

3. RESULTS

3.1 Management History

The property is currently managed as a dairy farm with a stocking rate of around 200 milkers in addition to some young cows. At this time the farm operated as a dairy farm with around 38 milking cows and up to 50 stock in total. This is considered to be a low to average stocking rate for the region (B. Embon pers. comm.). The average stocking rate for the region is 2.5 cows/ha Sargeant *et. al*/1996.

There is no information available regarding the history of the property before 1947.

Ploughing has occurred over approximately 2/3 of the property at various stages but not on a regular basis. In the past, ploughing was conducted using a horse and plough, and only small sections were ploughed at one time, usually in spring and summer. The soil was ploughed to a depth of around 4 inches. In the 1980s, there was some strategic ploughing for fodder crops and re-sowing of pasture. No ploughing has occurred for the past 8 years.

Fertilisers have been applied annually and lime added approximately every 5 years. In general, the creek banks were not fertilized. There have been small scale trials of organic fertilisers to encourage microbial activity. No pesticides have been used but there has been spot spraying of herbicides for the control of blackberries and other weeds. Irrigation is not practiced on this property.

Little remnant vegetation remains on the property apart from some large eucalypts. The property supports the threatened Strzelecki Gum (*Eucalyptus strzeleckii*). Some creek banks and gullies have been revegetated and fenced based on advice from the Powlett Project Land Care Group and Greening Australia. Planted areas include an overstorey of around 20% consisting of Mountain Grey Gum (*Eucalyptus cypellocarpa*), Manna Gum (*E. viminalis*), Messmate (*E. obliqua*), Swamp Gum (*E. ovata*), Strzelecki Gum (*Eucalyptus strzeleckii*) and Blue Gum (*E. globulous*). The understorey is composed of a variety of plants including Hazel Pomaderris (*Pomaderris aspera*), Daisy Bush (*Olearia* sp.), Blackwood (*Acacia melanoxylon*), Silver Wattle (*A. dealbata*), *Kunzea* sp, *Hakea* sp, in addition to *Lomandra* and grasses such as *Poa* sp. Cypress trees have been planted as wind breaks and in several areas prone to tunnel erosion.

3.2 Landscape and Land Use Changes Since 1947

Landscape and recent land use change on the Embon property was evaluated by comparing two vertical aerial photographs taken 16 November 2002 [colour] and 10 December 1947 [black and white] (Fig 5). Both photographs were enlarged by 6 times from original to a scale of 1:25 000. The 2002 photograph was orthorectified and overlain with the 10 metre contours from the state digital topographic data base.

The most evident changes are:

- A number of large (probably native) trees along the banks and floodplain of Foster Creek have gone. There is an increase in the continuity and density of tree and shrub vegetation lining the creek, but this has probably had little impact on the flow dynamics of the creek as much of the stream bank is exposed and undercut. There are now a number of windbreaks (exotic species) planted on the slopes above the floodplain.
- The north-flowing tributary of Foster Creek (east of the Embon's farm house), was an active gully in 1947 with bare bed and banks and very little bordering vegetation. It is now fenced and revegetated and a formerly extensive area of sheetwash above (west) the gully has also been reclaimed.
- There are several small dams in some of the drainage lines.

3.3 GGE distribution at study site

The landowner knew of three areas on the property where he had observed GGE in the past. The landowner was not aware of the presence of the GGE at two of the sites determined during this study. For the purposes of this study, a GGE earthworm population is defined as an area of GGE's that appears to be relatively isolated from other areas supporting GGE's. An active GGE population refers to sites where GGE gurgles were heard.

The current study found active GGE 'populations' at 6 sites (Fig 6). These included sites in;

- a) minor stream banks/drainage channel -revegetated and open (Plate 1) (Plate 2,3)
- b) alluvial terraces above the present flood plain (Plate 4)
- c) steep terraced south facing slopes (Plate 5)
- d) colluvial footslope without terracettes (Plate 6)

One site was identified by the landowner where the GGE was known to occur in the past but was not found in the present study. This site is a north facing but at the lower of the slope. GGE were observed during grading and construction of a culvert at this site 25 years ago. No sign of GGE were found during the present survey. The grading directed and concentrated the flow of cattle traffic towards the newly constructed track and over the drainage channel. This resulted in the GGE site receiving a large amount of cattle traffic resulting in heavy pugging and compaction of the site. Only a few GGE were dug up and killed during the earthworks. Old GGE burrows were also found at a site subject to a landslip some 5 years previously (Plate 7). However, no signs of earthworm activity were visible and the earthworm appeared to no longer be present at the site.

Each of the different habitat types can be used to illustrate various geomorphological/landscape features that may play a role in influencing GGE distribution. Each may require different management considerations for GGE conservation.

a) Minor stream banks and drainage channels

Revegetated creek bank

GGE were observed along this small tributary of Foster Creek by the landowner approximately 50 years ago. The creek was revegetated 8 years ago with wattles, gums, daisy bush etc. During the current survey the GGEs were found in the more open areas in the shallow embankment adjacent to the creek (see Plate 1). GGEs were absent from areas that obviously formed the creek bed when the creek was flowing. A small number of burrows were found further up the embankment, mainly in the more open sections, which supported relatively dense vegetation in parts. It is not clear whether these are old, unused burrows, present before the site was revegetated or whether they did support GGE not located during sampling. The soil in the embankment was significantly drier and contained a large number of tree roots.

Management Implications

- Revegetation of stream banks and gullies

Minor creek bank

GGE were located along several tributaries and drainage lines into Foster Creek. These sections were either lightly vegetated with scattered remnant eucalypts (understorey) or consisted of pasture with little overstorey (see Plate 2 &3). No GGE were found on the banks of Foster Creek in the areas of current flood regimes. These soils were dominated by coarser and sandier soils and apparently unsuitable for GGE.

Management implications

- Pattern of stock access (e.g. pugging caused by concentrated cattle access to one section)

- Water flow (including flooding)
- Changes to water course

b) Alluvial terraces above the present flood plain

This site occurs where the streams have incised channel into alluvial material over time forming terraces above the flood plane of the creek (see plate 4). The soil is of a more silty nature.

Management implications

- Alteration to drainage patterns
- Stocking rates (pugging, soil erosion).

c) South facing hillslopes with terracettes

Several south facing hillslopes with varying degrees of micro-terracing were observed at the study site. However, not all of them supported GGE populations. Two adjacent south facing slopes, both with well-developed terracettes, were examined. One site supported a relatively extensive GGE population (see Plate 5), whereas no GGE were located at the other site. The major difference in the two sites was the soil substrate. The site that did not support GGE was very steep (approx 30o) and had a very rocky substrate with shallow soil. The hillslope supporting GGE was not quite as steep, had a much deeper soil profile without stony colluvial debris. Size (depth and width) and activity of terracettes may be important indicators of potential GGE habitat. The terracettes present an irregular surface that provides temporary pondage during run-off, allowing retention and recharge of soil moisture.

Management Implications

- *Stocking rates (pugging, soil erosion)*
- *Water flow above hillslope/catchment*

d) Small colluvial footslope without terracettes

This site was brought to our attention by the landowner when he was advised of the common co-occurrence of yabbie mounds and the GGE. He knew about the yabbie mounds but he did not consider this a GGE site. The site is a small, very exposed south facing colluvial footslope located above a very minor a drainage channel/soak. (see Plate 6). The site was at the base of a very large catchment. The GGE were very localised at this site and confined to approximately a 30 m strip adjacent to the drainage line.

Management implications

- Alteration to drainage patterns.

3.4 Occurrence of GGE in relation to geomorphology of the Embon property

Examination of the geomorphological characteristics of the habitat types in which the GGE were found, has revealed several factors that appear to influence GGE distribution. These are;

- Worms are located in areas where regolith (soil and decomposed rock) is at least 1.0 metre thick and generally is greater than 1.5 metres thick.

- The greatest density occurs in areas where the regolith is partly or wholly composed of alluvial accumulation.
- The alluvium is silty clay or very fine sandy clay that is weakly stratified and over 2.0 m thick.
- This alluvium occurs as level to gently sloping surfaces of former floodplains (terraces) of Foster Creek elevated ± 10 metres above the bed level of Foster Creek.
- The alluvial terraces are areas of seepage and several springs occur at the upper edge of the terrace. The springs are not worm sites but sites occur below the springs on the better-drained areas of the terrace.
- The alluvial terraces are incised by steeply cut drainage lines that provide a means of lowering the water table of the terraces.
- The terraces show little other surface topography – they do not have terracettes and are therefore very stable.
- Other dense worm sites occur on steep ($\pm 20^\circ$) lower hillslopes and colluvial slopes with south-east, south to south-west aspect.
- Many of these slopes have a substantial terracette development but worms are not found in sites where there is stony colluvial debris.
- These sites are damp, partly due to aspect but also as a result of the irregular terrace surface providing temporary pondage during runoff, and thus allowing retention and recharge of soil moisture.
- Worms did not occur on the lowermost, active floodplain or in the banks of Foster Creek.

Fig 5 Vertical aerial photographs taken November 2002 (top) and December 1947



Fig 6 GGE sites shown on topographical map of study area (above) and Orthorectified aerial photograph of study area (below)

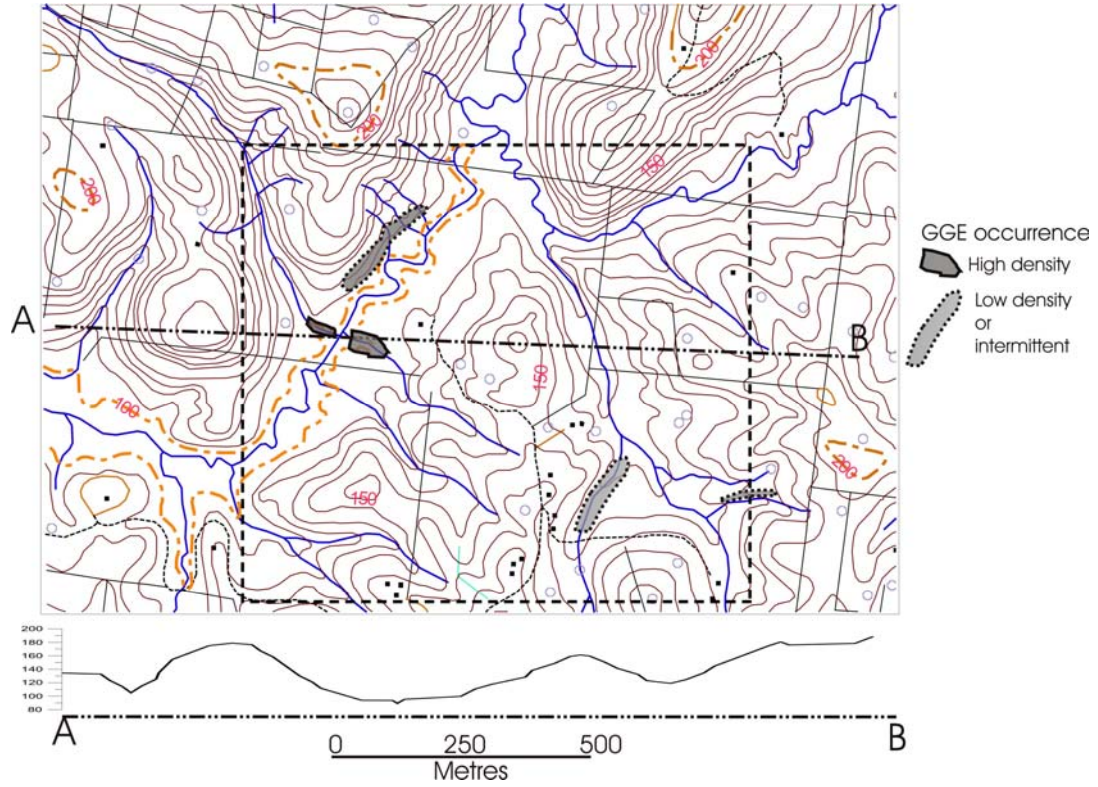


Plate 1 GGE site- revegetated drainage channel



Plate 2 GGE site- tributary of Foster Creek open



Plate 3 GGE site- drainage channel with small amount of remnant vegetation



Plate 4 GGE site- alluvial terrace above present flood level



Plate 5 GGE site- south facing slope with terracettes



Plate 6 GGE site- colluvial footslope without terracettes



Plate 7 site of landslip where old GGE burrows observed

