Ecology of Rabbits in New Zealand compared with California Rodents

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Even though there are some introduced mammals in New Zealand, the country is still relatively free of pests in comparison with California. For example, in New Zealand there is one kind of rabbit, one hare, one mouse and several rats, whereas there are about 100 species of rabbits and rodents in California.

During the past ten years I have had the opportunity of studying the changes in environmental conditions that have caused some species of rodents in California to become unusually numerous, hence also to become a pest to agriculture. The basic factor responsible for this situation is land use; when man alters the environment either intentionally to suit his needs or as a result of his method of using the land, many kinds of rodents then all but disappear, but a few other species are often favoured by the new conditions, and build up into dense populations.

Several examples will be given to show how significant an alteration of habitat conditions can be in determining the distribution and density of certain California rodents. The habitat changes that accompany either light or close degrees of grazing by sheep or cattle on much of the rangelands in that State result in several species of rodents practically disappearing, but at the same time it permits ground squirrels (*Citellus*), in particular, to become almost as serious a pest as rabbits ever were in New Zealand. When Douglas fir forests are logged, white-footed mice (*Peromyscus*) then become so numerous that they eat nearly all of both the natural and the broadcast seeds, and thus prevent regeneration of the forest. When irrigated pastures are established in the central part of California, the following groups of animals are no longer able to survive in those areas: ground squirrels, white-footed mice, pocket mice (*Perognathus*), kangaroo rats (*Dipodomys*), harvest mice (*Reithrodontomys*), cottontails (*Syvilagus*), which is the nearest relative of the wild rabbit of New Zealand, and others. But either of two species, the meadow mouse (*Microtus*) or the pocket gopher (*Thomomys*) may become far more numerous per unit area than the combination of all the other species that existed there before the land was planted in lucerne or other irrigated forage. The jack rabbit (*Lepus*), which is a hare, also increases in paddocks of lucerne.

Most animals can live in a variety of environmental conditions. Only where food and cover are optimum, however, can dense populations exist. Where the situation is less favourable, the species may manage to perpetuate itself, but, for some unexplained reason, at least with rabbits and a number of species of rodents, they never become very abundant. In these instances it is usually not a matter of low rate of reproduction that prevents a denser population from building up, but rather it generally is a consequence of low survival of young. The reason for this poor survival of young is often obscure.

What are the environmental conditions rabbits in New Zealand require before they can become sufficiently numerous to be a pest? Even though rabbits occupy a broad range of environmental situations, the principal factors that seem to govern this distribution and density appear to be the type of cover and food that is available to them. Rabbits do not thrive well in dense and tall grass; instead, they require bare ground or turf-like conditions plus suitable cover.

The type of cover or shelter required varies. If the soil is loose and well drained, in other words suitable for burrowing, no other cover is essential. If the soil is heavy and poorly drained, other types of cover are needed. Edges of bush and exotic forests are used. Gorse, manuka, matagauri, mountain tauhinu (*Cassinia*), *Dracophyllum*, and, to a lesser extent, lupin are used as cover. Broom and bracken-fern are not very good. River-bottoms, river terraces, limestone outcroppings, and other rocky areas are attractive to rabbits.

Rabbits eat a wide variety of plants. They close-crop nearly all of them, apparently preferring the growing tips close to the ground surface. This seems to be one reason why they thrive so well on what appears to be bare ground or turf-like conditions. Consequently, the more burned or otherwise depleted are tussocks or other kinds of vegetation, the more suitable the area becomes for rabbits. Often they are aided in keeping ground bare by the action of frost heave. Grazing by livestock, of course, also helps rabbits keep forage short.

It is not easy for rabbits alone to create favourable habitat. They need the assistance of burning, grazing or some other factor to create bare places. The less favourable weather and other conditions are for plant growth, the more easily rabbits can create additional bare soil or short grass conditions, and thus enlarge the area of suitable habitat. The better weather, soil texture, and soil fertility are for grass growth, the more difficult it becomes for rabbits to "get on top" of the vegetation and maintain it bare or in short grass. On more productive and topdressed sites, the flush of grass growth can rule the rabbit. In all instances, where a healthy growth of herbaceous vegetation has been obtained, the rabbit alone cannot take over quickly. The rabbit's rate of increase, which is determined by the degree of survival of young, and not a consequence of large and frequent litters, is never as great on well-vegetated land as it is on bare soil or where moss and lichen are the principal ground cover.

There are existing examples in New Zealand that clearly illustrate the fact that rabbits cannot take over seeded and topdressed paddocks where the annual rainfall is at least 30 or 40 inches. This situation occurs in localities that have never been within a rabbit board, and even though the rabbits are not being controlled in these places, they still do not become numerous. There are also examples of this type of improved farming country that are adjacent to high rabbit densities, yet such rabbit populations have not spread into the surrounding paddocks. Rabbits do not thrive in dense tussock or tall grass. Topdressing alone has been able to "control" the rabbit in many localities. Generally, it is necessary to first reduce the rabbit population artificially, to give the forage a chance, then the rabbits can no longer convert it back to a suitable habitat for themselves. In dry conditions like Central Otago the picture is different, but even in localities of 10 to 20 inches of rain, once the rabbits have been controlled and the area has been allowed to become well grassed, due to light grazing, complete spelling, seeding and topdressing, rabbits cannot again deplete large areas in just a few years. Under these conditions they do not increase as rapidly as they formerly did when such country was quite bare.

Why did the rabbit become such a devastating problem in New Zealand? It is because the pioneer farmer and run-holder had no recourse but to use fire to clear the bush and open up the scrub and tussock for his flocks. And it was also discovered early that most of the tussocks became more palatable when burned. It was clearly the indiscriminate burning, more than overstocking, that provided a favourable habitat for rabbits.