The role of shelterbelts in grazing systems in the New England Tablelands: impacts on earthworm composition and abundance.

L. A. Lobry de Bruyn[A] and E. A. Po[B]
[A] Department of Ecosystem Management, UNE, Armidale, NSW, 2351
[B] Crop Sciences Unit, Agricultural Sciences Department, College of Agriculture, Xavier University, 9000 Cagayan de Oro City, Philipines.

Introduction

There is a lack of data concerning the impacts of native tree shelterbelts on soil biological activity, especially earthworm composition and activity. This paper reports measurements of earthworms in such shelterbelts. A further aim was to determine whether replanting trees in the landscape would assist earthworm presence or whether the removal of grazing was needed to ensure earthworm survival and proliferation.

Methods

Four treatments consisted of pasture or shelterbelts (several hundred metres in length and less than 10 m in width) each with grazing by sheep either permitted or excluded using fences. In each treatment there were nine plots each 5 by 5 m in size. Approximately each month from August 1995 to September 1996 six sods of soil (20 x 20 x 20 cm) were dug from random positions in each plot (10 x 10 grid, ignoring the outer grid points making 81 sampling points). By the end of the 12 month sampling period, a total of 72 points had been sampled over the plot. Rainfall data were collected for each month, and the height, girth and species of wooded vegetation measured for each plot. One soil core (10 cm in diameter and 10 cm in depth) was taken and the percentage organic carbon measured. The soil sods were hand-sorted to assess earthworm abundance and composition.

Results and discussion

There were relatively low numbers of earthworms (mean earthworm density was 76 earthworms/m^2) which ranged from 27 to 135 earthworms/m^2 over the year (Figure 1). The greatest abundance of earthworms was recorded when soil moisture and soil temperatures were optimal (September and October 1995 and December and January 1995/96). In very wet periods, the soil became water logged which was detrimental to earthworm activity (for example February 1996) (Figure 1).

Three species of earthworm were recorded in all treatment combinations. They were *Spenceriella* sp. (deep burrowing, large earthworm), *Aporrectodea trapezoides* and *Microscolex* sp. The latter two species are both likely to be introduced species and shallower burrowers compared with *Spenceriella* sp. Thus, the earthworm most likely to have beneficial effects on soil properties through its capacity for burrowing and cast production in the soil was least abundant (Figure 2) and usually few adult specimens were recorded (4-7% per treatment). This is in contrast to the smaller shallow burrowing species *Microscolex* sp. that presented 72-85% of specimens as adults in of all four treatments, and was somewhat more likely to be recorded in shelterbelts than in grazed pastures (Figure 2). The converse was apparent for *Spenceriella* sp. which was more likely to be recorded under grazed pasture than in the shelterbelts (Figure 2).

One difficulty in identification of earthworms to species level was the large proportion of juvenile earthworms (usually greater than 70%) and in the case of *Spenceriella* sp. was up to 92% and hence absolute identification of species was uncertain. As the lowest earthworm density was recorded under grazed pasture, it appears that trees and grazing exclusion can favour earthworm presence (Figure 2).

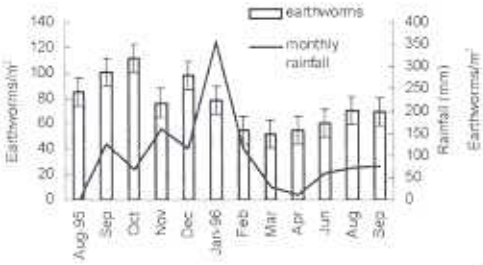

Figure 1. Abundance of earthworms and monthly rainfall (average of grazed and ungrazed pasture and shelterbelts) in the New England Tablelands. Standard error bars are ± 2 standard errors of the grand mean.

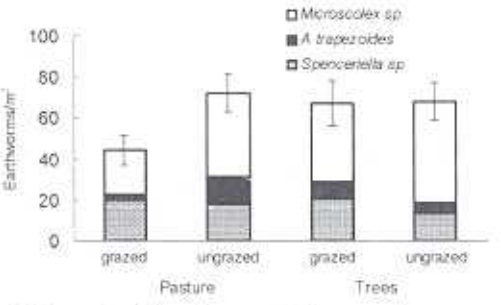

Figure 2. Abundance of three earthworm species recorded (average from January to September 1996) in four different grazing and tree management combinations in pasture and shelterbelts in the New England Tablelands. Standard error bars are ± 2 standard errors of the treatment mean.

Conclusions

Earthworm numbers were not as high as those reported for southern pasture systems (up to 400 earthworms/m² by Baker *et al.*, 1992), but earthworm activity occurred in all months of the year, in contrast to areas of winter dominant rainfall where earthworm activity is absent for most of the summer. In the New England Tablelands, where rainfall is more reliable in spring and summer than autumn, earthworm activity is likely to be greatest in spring and summer. It appears that, apart from seasonal effects, earthworm activity is promoted somewhat in areas with trees (grazed or ungrazed) or in pastures protected from grazing.

References

Baker, G. H., Barrett, V. J., Grey-Gardner, R. & Buckerfield, J. C. (1992). The life history and abundance of the introduced earthworms *Aporrectodea trapezoides* and *A. caliginosa* (Annelida: Lumbricidae) in pasture soils in the Mount Lofty Ranges, South Australia. *Australian Journal of Ecology* **17**, 177-188.