

adjacent control area (not fenced from grazing pressures) was subjected to similar manure/manure free treatments. The soils and vegetation of these enclosure and control plots were described in detail before the addition of manure. These enclosure and control plots are being monitored monthly for at least 12 months to identify weed germination and subsequent survival rates under different experimental conditions. The experimental treatments can be summarised as:

- with and without horse manure;
- with and without marsupial and rabbit grazing;
- with and without surface disturbance;
- over the climatic extremes of all seasons.

Weeds were systematically counted throughout the year, to monitor germination and to determine whether the weeds could reach reproductive stage (i.e. be able to spread) in the climatic conditions of the Central Plateau. The weeds were traced to their germination source to ensure that the weeds observed did actually originate from the horse manure.

The data outlined above is currently being analysed. Initial results suggest that the type and extent of damage varies in different vegetation and soil types and that recovery rates also vary. The survival of weeds is most favoured by the combination of freedom from grazing and bare ground covered by horse manure. Not all weeds that germinated had reached reproductive stage 12 months after the trial commenced.

FAUNA MANAGEMENT IN THE WORLD HERITAGE AREA

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RESEARCH AIMS

The World Heritage Area (WHA), comprising approximately 20% of Tasmania's land mass (~1.38 million hectares), contains a diversity and uniqueness of fauna which is of world significance. The priorities for work to be conducted in the field of zoology in the WHA are: inventory of the fauna; fire ecology; monitoring and management of environmental changes and communication

(i.e. interpretation and training). This work involves surveying new areas (terrestrial, aquatic and caves), monitoring established sites, management of threatened species, investigating species/habitat relationships, and determining impacts such as feral species and public usage. The WHA comprises a number of state and commonwealth land tenures. Management actions must therefore be sensitive to the needs of all stakeholders and compatible with the four management zones proposed in the WHA Management Plan (Department of Parks, Wildlife and Heritage, Tasmania 1992) i.e. wilderness zone, self-reliant recreational zone, recreational zone and visitor services zone.

FAUNAL INVENTORY

A program called Directed Wildlife Research (DWR) operated between 1986 and 1989. Its aim was to establish an inventory of flora, fauna and wildlife resources of the WHA. The program operated by providing funds for travel and logistic support to volunteer specialists who collected information from many locations in the WHA. Although successful, the information collected was fragmentary as different scientists undertook work in different areas. In 1990 DWR was superseded by the Wilderness Ecosystems Baseline Study (WEBS). This new program concentrates research in two remote and very different locations; Mt. Ossa - Pelion Valley and Bathurst Harbour - Melaleuca. Examples of some of the 40 or so fauna projects undertaken to date are: ecology and microhabitat of reptiles and amphibians; fish assemblages of Bathurst Harbour; and species inventories of terrestrial and freshwater invertebrates, freshwater fish, crustaceans, small mammals and birds. WEBS has provided three years of valuable information on the physical environment, fauna, flora and ecology of the WHA. Many new species have been discovered; for instance, during the Bathurst Harbour fish inventory a previously undescribed species of skate was found (Edgar 1991). The use of gill nets has been prohibited from the Bathurst Harbour estuary in order to provide protection for this and other species. The DWR and WEBS programs have provided a much greater understanding of the biological diversity of the WHA and ultimately Tasmania.

MONITORING THREATENED SPECIES

The WHA is the last refuge for a number of rare and threatened species and implementing conservation plans for these species has become an integral part of the fauna directive. The orange-bellied parrot (*Neophema chrysogaster*) breeds exclusively in the southwest of Tasmania and every year volunteers record the colour bands and numbers of birds returning from the mainland. This information is providing important biological data on an endangered species and is essential in directing the long term management program.

The flooding of Lake Pedder in the 1970's has led to the demise of one of Tasmania's native galaxiid fish, *Galaxias pedderensis*, due to competition and predation from introduced trout (*Salmo trutta*) and the invasion of another native galaxiid (*G. brevipinnis*). The total population of *G. pedderensis* has been reduced to between 50 and 200 individuals and is continuing to decline. A captive breeding program undertaken by the Inland Fisheries Commission has been unable to produce fertilized eggs and so, in an effort to save the species from extinction, a small number of individuals have been introduced into an alpine lake in the WHA which was free of predators (Davies 1991).

Another threatened species in the WHA, the ptunarra brown butterfly (*Oreixenica ptunarra*) is located at a few sites in the Central Plateau Conservation Area. Implementation of a recovery program for the species has involved fencing areas of *Poa* tussock grassland to assess the impact of grazing and fire on the numbers of this species (Neyland 1991).

Other vertebrate species at risk and monitored on a regular basis in the WHA are the Pedra Branca skink (*Niveoscincus palfreymani*), ground parrot (*Pezoporopus wallicus*), swift parrot (*Lathamus discolor*) and hooded plover (*Charadrius cucullatus*), combined with an even longer list of threatened invertebrates including onychophorans, crustaceans and molluscs.

FERAL SPECIES

The WHA Management Plan (1992) states that actions for management shall include eradicating introduced rodents and rabbits at disturbed sites and controlling other feral and introduced species, such as goats, cats, dogs, fish, starlings, bees and wasps. Because of their tenacious nest building habits the European starling (*Sturnus vulgaris*) has an impact on the endangered orange-bellied parrot and vulnerable swift parrot in regions of the southwest, Hartz Mountains and Central Plateau Conservation Area. Monitoring and eradication of starlings is undertaken jointly by the DPWH and Department of Primary Industry. A rabbit eradication program is planned for the Strathgordon/Maydena area in 1993 whereby an intensive period of poisoning and shooting rabbits around inhabited areas bordering the WHA will be undertaken by SW rangers and contract staff.

Feral goats are causing widespread damage through browsing, soil erosion and spread of disease in a number of regions, particularly the Central Plateau Conservation Area. A control program administered jointly by the DPWH, Department of Primary Industry and Forestry Commission involves tracking and destroying feral goats. Goats wearing radio collars (Judas goats) are released to aid in the location of feral herds. Aerial surveillance using fire spotting aircraft from the Forestry Commission has been employed to locate herds in areas of

difficult terrain (G. Atkinson, pers. comm.).

CENTRAL PLATEAU FISHING

A Trout Fisheries Management Plan for the Central Plateau (Sloane 1991) has provided important information on use, access and facilities at fishing sites at the Western Lakes. Results from a questionnaire found that since the 1986/87 season on average some 2,000 anglers have fished in the Western Lakes each season, spending approximately 5 days a year for an annual harvest of around 15,000 trout. The report makes a number of recommendations, one being that the bag limit is reduced from 12 to 6 fish per day for the entire Western Lakes region. This is in keeping with a philosophy of maintaining the area as essentially a wild trout fishery and to encourage the conservation of fish stocks thereby reducing the need to extend stocking programs.

HUMAN IMPACTS

While encouraging visitation to the WHA, the presence of people is not without its problems. Sewage disposal, litter, escape of camp fires and bacterial contamination of water are all problems in wilderness area. Observations at Lake St. Clair and Cradle Mountain indicate that buttongrass moorlands and subalpine tussock grassland have limited abilities in absorbing and assimilating high-nutrient sewage effluent (Smith 1990). Faecal material entering waterways has in the past caused the outbreak of giardia, a bacteria causing diarrhoea and gastroenteritis in humans. Disposal and treatment of effluent in natural areas has therefore become an important management issue facing the WHA. Designing new composting toilets and educating the public on hygiene are two methods employed to deal with the problem.

FIRE RESEARCH

The use of fire as a management tool in the WHA remains a controversial one. The fire management plan for the Southwest National Park (1988) allows for the controlled use of fire to maintain a diversity of plant and animal communities. Over summer the orange-bellied parrot is dependant on moorland vegetation in the age range of 5 to 12 years (Brown and Wilson 1983), therefore burning to maintain a mosaic of this food source is undertaken when required. The ground parrot also prefers specific aged vegetation, however, the size of the population at present does not warrant a prescribed fire management program (Bryant 1991).

The broad tooth rat *Pseudomys fuscus* (formerly *Mastacomys*) has its stronghold in the WHA where it occupies heathland copses. A research program is currently investigating the interrelationship between this species and age of

moorland vegetation to determine its distribution and the age at which regenerating heathland becomes suitable for habitation by broad tooth rats (M. Driessen, pers. comm.).

APPRAISAL

Past and current research programs have uncovered a wealth of faunal information in the WHA. The discovery of new species including fossil evidence of relic species have highlighted Tasmania's Gondwanan affinities and biological uniqueness. Research information is continually being translated into management actions so that the biological integrity of the WHA can be maintained for future generations.

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