Catchment Management in Tasmania – A Hydro-Electric Commission Perspective

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Abstract

The Hydro-Electric Commission utilises water to produce electricity from six major catchment areas throughout Tasmania. This water is a very valuable resource, producing electricity worth $351 million in 1989/90, and catchment management is essential to maintain and improve this resource. While there are particular problems with pollution and land degradation within our catchments there are also many current positive initiatives within these areas. A highlight of this has been the rapid expansion of Landcare Groups throughout Tasmania, with 35 Groups being formed to date. The adoption of Total Catchment Management is recommended for Tasmania.

Introduction

Tasmania's hydro-electric developments can be conveniently grouped into six separate catchment areas (HEC, unpublished data):

1. **Great Lake/South Esk,** with three power stations – Tods Corner, Poatina and Trevallyn.

2. **Derwent,** with ten power stations – Butlers Gorge, Tarraleah, Lake Echo, Tungatinah, Liapootah, Wayatinah, Catagunya, Repulse, Cluny and Meadowbank.

3. **Mersey/Forth,** with seven power stations – Fisher, Rowallan, Lemonthyme, Wilmot, Cethana, Devils Gate and Paloona.

4. **Gordon/Lake Pedder,** with one power station – Gordon.

5. **Pieman/Anthony,** with four power stations – Mackintosh, Bastyan, Reece and Anthony (planned completion 1994).

6. **King,** with one power station – John Butters.

The combined catchments of these power developments cover a significant portion of Tasmania (Fig. 1) and the appropriate management of these catchments is important to the Hydro-Electric Commission (HEC) and all Tasmanians.

Water and electricity production from Hydro-Electric Commission catchments

The basic resource used by the HEC to produce income from electricity sales ($351 million in 1989/90 [HEC 1990]) is the water (runoff) flowing from catchments into the storages of the power generation system. This runoff varies from year to year and season to season (Fig. 2) and its variability affects the amount of water available for power generation. This in turn may influence the cost of power generation because most costs are relatively fixed and the amount of power generated is strongly influenced by the occasional dry years. The size and nature of the hydro-electric industry means that intelligent catchment management can produce substantial economic benefits.

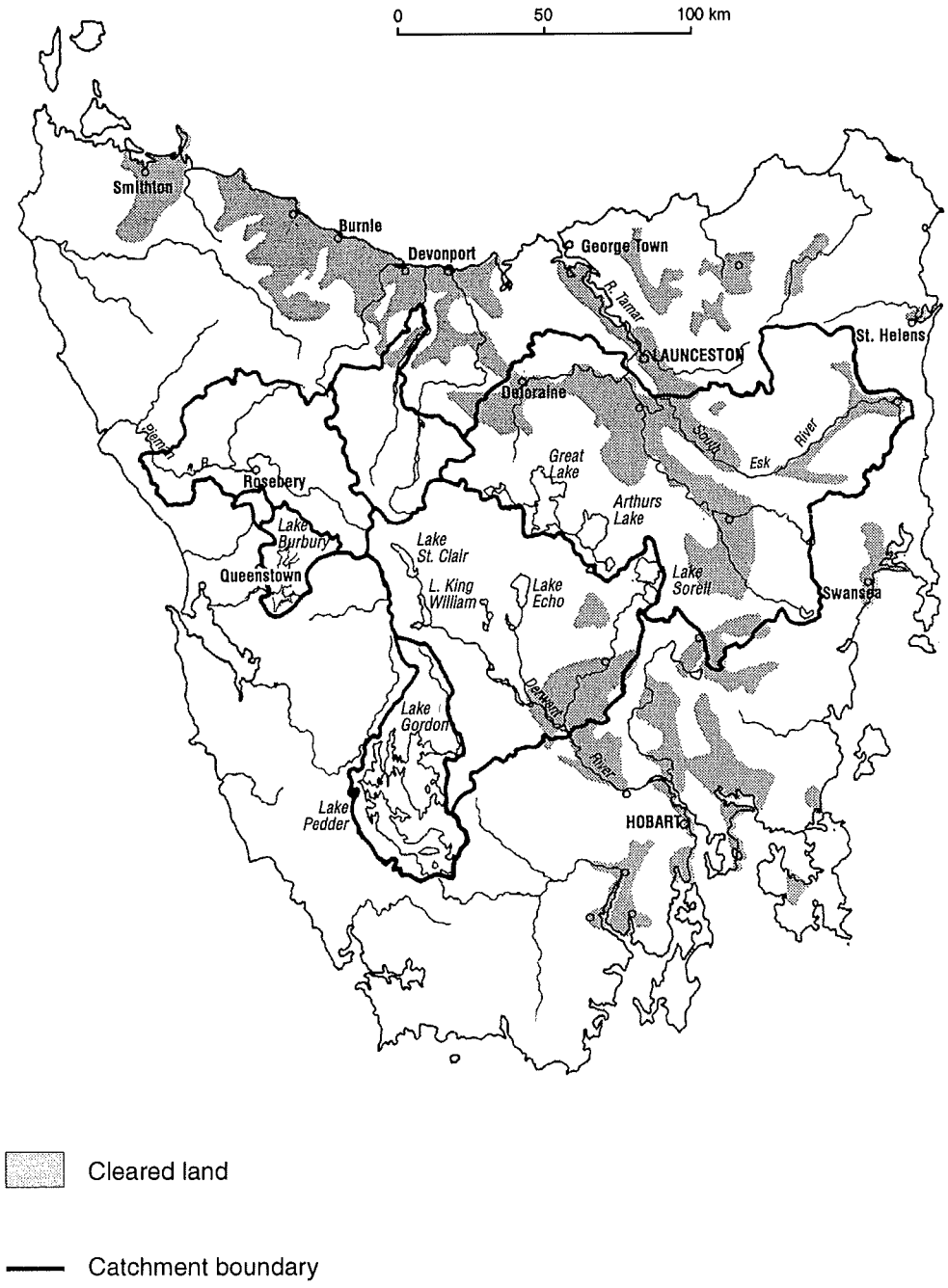

Figure 1. HEC catchment boundaries and cleared land (base map modified after Kirkpatrick and Dickinson 1984).

Runoff variability

The proportion of rainfall that actually reaches HEC storages and the timing of any runoff is greatly influenced by the nature of the catchment and catchment management practices. Runoff variability is caused by the natural variability of rainfall and by variability in the rainfall/runoff processes. Even on Tasmania's West Coast where rainfall

is generally higher and more consistent than most of Australia, rainfall varies greatly. Figure 3 shows the average monthly runoff and rainfall for the Collingwood River on the West Coast, the North Esk River in the Central North and Goatrock Creek on the East Coast. The differences in Figure 3 between the Collingwood River catchment and Goatrock Creek catchment are due, in part, to the nature of the vegetation in the catchments. The Collingwood is mapped as rainforest, wet forest or swamp forest while Goatrock is mapped as coastal grassy forest (Kirkpatrick and Dickinson 1984).

The use of average monthly values does not show the additional variability caused by flash flooding. When flash flooding occurs, many of the smaller water storages spill because the inflows greatly exceed the capacity of the power stations to use the flow. Spill also occurs during wet periods because the load is met elsewhere in the system and storage is insufficient.

Catchment management can reduce and delay flood peaks, effectively storing more water in the system for later power generation. For example, vegetation intercepts rainfall, increases evapo-transpiration and stops drainage channels from being formed by erosion. These and other factors slow the rate at which rainfall is converted to runoff, thus reducing and delaying flood peaks. Runoff is reduced but the proportion that is spilled by the water-storage system during high flows is also reduced resulting in a net benefit.

Managing catchment yields

There are many forms of land management that influence runoff. These include clearing, farming practices, timber harvesting and plantation establishment. Some practices increase water yield (e.g. timber harvesting temporarily), others decrease water yields (e.g. pine plantations on farm land). Many water supply authorities in Australia and overseas 'manage' their catchments and water yields by preventing any form of access or development. Because of the size and location of HEC catchments this is inappropriate and the HEC must consider other options to manage water yields. For example, rainfall can also be 'managed' and the HEC uses cloud seeding to increase rainfalls over target catchments. Figure 4 shows how rainfall in target catchments has been increased while elsewhere rainfall in the same period was about average.

Land degradation types in HEC catchments

Most HEC catchments are timbered or have native vegetation cover to help protect the land. However, problems do occur. Sections of the lower Derwent catchment and large areas of the Trevallyn sub-catchment are cleared (Fig. 1) while peat fires have degraded considerable areas of the Central Plateau and the South-West by reducing the peat layer which protects the underlying soil from erosion.

Soil structural damage

The types of land degradation in Tasmania are numerous (Cooper and Richley 1989) and to varying degrees, these types of land degradation are also present in HEC catchments. They include:

- **Sheet and rill erosion.** Over 200 000 ha of grazing and cropping land have been affected.
- **Gully erosion.** Over 40 000 ha of farm land have been affected.
- **Waterlogging and salting.** It is estimated that over 11 000 ha of salting in Tasmania is from inappropriate land management.
- **Tunnel erosion.** Possibly 8000 ha have been affected.
- **Mass movement.** Approximately 40 000 ha of land-slips occur in Tasmania.
- **Frost heave.** Vast areas of the State's highlands left bare by fire and grazing are

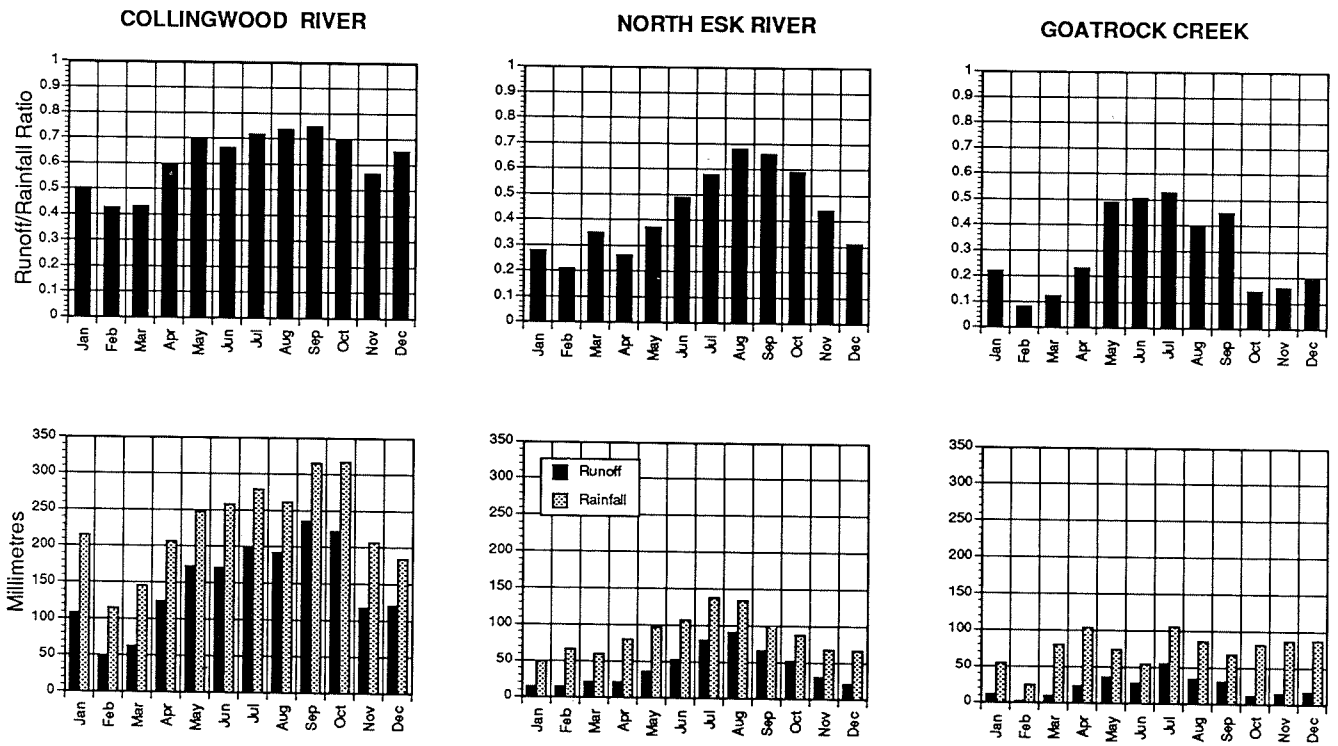

Figure 2. Rainfall and runoff for three Tasmanian stations.

prevented from recovery and continue to be degraded by rain and wind due to the effects of needle ice.

- **Burning of peat.** Over 140 000 ha of Crown Land have been degraded, with a substantial portion of this being on the Central Plateau and in the South-West. This damage leads to serious erosion as well as higher and more frequent flood flows in streams flowing out of the area.

- **Wind erosion.** Over 66 000 ha of Tasmanian farm land have been degraded by wind erosion.

Other degradation

Other types of degradation exist in Tasmania and in HEC catchments. These include:

- **Tree decline.** This is happening over large areas of the Midlands (part of the Trevallyn sub-catchment). The cause of the problem is not certain, but agricultural practices, defoliation and drought are major factors involved in this tree decline.

- **Weed invasion.** Weeds such as gorse, broom, pampas grass and blackberry compete with pasture and native understorey species and have a considerable potential to cause more problems in the future.

- **Stream bank erosion.** The Bracknell – Liffey Landcare Group did a survey of a 16 km section of the Liffey River and found 68 eroded swirls (Armstrong 1991). The most frequent causes were speculated to be livestock (32%), blocks/log jams (27%) and willows (16%). Linear bank erosion was recorded at 110 sites, the most common length being 20-50 m. Eroded areas were rare when the adjacent bank carried thick native vegetation and where stock access was prevented.

- **Wildfires.** Wildfires have the potential to cause large soil conservation problems in HEC catchment areas. Little information appears to be available on this in Tasmania. Atkinson (1984) measured soil losses of up to 48 t/ha from a 1983 wildfire which was followed by heavy rains in bushland catchment in Royal National Park (south of Sydney). Despite wildfires being natural events in Australia, very hot fires can destroy all the organic matter in soils and leave them open to erosion (Goldsmith 1988).

Water quality problems in HEC catchments

While good catchment management has the potential to beneficially affect water quantity issues such as flooding, water yields and storage regulation, it is water quality that is often used as an indicator of catchment 'health'. Particular problem areas do occur in HEC catchments and the HEC is currently involved in several research/management projects that were initiated by concern over water quality.

Examples of current water quality problems are:

- **Pieman catchment.** A $200 000 baseline study of the overall environmental health of the Pieman River catchment is now being carried out. This project began when it was found that fish were killed by gas bubbles resulting from a combination of low water levels and air entrainment in the power station discharges. The comprehensive study will investigate the quality of the Pieman River catchment and potential impacts of all land uses in the catchment. The study will help in the preparation of a Catchment Management Plan. Data collected so far indicate that Lake Pieman is accumulating some metal pollution but the presence of metals in fish caught in the Pieman River is much lower than the guidelines set by the National Health and Medical Research Council (*Advocate* 1991).

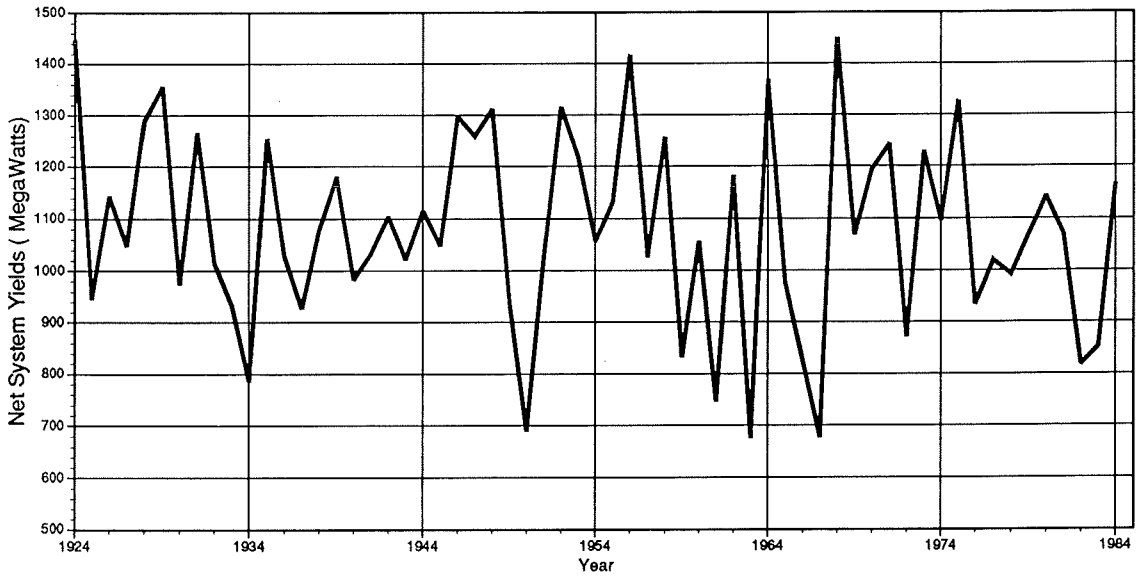

Figure 3. Variation in Hydro Net System Yields.

- **King catchment.** Heavy metal pollution from old mine workings (mainly copper) may make significant parts of the new Lake Burbury toxic to fish. The State Government has given a commitment that Lake Burbury will become a recreational trout fishery and the HEC has adopted the management strategy of diverting polluted water out of the Lake Burbury catchment and into the already heavily polluted Queen River. The HEC has already diverted some of the polluted water from the Linda and Comstock Creeks. Physical, chemical and biological monitoring is continuing and, if necessary, more polluted water will be diverted.

- **Lagoon of Islands (Derwent sub-catchment).** Inflows of phosphorus from fertilized lands and changes to Lagoon conditions have caused algal blooms in this Lagoon since 1986/87. Following a period of study, a management strategy was developed to cover the operation of this lake. This stategy includes minimising Ripple Creek inflows which are high in phosphorus, emptying the Lagoon by the end of the irrigation season (March) and modifying the present fertilizer spreading in the catchment above Ripple Creek (Krohn 1991). Water quality has improved to such an extent that in the 91/92 irrigation season, Lagoon water was used to meet riparian needs rather than the valuable Great Lake water previously used.

- **Meander (Trevallyn sub-catchment).** Rolley (1991) identified a study by the Forestry Commission, Tasmania, that monitored the condition and changes in the Meander system in its journey from the Great Western Tiers to Deloraine. Samples were collected at 10 points throughout the Meander River system from 1982 to 1991. Streams flowing from the mountains were of high quality whether from previously logged or unlogged catchments. The quality deteriorated as certain streams, specifically Jackeys Creek, Muddy Creek and Montana Creek, entered the system. Farming and related management activities were implicated. Two creeks feeding Montana Creek were found to be highly polluted. Possible causes were given as bad ploughing, allowing stock into streams, piggeries, dairy effluent and excessive use of fertilizers.

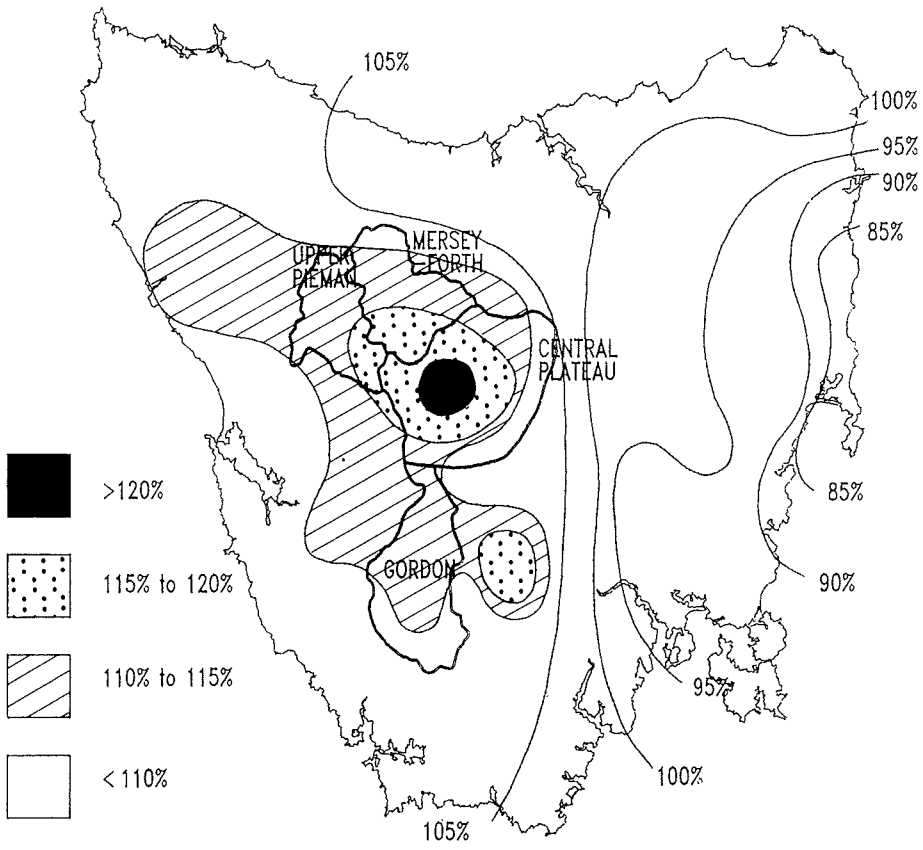

Figure 4. Comparison of rainfall in seeded months with average rainfall based on non-seeded months.

Activities helping to sustain HEC catchments

There are many initiatives underway to restore and sustain Tasmanian catchments. Most, but not all, apply to HEC catchments:

- **Review of the Environment Protection Act.** This review is being undertaken by the Department of Environment and Planning, with considerable input from the public, many organisations and government departments.

- **Development of an Ecologically Sustainable Development philosophy.** There are currently nine Working Groups, including Agriculture, Fisheries, Forest Use, Mining, Energy Production, Manufacturing, Transport, Energy Use and Tourism, reviewing this development.

- **Total Catchment Management.** Total (or integrated) catchment management means that all resource allocation and environmental issues are considered when planning, development or operational decisions are made. Interest in this subject is increasing rapidly in Tasmania. A wide range of representatives attended a recent catchment management conference at Launceston presented by the Australian Waste Water Association. Many Landcare Groups are tackling catchment issues. Indeed, the Bracknell – Liffey Landcare Group published a Catchment Management Plan in 1991, covering an area of 13 100 ha.

- **Continuation of the Tasmanian Technical Committee on Soil Conservation.** This Committee considers soil conservation matters throughout

Tasmania and reviews all National Soil Conservation Program submissions prior to review by the State Assessment Panel and a national committee in Canberra.

- **National Soil Conservation Program projects.** Current Tasmanian projects include Land Capability Studies; Public Participation, Education and Training; Landcare Support and Community Landcare. Current funding is approximately $1.3 million/year.

- **Forest Practices Act and Code (1987).** Forest harvesting and reforestation activities on Private and Crown Lands are controlled by the Forest Practices Act. The Code provides a set of standards to protect environmental values during roading, timber harvesting and reforestation. The Forestry Commission also has a number of specialised research trials underway to develop practical guides to improving forest catchment management. These include harvesting trials on highly erodible granite soils, a Musselboro Creek study and a Mole Creek karst study (Rolley 1991).

- **Tasmanian water policy plan.** The management and allocation of water has a significant effect on catchment management and a discussion paper on water policy is being prepared by the Rivers and Water Supply Commission to encourage public participation in water policy issues before new legislation is drafted.

- **Issue of the booklet *Land Degradation and Soil Conservation in Tasmania*** by the HEC and the Department of Primary Industry. This provides information on types, causes and extent of land degradation in Tasmania as well as methods of conserving soil.

- **Restoration and revegetation activities throughout the State** including works by the mining companies, HEC and other government departments. Restoration and revegetation practices have improved considerably throughout the decade.

- **Pieman River Environmental Study.** The aim of this study is to provide background data for a Catchment Management Plan for the Pieman River area.

- **Decade of Landcare.** 1991-2000 is the Decade of Landcare. Landcare is a community programme involving landholders and other people working in Groups to tackle land degradation problems of concern in their local area. Landcare projects have occurred on private and public lands in Tasmania. To date, 35 Landcare Groups have formed in Tasmania (Anon. 1991). The problems being tackled include river bank erosion, flooding, catchment management, water quality, soil erosion, tree decline, salting, rehabilitation, drainage works, weed control and pest control. Another 15 Groups are involved in Landcare issues related to urban areas, revegetation management and coastal management.

- **River improvement schemes.** There are currently seven River Improvement Schemes throughout the State (S. Ratcliffe, pers. comm.). These schemes tackle many river issues, including erosion control, channel improvement and Crack Willow control. The Rivers and Water Supply Commission is planning to conduct trials with three *Salix purpurea* clones, since they are multi-stemmed male clones and should not spread as the brittle Crack Willow has done. These trials will be in the North Esk River Improvement Scheme.

- **Greening Australia.** This organisation conducts many projects and programmes in Tasmania, including The One Billion Trees Programme, The Schools Greening Programme, The Roadside Vegetation Management Project and The Residual Woodland Management Project.

- **Property Management Planning.** There are three farms in the Midlands (Trevallyn sub-catchment) demonstrating Whole Farm Planning. These plans enable farmers to plan development for a stable sustainable ecology and continued profitability. Courses are conducted by the Department of Primary Industry.

- **Land Capability Mapping.** A seven-class system has been developed specifically for Tasmania. This is based on the capability of farm land to support a range of uses on a long-term sustainable basis. The project commenced in 1990. This information will provide basic planning information for farmers, planners and for Total Catchment Management. The Forestry Commission, Tasmania, is undertaking work on the classification of the suitability of land for plantation development.

Conclusions and recommendations

There are considerable land degradation problems in Tasmania and in some HEC catchment areas. However, there are also many current and proposed initiatives helping to restore and sustain catchments in Tasmania, but much more work is needed. The continued expansion in the number of Landcare Groups is very encouraging. The examples of the Lagoon of Islands and the Pieman River show that water quality and water quantity problems cannot be considered in isolation. The HEC will continue to monitor both the quantity and quality of the waters in the streams, rivers and lakes of the power generation system and take an active role in other catchment management issues.

It is recommended that a policy of total catchment management be adopted as the best method of integrating the use of natural resources and sound environmental management. This would encourage government departments, local government and other organisations to get together and focus on individual catchment problems on a collective basis. This would benefit all stakeholders, including the HEC.

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Tasforests