitoring

Output
- review not full appraisal
- begin strategic planning

2.2) Problem Analysis

2.2.1) Discussion of Key Areas

The participants were asked to:
1. Identify and detail key issues/problems in key areas,
2. Identify possible solutions to key problems,
3. Develop recommendations for immediate action - methods of integration into current programme.

Identified issues/problems in key areas were:
1. Strategic planning for the Programme
2. Measurable Goals and Monitoring
3. Feasibility/Project Justification
4. Management Structure and Implementation

Outcome of Group Discussion:

2.2.1) Group 1: Strategic Planning for the Programme

Main Problems
- lack of evidence of strategic planning
- lack of security
- process is transparent and defendable
- are in position of opportunism as strategy
- management plans in progress - long term
- goals short term
- goals not written and carried through
- project managers have concepts but not available
- to achieve scale of potential - need to access all external resources
- key role players
- integration of government
- maintenance of cleared land, follow-up
- role of Forestry and Agriculture?
- sustainability
- need external expertise
- external communication and training
- internal communication

Departure Point for Detailed Problem Analysis
- Maximise the benefits of the three programme pillars (water, biodiversity and social welfare)
- Unanimity of purpose, internally and from other departments e.g. Environmental Affairs and social welfare, i.e. injection of resources
- Water Affairs getting an unfair deal

Detailed Problem Analysis
a) there are certain key role players that are not on board/misinformed/ territorial/threatened
b) lack of unanimity of purpose internally and externally
c) legislation and enforcement
d) lack of an integrated plan and commitment

e) the agricultural sector (government/farmers) is not an integral part of the programme
f) economic welfare benefits are not quantified and marketed/resource economics
g) being in control of alien invader plants in a sustainable manner
h) insufficient linkages with other related programmes
i) criteria for prioritisation not clearly defined
j) insufficient capacity
k) not maximising the benefit of supportive partners
l) influential critiques and issues
m) wider implications of our actions e.g. wattle industry, including regional considerations
n) insufficient internal communication

Possible Solutions

a) Assess role players, define their roles and responsibilities by clarifying economic, social and welfare benefits and benefits for the role players.
b) Expand funding base beyond DWAF and broaden the allocation.
c) Develop and produce an integrated plan (biocontrol etc.).
d) Develop an appropriate management structure and capacity.
e) Review legislation related to alien plant control and enforcement thereof.
f) Cultivate involvement of supportive partners (including neighbouring countries).
g) Understand issues of criticism and seek compromise.
h) Revise, extend and maximise marketing opportunities of successful projects.
i) Maximise sharing and marketing opportunities.

Recommendations

a) Revise management structure.
b) Identify the capacity needs.
c) Contract appointments with the department and outside.
d) Restructuring the budget and making appropriate allocations to potential partners/role players.
e) Review communication priorities.
f) Develop baseline studies.
g) Review economic appraisal requirements for sustainability

2.2.2) Group 2: Measurable Goals and Monitoring

Main Problems

- no quantifiable, measurable goals and monitoring
- opportunity to develop measurables unique
- independent research and monitoring functions not evident
- further research needed
- lack of baseline data - requires time
- give logic to sites
- help to clarify goals and objectives
- layers of research to clarify lacks of objectives and intervention
- no biological diversity goals
- more details about measurable goals
- quantify water benefits (hard data)
- business plans are not expressed with progress and measurable goals
- social research required
- issue: long-term LTER's
- clarify development lines and goals (HR)
- evaluate predictions in a systematic way
- agricultural potential - objectives/goals
- not enough empowerment at project level to understand basis of action

- measure erosion and restoration

Goals
All goals are at level of project (territory catchment) for duration of project (< 20 years)
The programme and its projects do not have measurable goals, gaps in knowledge are not identified and there is no research programme to fill gaps.

Key issue 1 **Gaps in knowledge (see 2.1.2 - 2.1.4)**
Key issue 2 **Goals are poorly formulated and difficult to translate into measures to judge process (see 2.2.1 - 2.2.3)**
Key issue3 **Baseline data are often missing and monitoring systems are not in place**

Key Issue 1: Gaps in Knowledge

Water:

Existing Knowledge	*Gaps*
Trees use lots of water: - Pines - Eucs	Prosopis Wattles Hakea etc. Indigenous vegetation
Response of small gauged catchments	Extend of invasion and rate of spread.
Something about: Fynbos Grassland Riparian indigenous Forest Poplars	Relationship of water use to site.

Biodiversity:

Existing Knowledge	*Gaps*
Species eliminated by aliens	Rehabilitation
Structure is changed - water use, fire, erosion	Thresholds of loss
Function is changed	
Hotspots at national level are known	Hotspots not known at a local scale

Welfare:

Existing knowledge	*Gaps*
Population numbers Levels of unemployment Economic profiles	• Profiles at a community level: - household numbers - income - (baseline) • Impact of WFW programme on: - gender equality - empowerment - alcohol and drug abuse - health and nutrition levels - (individual vs. community)

Possible Goals

Water:

- To clear the catchment of alien trees over the next 10 years and maintain catchment in clear condition
- Prevent further losses of water (state quantity) and/or increase water through clearing existing infestations (state quantity)
- Assurance of supply, low flows, MIFR (Minimum Instream Flow Requirements)
- Reduce nitrogen levels in streams and groundwater to below 11mq/m^3 (and others - be specific)

Biodiversity:

- Prevent further loss of species (maintenance of viable populations) (Indicator: number of individuals and species)
- Maintain given percentage of catchment under natural vegetation
- Maintain evapour transpiration levels of vegetation below 200 mm/year
- Confine erosion to acceptable levels
- Prevent fragmentation, maintain corridors
- MIFR
- Downstream impact on estuaries

Welfare:

- Provide x jobs
- Specify the number of female, number of < 25 years, number of disabled

- Empowerment
  - training: operations, environmental awareness, management and business skills
- Impact on household expenditure and income:
  - standard of living (nutrition, education and health)
- Payment for services
- Crime levels
- Access to control of resources

Possible Solutions to Key Issues

Key Issue 1: Gaps in Knowledge
- Develop standardised methods to measure water use.
- State assumptions, then set goals, then:
- Formulate research strategy to identify all gaps in knowledge, prioritise them, and design research programme to address them at relevant scales (LTERS, species).
- Develop surrogate measures.

Key Issue 2: Goals Poorly Formulated
- Clear formulation of goals at the project level, with reliable measures to assess progress towards, or attainment of, the goal.
- Goals should relate to the three legs of the programme: water, biodiversity, and welfare.
- Goals should be clearly stated as long-, medium-, or short-term with appropriate indicators.

Key Issue 3: No Baseline Data and Monitoring System
- Identify and document all available baseline data into management plans.
- Link into monitoring systems that are running anyway (clinics, numbers of creches, bird atlas, payment for services (municipalities), national biomonitoring system (SASS scores).
- Prioritise goals and establish minimum strategic monitoring system (mismos).
- Establish minimum set of goals to be monitored at all projects.

2.2.3) Group 3: Feasibility/Project Justification

Main Problems
- management plans in progress have feasibility
- feasibility of individual projects is not established
- baseline - benefits socio-economic estimates
- there are studies on ecological feasibility
- difficult to come to terms with objectives and prioritisation of action
- need national strategy and linkages with programme
- new water act will help to clarify catchment complexity
- identify feasibility indicators for project selection
- many other factors influence justification of areas
- benefit of cleaning aliens is water
- selection process:
  - alien plants
  - capacity to manage
  - water benefit
  - RDP
- need to be able to explain logic of working at any site
- only water aspect is being addressed sufficiently at present

- establishment of second industries
- problem of wood utilisation
- rescue long-term LTER's

Key Issues
3.1.1) Indicators/Criteria for Project Selection
3.1.2) Secondary Industry
3.1.3) What Baseline Data Required
3.1.4) Resource Economics/Cost-Benefit

Criteria for Project Selection
Primary Objective:
* Accessibility, biocontrol, rehabilitation, improvement of catchment stability

* Increased water supply for domestic, agricultural, and industrial use
- where there is high demand for water
- where clearing benefits existing and future Water Schemes
- where rural communities will benefit from streamflow
- where increased water supply will enhance agricultural development
- where clearing will increase water levels in aquifers
- where clearing has the greatest benefit in terms of water (by species)

Secondary Objective:
To improve catchment stability
- where it will benefit species diversity
- where it will contribute to instream requirements of aquatic systems
- where the value of the natural resource is greater
- where clearing will reduce fire intensity and frequency
- relation to areas surrounding (e.g. invasion)
- position in landscape

Third Objective:
To empower and build capacity in previously disadvantaged communities
- where unemployment levels can be decreased
- where capacity building uplift communities
- where secondary industries can easily be implemented

Recommendations for Immediate Action:
- Task group to be formed (include Christo Marais) to prioritise criteria (by October 1997) and design weights.
- All potential new projects should be evaluated against the list of criteria and reviewing existing projects.

Secondary Industry
Issue: - Secondary Industries are not established on a large scale
- One should get rid of waste-wood because of:
  * increased fire intensity
  * flood damage
  * cost of fire management
  * cost of follow-up

Recommendation for Immediate Action:

- buy in capacity to initiate secondary industries (project management over committed and not skilled)
- pilot schemes (Kouga and Genadendal)
- establish partnerships with private sector (e.g. SAPPI)

Baseline Data Required

- complete hydrological models for all invasive species
- some water demand projections (some)
- GIS overlay of Government Water Schemes
- river systems in relation to rural communities
- map of agricultural potential
- geohydrological maps (some)
- distribution of alien plants by species and densities (60%)
- vegetation-types map
- obtain data on instream requirements for river systems throughout RSA
- veld age maps (some, 30%)
- obtain results of census 1996
- terrain models

Recommendation for Immediate Action:

- complete mapping of alien plants (priority no. 1)
- develop hydrological models for water
- develop models for invasion in riparian zones

Resource Economics

Problem: - good values only available for water
- good cost of clearing data

However: - no economic values available for biodiversity/catchment stability, empowerment and capacity building

Solution: - develop techniques to quantify 'value' of biodiversity/catchment functioning in all vegetation types.

2.2.4) Group 4: Management Structure Implementation

(this was only dealt with in general on the first day of the workshop because of time constraints)

Main Problems

- outgrown management systems and capacity for current rate of growth
- not sufficient use of independent consultants and services
- bureaucracy/poor decision making
- shortage of management capacity and expertise
- integrated catchment management

WORKING FOR WATER

Record of Discussion

Participants:

Dr. Roberto Rensi, Economic Advisor, European Union
Dr. Guy Preston, Chairperson, National Water Conservation Campaign
Ms. Eileen Meyer, Manager, Technical Assistance Consultancy Programme
Prof. Charles M. Breen and Mr. Eberhard Jelinek (Consultant)

Subject:

Working for Water Programme (WFW)
- Evaluation of WFW by Consultant -

A meeting was held in the office of EU on June 13, 1997 at the request of the Consultant engaged in conducting an evaluation of the WFW. The team of the Consultant, composed of six professionals, had the opportunity to visit various projects in the Western and Eastern Cape Provinces and in KwaZulu Natal. Discussions with staff of the Department of Water Affairs and Forestry (DWAF), CSIR, Natal Parks Board, SAPPI and Umgeni Water Board proved to be useful. Various issues were addressed in a workshop at CSIR on June 7, 1997.

Consultant's Impressions

Positive impressions gained during the field reconnaissance trip may be summarised as follows:

1. The project is founded on convincing evidence of the potential threat of failure to address alien plant invasion.
2. The programme addresses three critically important issues: Water, welfare and biodiversity in a unique and holistic manner.
3. The programme is championed by the Minister of Water Affairs and Forestry and is led by a small team of enthusiastic, dedicated and highly qualified staff in DWAF and the CSIR. Regional managers are well qualified, experienced and enthusiastic. They bring provincial and private sector organisations into the programme.
4. Project Steering Committees play an important role in decision making at local level.
5. Non-government organisations contribute meaningfully to some projects.
6. Significant numbers of jobs have been created in a very short period of time.
7. Valuable experience has been gained in mobilising and managing resources and labour. The welfare benefits emanating from projects are meaningful and greatly appreciated by benficiaries. They are spread over a number of provinces.

8. Empowerment is clearly evident in the projects.
9. Women are well represented at worker and project management level.
10. The project has the potential to contribute significantly to reducing water wastage and to integrated catchment management.
11. The project is contributing significantly to restoration of fynbos biodiversity – particularly as evidenced in the Riviersonderend catchment.
12. Soil erosion associated with removal of aliens does not appear to be problematic.
13. The programme is promoting research into biological control as this is seen to be a cost-effective way of dealing with certain species (eg *Prosopis*) and with maintenance. Biological control is evidently successful in undesirable species of *Acacia*.

Constraints observed by the Consultant:

14. The programme has grown rapidly to over 40 projects in less than two years. It has outgrown the management capacity and system. A complete restructuring of management is required and management capacity should be increased. This need was recognised by participants in the programme.
15. A directed independent research and monitoring programme is necessary to provide a sound scientific base for the programme and to justify or refute claims relating to benefits.
16. The programme makes little use of expertise in the private sector (eg consulting firms and universities). The claim that they are too expensive is questioned by the consultant as experience shows them to increase cost-effectiveness.
17. The programme is strongly driven by the need for employment. Whilst this is understandable and justifiable it causes difficulty when justifying the projects in terms of either or both biodiversity and water availability. There is little evidence of strategic planning at the programme or project level. Goals are short term and are most commonly expressed as hectares cleared. Whilst it is understood that this reflects the uncertainly surrounding funding, it is urgently required to ensure a cost-effective programme which is defensible.
18. The Consultant received 2 business plans for the WFW and 4 business plans for individual projects (Tsitsikamma, Kouga, KwaZulu-Natal, Great Letaba). There are insufficient data to permit appraisal. For Example : absence of land use and vegetation cover maps, giving, inter alia, location, type, extent and density of alien invasive plants; there are no catchment treatment/ management plans; no goals have been quantified; no hydrological modelling was carried out to determine the impacts of invasive plants on water yield; soil conservation and utilisation of biomass (e.g. fuel wood) received little attention; planning by objectives with a time horizon of, say, at least 20 years would be

required supported by an annual quantification of costs and benefits with a sound economic analysis to justify the investment of public funds.

19. In the opinion of the Consultant, the business plans hardly meet pre-feasibility requirements according to international standards. The information provided appears to be inadequate for the appraisal as stipulated in the Terms of Reference provided by the European Union.

Responses to Consultants Impressions

20. Dr Preston agreed with the criticism raised. The team was aware of the urgent need to restructure and improve management and to develop improved business plans.
21. He stressed the importance of a pragmatic approach in which there was an appropriate (given circumstances prevailing in South Africa) balance between action on the ground and planning and research.
22. He foresaw that the programme would continue to be driven by the urgent need for poverty relief because of both the need and the success of the programme in delivering community benefits.
23. Dr Preston undertook to followup the need for improved management (capacity, structure and process).
24. The client (European Union), the agent (GTZ) and Dr Preston agreed that it was not possible for the consultant to fulfil the requirements (appraisal) of the Terms of Reference.
25. Mr Rensi suggested that some alternative approach to appraisal might be considered.
26. After discussion it was agreed that :
    - the Consultants would review the programme
    - a logframe workshop would be held in Pietermaritzburg on June 18 and 19 to address strategic planning at national and provincial levels. Ms Meyer had arranged for an experienced Facilitator to be present. She will be brief by the Consultant on June 17.
    - in the Consultants report the reasons why an Appraisal was not possible would be clearly explained.