

# Natural Areas in New Zealand—Earthworms

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This paper is concerned with the distribution of the endemic earthworms of New Zealand and its surrounding islands. The fauna consists of 178 species, of 27 genera of the family Megascolecidae, divided between the two subfamilies Acanthodrilinae (126 species, 17 genera) and Megascolecinae (52 species, 10 genera).

In the accompanying map, the main islands of New Zealand have been divided into nine principal areas, based on the distribution of Megascolecidae. The various areas are characterized as follows:

**Area A:** A large number of species (46), which, with a few exceptions, have a very restricted distributional range. The fauna is dominated by the genera *Megascolides* (Megascolecinae) with 17 species and *Rhododrilus* (Acanthodrilinae) with 11 species. 39 of the 46 species are restricted to area A. *Megascolides* is otherwise found only on the fringe of areas B and D, adjacent to area A.

**Area B:** 15 species (9 confined to area B) dominated by Acanthodrilinae (especially *Rhododrilus*) and with few Megascolecinae (3 species of *Megascolides* only). The species of *Rhododrilus* are closely related to species from area A.

**Area C:** 15 species (8 confined to area C) dominated by Acanthodrilinae and with only two species of Megascolecinae. The fauna shows close relationships to those of areas B and E.

**Area D:** The fauna is dominated by four species of *Rhododrilus* and two megascolecine species, each of which is very widely distributed in area D and in one or more of areas A, B and C. Eight other species occur in area D, but they are found only on the fringes, adjacent to neighbouring areas.

**Area E:** 26 species, 19 confined to the area; 24 species are Acanthodrilinae. The acanthodriline genera *Maoridrilus* (10 species), *Neodrilus* (3 species) and *Octochaetus* (4 species) are dominant. The portion of area E east of the main ranges in the North

Island is differentiated as sub-area E<sub>2</sub>, since it contains some species known from area E<sub>1</sub> and a few species characteristic of area B.

**Area F:** The fauna is dominated by Acanthodrilinae, of which there are 22 species out of a total of 25 (18 species are confined to area F). *Maoridrilus* (10 species), *Octochaetus* (4 species) and *Eodrilus* (3 species) are most common. The fauna of this area contrasts strongly with those of other areas (especially A and E) in that individual species are very widely distributed. Banks Peninsula is differentiated as sub-area F<sub>1</sub> as it appears to be the centre of distribution of four species which are now found on the Canterbury Plains adjacent to Banks Peninsula.

**Area G:** 13 of the 16 species are Acanthodrilinae. 9 species are confined to area G. *Maoridrilus* (3 species), *Plagiochaeta* (2 species), *Octochaetus* (2 species) and the megascolecine *Diporochaeta* (3 species) dominate a fauna, which, though similar to that of area F at the generic level, more closely resembles those of areas E and H at the specific level.

**Area H:** The eastern boundary of this region is not well known. 13 of 19 species are Acanthodrilinae and 6 Megascolecinae. 10 species are confined to area H. The fauna is related to those of areas F and G, but the strongest relationship is to the fauna of Stewart Island, Snares and Auckland Islands, and in one genus (*Hoplochaetina*) to the fauna of area A.

**Area I:** The earthworm fauna of area I (Stewart Island) has much in common with those of areas H, F and Snares Island. 7 species, 4 Acanthodrilinae and 3 Megascolecinae, are known. Only 2 species are confined to the island and the area has probably been connected to areas F and H so recently that there has been little or no differentiation of species since the areas became separated.

The overall distribution pattern may be summarized as follows:

1. Acanthodrilinae and Megascolecinae are found in all areas.
2. Area A differs from the remainder in the dominance of Megascolecinae (especially *Megascolides*), the large number of species and the small distributional area of individual species.
3. Area B has a fauna consisting almost entirely of Acanthodrilinae, some of which are closely related to the Acanthodrilinae of the northern portion of area A.
4. Area D is dominated by a few species, each with a very wide distributional area, which have apparently come from surrounding areas.
5. The position of Cook Strait has had little or no influence on the present distribution of earthworms.
6. Area F, which is very large, has a comparatively small number of species, each with a wide distributional area.
7. The fauna of area H includes a number of species not closely related to those of other South Island areas, but similar to species from Snares and Auckland Islands, and a few species which are closely related to species from area A.

This distribution pattern indicates that Megascolecinae have entered New Zealand (from the north) much more recently than Acanthodrilinae. Very recent volcanic activity in central North Island, together with

changes in the distribution of land and sea, have prevented most Megascolecinae from advancing south of area A. Soils derived from the most recent Taupo ash shower (all of area D) have been repopulated from surrounding areas, and because of their peculiar physical and biological properties only a few species have succeeded in them, and they have become very widespread. These soils have, by forming a barrier to the distribution of Megascolecinae, allowed the fauna of area B to develop in isolation, and though strong resemblances exist between some of its species and the Acanthodrilinae of area A, species peculiar to the area are also found. Area E is populated by a forest soil earthworm fauna whose distribution indicates that Cook Strait is of very recent origin. The fauna of area F is apparently mainly derived from that of area E. There have been great changes in the vegetation of area F since the last glacial maximum, and most of the area has probably been repopulated since that time. Species have a broad distribution pattern similar to the dominant species of area D. Much of area G was recently covered with ice and it has been repopulated by species from areas E and H. That portion of the fauna of area H which is similar to the fauna of subantarctic islands is probably a relic of a pre-glacial fauna which survived in isolated pockets of forest in the south-west of the South Island during the last glaciation and spread out again as the glaciers retreated.

## Natural Areas in New Zealand—Land Snails

*R. K. Dell*

The species that *can* be present in an area are regulated by the interplay of the two factors of the geological history of the area and the power of dispersal of the animals concerned. Ecological processes in the area then determine which of these possible species *will* be present in the area. An attempt to delineate natural areas presupposes a belief that ecological processes will act on each member of a group of species in the same way and that the boundaries of each member of the group will be similar. If such were

the case this symposium would be unnecessary because the boundaries would be self-evident.

It is the writer's belief that the distribution patterns of invertebrate animals owe more to the factors of geological history, powers of dispersal and the re-occurrence of certain quite limited ecological niches throughout New Zealand than they do to any broad ecological boundaries.

Several different methods of analysis are

## KEYS TO CLIMATE AND SOIL MAPS

## MAIN CLIMATIC DISTRICTS

(See map)

- A. Very warm humid summers, mild winters. Annual rainfall 45-60 inches with maximum in winter. Prevailing wind south-westerly but occasional strong gales and heavy rain from east or northeast from Auckland northwards and about Coromandel Peninsula.
- A<sub>2</sub> Similar to type A but much wetter; rain-60-100 inches.
- B. Sunny, rather sheltered areas which receive rains of very high intensity at times from the northeast and north. Very warm summers and mild winters. Annual rainfall 40-60 inches with maximum in winter.
- C. Very warm summers, day temperatures occasionally above 90°F with dry Foehn NW wind blowing. Rainfall 40-60 inches per annum; marked decrease in amount and reliability of rain in spring and summer; moderate winter temperatures with maximum rainfall in this season.
- C<sub>0</sub> Drier than type C—rainfall 25-35 inches. Very sunny.
- C<sub>2</sub> Cooler and wetter hill climates. Very heavy rains at times from east or southeast; annual rainfall mainly 60-80 inches.
- D. West to northwest winds prevail with relatively frequent gales. Mean annual rainfall 35-50 inches; rainfall reliable and evenly distributed through the year. Warm summers, mild winters.
- D<sub>2</sub> Wetter than D—rainfall 50-80 inches.
- E. Mild temperatures, high rainfall increasing rapidly inland with height, minimum rainfall in winter especially in the south. Prevailing winds SW but gales not frequent at low levels in spite of exposed coastline.
- F. Low rainfall, 23-30 inches; in the south slightly more in summer than in other seasons. Warm summers with occasional hot Foehn north-

westerlies giving temperatures above 90°F, cool winters with frequent frosts and occasional light snowfalls. Prevailing winds NE near the coast, NW inland.

- F<sub>2</sub> Cooler and wetter hill climates. Rainfall 30-60 inches. NW winds prevail with occasional very strong gales specially along river courses. Snow may lie for several weeks in winter.
- F<sub>0</sub> Semi-arid areas, rainfall 13-20 inches. Very warm, dry summers; cold winters.
- G. Warm summers, cool winters. Rainfall 25-35 inches, evenly distributed except for slight falling off in winter.
- G<sub>2</sub> Wetter and slightly cooler than G climates; rainfall 35-50 inches; in coastal districts cloudy, windy conditions and frequent showers.
- M. High rainfall, mountain climate.

“NATURAL AREAS” OF NEW ZEALAND SOILS.  
(Boundaries generalized from Soil Map of N.Z. 1948.)

## SOILS IN WHICH THE ENVIRONMENT IS

## FULLY EXPRESSED:

1. Soils of the cool semi-arid zone, developed under tussock grasses.
2. Soils of the mild sub-humid zone developed mainly under tussock grasses.
3. Soils of the humid zone developed mainly under forest.

## SOILS IN WHICH THE ENVIRONMENT IS NOT FULLY EXPRESSED, DUE TO THE DOMINANCE OF CERTAIN FACTORS:

4. Skeletal soils on steep slopes dominated by the topography factor.
5. Recent soils from alluvium or volcanic ash, dominated by their youth—the time factor.
6. Soils from old volcanic ash, dominated by their abnormal parent material.
7. Soils from younger volcanic ash, dominated by their youth and their abnormal parental material.

## Excursion

On Saturday, May 12th, there was an excursion by bus from Wellington, over the Rimutaka Range, to the southern portion of the Wairarapa district.

During the excursion stops were made at the following places:

1. Summit of Rimutaka Range: Mr. A. L. Poole and Mr. A. P. Druce pointed out features of the vegetation, which consists of scrub (manuka and some sub-alpine species) and remnants of the red beech and silver beech forest which formerly covered the area.

2. Western Lake Forest Reserve: Beech forest here comes down to the edge of Lake Wairarapa. Mr. Poole and Mr. Druce explained some features of the forest.

3. Lake Pounui: This is a small lake which is a bird sanctuary, and since the shooting

season was in progress considerable numbers of waterfowl were seen. A stop was made at this point for lunch.

4. Top of hill above Lake Onoke: From this point an excellent view was obtained of Palliser Bay, Lake Onoke, which is separated from the sea by a long narrow shingle spit, Lake Wairarapa, and the southern portion of the Wairarapa district, bounded on the east by the Aorangi Range.

5. Lake Onoke: Most of those present walked along the narrow spit and examined contrasting conditions on the seaward and landward sides.

From Lake Onoke the bus returned to Wellington over the same route. Commentaries on points of interest near the road were given throughout the excursion by various members, using the loudspeaker system in the bus.

