

## 1. INTRODUCTION

### 1.1 Ecologically Sustainable Agriculture Initiative (ESAI)

“Threatened Species and Farming” is a sub-project of the ESAI. This project will identify how agricultural practices might be modified to help conserve selected threatened species as part of working toward ecological sustainability. The project will document case studies of selected threatened species in five bioregions: the Victorian Riverina, Wimmera, Victorian Volcanic Plain, Gippsland Plain and Glenelg Plain. The farms considered include examples from the meat, wool, dairy and grains industries. This case study focuses on the Giant Gippsland Earthworm *Megascolides australis* McCoy 1878 in the Gippsland Plain region.

### 1.2 The Giant Gippsland Earthworm

The Giant Gippsland Earthworm (GGE) is considered one of the largest species of earthworm in the world, reaching lengths of over 1 m. The GGE has International, National and State conservation significance. It is listed as Vulnerable by the IUCN (IUCN SSC 2003), Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and as Threatened under the Victorian *Flora and Fauna Guarantee Act 1988*. About 90 hectares of its habitat has also been listed on the register of the National Estate (Coy 1991).

#### 1.2.1 Distribution and habitat

The GGE is endemic to a small area of approximately 40,000 ha in the Bass River Valley of south and west Gippsland, Victoria. Distribution of the GGE is confined to an area roughly bound in the north by Warragul, and in the south by Loch and Korumburra. Within this range, GGE distribution is fragmented and populations can be restricted to very small areas of habitat. Populations are usually associated with creek banks, gullies and soaks or hillslopes with a southerly or westerly aspect. Anecdotal information regarding historical distribution patterns suggests that numbers have declined and the range of the species has contracted through farming activities and infrastructure development, although precise factors responsible for this decline are unclear.

The habitat of the GGE occurs predominantly in permanent pasture with agriculture representing the major land use throughout its range. Farms with dairy cattle and/or beef cattle predominate, with some growing potatoes, vegetables and fruit (Taylor *et al.* 1997). The GGE occurs at Mt Worth State Park, on the eastern edge of the species range. The Park represents one of the few remaining areas supporting the original Wet Forest (mostly Mountain Ash) that would have once been widespread throughout the GGE’s range (Gippsland CRA 1999). This vegetation has now been almost entirely removed with only small pockets of remnant vegetation remaining along some creek banks, roadsides and gullies. However, revegetation and habitat restoration of stream banks and gullies is currently undertaken by a large majority of landowners in the region, although the amount of replanting varies widely (J. Bowman pers. com.).

#### 1.2.2 Biology

The GGE is of conservation concern because of its limited distribution and life history characteristics. Particular aspects of the biology and ecology of the GGE such as long life span, low reproductive and recruitment rates, and low dispersal ability render the fragmented populations vulnerable to threatening processes (Van Praagh 1992; McCarthy *et al.* 1994). The GGE is a hermaphroditic species. Breeding occurs predominantly in spring and summer. Large amber coloured egg cocoons ranging in size from 5 to 9 cm are laid in chambers branching from the adult burrow at an average depth of 22 cm (Van Praagh 1994). Only one embryo is found in each egg cocoon, which is thought to take over 12 months to incubate. Egg production appears to be very low (0.36 per annum) and may not occur every year, depending on seasonal conditions. Although the life span of the species is unknown, field and limited laboratory studies suggest that it is long lived, possibly taking up to 5 years to reach sexual maturity. Field

studies show the population consists predominantly of adults at all times of the year (Van Praagh 1994). This suggests a slow growth rate and population turnover, with a low rate of recruitment. Individuals are extremely fragile and even slight bruising or damage may result in death. Populations of GGE appear isolated from others and the opportunities for genetic exchange may be limited.

The worms live in complex, permanent burrows that extend to around 1 to 1.5 m in depth. Worms appear to remain underground, feeding on the root material and organic matter ingested in the soil. Occupied burrows are always wet, even in summer, probably aiding the worm in movement and gas exchange. Worms can be locally abundant with a mean density of 2 per m<sup>3</sup> with up to 10 worms per m<sup>3</sup> recorded (Van Praagh 1994).

### ***1.2.3 GGE and agriculture***

The GGE has co-existed with agricultural land use since European settlement of South Gippsland in the 1870s and has survived major changes to its habitat mostly associated with agricultural development and expansion. While the species has survived major vegetation clearance and the activities associated with grazing and dairy farming, the overall effects of these changes on the soil habitat occupied by GGE's, and the effects on their distribution and survival are not clearly understood. Most of the information regarding effects of agricultural practices on earthworm populations are derived from observations of European earthworms, primarily because native megascolecids are absent from most pastures having died out after habitat clearance. Therefore we have very little direct knowledge of the effects of these activities on indigenous earthworms surviving under pastoral systems.

### ***1.2.4 Threatening processes***

The GGE appears to have some tolerance to disturbance as evidenced by its presence in pastures, under vehicle tracks and sections of pine plantations (Van Praagh and Hinkley 1999). However, while the GGE co-exists with the current agricultural systems of South Gippsland, the relationship may be very fragile because of the species fragmented distribution and life history characteristics.

Whilst not all threatening processes operating on the GGE are known or understood, some key threats can be identified. These threats include physical and chemical disturbances to the soil and altered hydrology such as changes in water-table level, flooding and drainage patterns. Many of the actions responsible for these threatening processes are interrelated and are associated with infrastructure development and agriculture.

Given that the species distribution is confined almost entirely to privately owned land used for agriculture, conservation of the GGE will rely largely on farmers maintaining areas of suitable habitat on their properties, and appropriately managing activities that might otherwise adversely affect the GGE. Therefore identifying the effects of agricultural and land management practices on GGE remains crucial to the conservation management of this species. One of the key requirements in furthering our understanding of threatening processes on GGE populations is to more clearly understand the factors responsible for influencing earthworm distribution.

This information should form the basis of development of sound guidelines for the management and conservation of Giant Gippsland Earthworms on farming properties in South Gippsland.

## **1. 3 Aim of Project**

To determine the main topographical, hydrological and physical and chemical soil factors influencing the distribution of the GGE within the landscape of individual farms, and to ascertain the effects of land management on these factors.