EXECUTIVE SUMMARY

INTRODUCTION

The Eastern Cape province offers major potential for new forestry development, and forestry has been identified as been one of the most promising economic forces for growth in the province. It is also recognised that forestry has a significant impact on the water resource and that national and regional growth of the industry must be managed with this in mind.

Successive strategic forestry development plans pin-pointed the north-eastern Cape as suitable for forestry and extensive afforestation was initiated by the newly established North East Cape Forests (NECF). The objectives of this development were to establish a primary timber resource approximating one million tons per annum grown on some 100 000 ha of land. A secondary processing plant would be built once the primary source of raw material was guaranteed.

Most of the land earmarked for this development is situated in the Umzimvubu catchment, together with some afforestation in the Bashee catchment. Rainfall varies from about 600 mm to 1 200 mm per annum. To date (1996) some 30 000 hectares of trees have been planted.

The region is considered to be well watered, and water not considered an a *priori* reason for the refusal of afforestation permits. A preliminary survey indicated a dearth of hydrological data. Only one river (the Mooi) had a long and reasonably consistent streamflow record. There was also a very limited rainfall record, and almost no climatic data.

The focus of this report is upon hydrology, and most specifically upon the likely impact which trees may have upon downstream water users, especially with regard to total water yield.

OBJECTIVES

The aims of this study were:

(i)   To survey and map environmental resources in the north-eastern Cape forest region;

(ii)   To assess the impacts of afforestation and forestry management practice on water yield, water quality, and the conservation of riparian zones;

(iii)   To provide guidelines for policy development, together with practical management guidelines to improve water quality and yield, and to ameliorate the impacts of afforestation on the natural environment;

(iv)   To provide a wider overview of the impacts of the regional scale land use change through afforestation, and particularly to place this in a socio-economic context.

RESEARCH APPROACH

The use of spatial information and the spatial intelligence of a Geographical Information System (GIS) was fundamental to both the setting up of the information baseline and the subsequent impact modelling exercises. Information incorporated into the GIS included areas of current and immediately planned afforestation, together with information on species, site and rainfall. Use was made, as far as possible, of existing data sets.

On the basis of all available land use and resource information, water use by current and immediately planned afforestation was modelled using the CSIR's forest water use curves, and impacts determined at the level of quaternary, tertiary, secondary and primary catchment. A water quality baseline was also put in place through successive biological monitoring of stream health at 15 stations on the major rivers in the region (the Gatberg, Wildebees, Mooi and Pot).

BASELINE RESOURCE INFORMATION

In addition to existing streamflow records and the spatial distribution of areas afforested and immediately planned for afforestation, an extensive baseline of physical resource information has been assembled. The most important elements include a land cover classification and information on land cover types, the location of wetlands, and the distribution of alien invasives. Additional socio-economic data has been assembled in order to put the potential impacts of afforestation into the regional context.

Prior to current afforestation plans, the principal land-use was extensive livestock grazing of both cattle and sheep, although this has been a very depressed industry. There is also a considerable area of dryland cultivation, and minor areas of irrigated cropland and dispersed forestry on a woodlot scale. Woodlot species are predominantly *Acacia mearnsii*, *Acacia decurrens* and *Eucalyptus* species. There is much evidence of overgrazing in the steep catchments and resultant erosion where thinner soils occur. Land cover data has also been categorised for each of the ten quaternary catchments within which forestry has taken place or is immediately planned.

IMPACTS OF AFFORESTATION ON WATER RESOURCES

Water Quality

A 'biological baseline' has been established at 15 monitoring sites on the major rivers in the district (the Wildebees, Mooi, Pot and Antelopespruit). This methodology entails a survey of the biological health of the river and can easily be repeated either at regular or at event driven intervals. The conclusion from the baseline study is that the rivers are biologically in a good condition.

Water Yield

The CSIR's 'flow reduction curves' were used to estimate impacts of afforestation on the expected virgin yield from 10 quaternary catchments.

The importance of both spatial distribution (across rainfall zones) and of age class distribution in water use was considered. Impacts are primarily dependent on the area afforested, the rainfall class distribution over which that afforestation takes place, and upon the age class distribution of trees within catchments. The concern with age class distribution is a function of the use of peak or maximum impact of afforestation as the chief measure. Where all trees within a catchment mature in the same year then the impact will peak in that year. By distributing the age classes across the length of the rotation the peak impact on the yield from may be reduced by 35%. Depending upon the measures used this could mean that a further 35% of afforestation may be acceptable to the decision making authority. This observation also has implications for the Afforestation Permit System.

In the north-eastern Cape the peak (maximum) impacts of all current and planned afforestation (ie 53 395 ha), on mean annual runoff within the 10 quaternary catchments varies from 2-18%. Worst impacts on low flows range from 5-31%. Mean annual impacts (impacts distributed over the length of the rotation) would be considerably lower than this - with the peak impacts reduced by an estimated 35%.

The maximum total impact of afforestation at the level of the tertiary catchment is 5%, at the secondary catchment about 1%, and < 0.5% at the level of the primary catchment. This situation would be reached in 2009 or 2010 and is also a function of the compacted age class distribution. Should forestry age classes be better distributed this maximum impact will be ameliorated. Even given current planting practice the consequences of afforestation at the regional scale do not seem to be of especial significance, which is in line with the original
 contention that this was a well-watered region which could afford to support a viable forestry industry.

GUIDELINES FOR POLICY DEVELOPMENT AND LAND MANAGEMENT

The major issues in the north-eastern Cape have been identified as maintaining long term run-off and ensuring equitable access to clean water supplies; regional economic development; the conservation of biodiversity; maintaining and improving the agricultural base; addressing the basic needs of the population within the RDP framework; ensuring national forest resource provision; and ensuring a return on investment for commercial forestry.

A number of recommendations are made with regard to policy goals and land management objectives. These include recommendations on regional planning, catchment afforestation planning, the procedure and practice of plantation forestry, the management of wetlands, riparian zones, alien invasive plants, the rehabilitation of degraded land, road construction, monitoring and policy development.

A number of research questions have also been highlighted.