

# Population Dynamics of Newly Introduced Species

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## Population Fluctuations in Adventive Plant Species in New Zealand

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This contribution is an attempt to present instances of population fluctuations in adventive plants, treating the subject from two viewpoints.

A.—*Fluctuations in species populations in relation to period of domicile of the particular species in New Zealand*

Consideration of the adventive flora of New Zealand (circa 1400 species) shows that the constituent species, in terms of abundance and probable period of domicile, fall into one or other of the groups or categories detailed below.

GROUP I: Population usually small, derived in the main from repeated new introductions, or escape from cultivation: species of early or recent introduction.

The populations of species in this group fluctuate from year to year, depending in large degree on opportunities for introduction, as related to import of certain commodities or growth of a particular crop, etc., e.g. Mexican poppy, *Argemone mexicana* L., \*(T. W. Kirk, 1895, Taranaki, Hawke's Bay, Marlborough) in imported wheat; *Camelina sativa* (L.) Crantz, (Cheeseman, 1883, Auckland) in imported linen flax seed; broomcorn millet, *Panicum miliaceum* L., (Healy, 1944, North and South Island localities) in bird seed mixtures.

GROUP II: Populations small to medium, showing minor fluctuations; species of

early or recent introduction, local in occurrence.

Heath, *Epacris purpurascens* R. Br., (Hooker, 1855, Papakura), *E. microphylla* R. Br. (Urquhart, 1882, Manakau Harbour), and *E. pulchella* Cav. (T. Kirk, 1896, Karaka district) are all species of long standing which have persisted without marked fluctuations in population in the same locality.

Horsetail, *Equisetum arvense* L., (Atkinson, 1922, Wanganui) has shown little fluctuation in its original occurrence, while a reported South Island occurrence of this or a related species indicates similar behaviour.

GROUP III: Populations now small, initially large; species of early introduction.

Corn cockle, *Agrostemma githago* L., (T. Kirk, 1870, Waitemata district) was reported until early in this century as economically significant as a weed of cereal crops; now the species is rare in waste places, and absent from cereal crops. This decreasing abundance has also been reported for the species in Great Britain and elsewhere.

Sorrel, *Rumex acetosa* L., (Hooker, 1855, locality not cited), reported as not uncommon until the 1920's appears to be virtually if not totally extinct now, specimens not having been observed or submitted for identification for a number of years.

GROUP IV: Populations small to medium, showing slow but steady increase; species of early or recent introduction.

Species as fleabane, *Erigeron pusillus* Nutt., (Allan, 1940, Auckland), turnip weed, *Rapistrum rugosum* (L.) All., (Cheeseman, 1883, Auckland), and bittersweet, *Solanum dulcamara* L.,

\*Denotes botanist making original formal record of the species, year of publication of record, and original locality or localities. The date cited, while in some instances approximating to time of actual introduction, is obviously in other instances a varying number of years later than the actual introduction. Also the locality or localities cited are those known at that time, but the species may have been present, but not observed, in other localities.



(Healy, 1944, North Island localities, Hawarden) are representative of this group.

GROUP V: Populations large, build-up rapid following introduction; species of early introduction.

Examples of species in this group are watercress, *Nasturtium officinale* R. Br. [sensu lato], (Hooker, 1852, Auckland), sheep's sorrel, *Rumex acetosella* L., (Travers, 1864, locality not cited), and hairgrass, *Vulpia dertonensis* (All.) Volk., (Hooker, 1855, Bay of Islands, Auckland, Great Barrier Island).

GROUP VI: Populations large, but from time to time with periods of diminution in numbers in particular localities; species of early introduction.

Foxglove, *Digitalis purpurea* L., (Hooker, 1867, Auckland) achieved wide distribution and large populations during the previous century, and early in this century it became regarded as a serious weed of pastoral land in higher rainfall districts, requiring heavy expenditure on control measures. It was then found, in localities over the range of the species, that populations decreased to insignificant numbers, and now, while it may persist in large numbers for a period in particular localities, it is regarded as economically insignificant owing to this fluctuation in population.

GROUP VII: Populations medium to large, with initial small populations for long period, followed by rapid increase; species of early introduction.

*Chrysanthemum segetum* L., (T. Kirk, 1870, Auckland) has been occasional in cultivated land and waste places for many years, but it exhibits from time to time marked temporary increases in population, followed by a similarly marked decrease.

Hawkweed, *Crepis taraxacifolia* Thuill., (T. Kirk, 1870, Waikato district) was reported subsequent to 1870 from a number of North and South Island localities, but nowhere was it more than occasional to uncommon. After 1940, there was a remarkable increase in population numbers in some localities, such that in parts of the Wellington Province and Canterbury it rivals its congener *C. capillaris* (L.) Wallr. in abundance and significance as a weed of pastures, waste places and lawns.

*Galinsoga parviflora* Cav., (T. Kirk, 1896, Wellington) later appeared subsequent to 1896 at Auckland and Nelson, and appeared to increase about Auckland about 1930. The species showed

a marked increase about market gardens in the lower Hutt valley in the early 1940's, but in the upper Hutt valley in 1945 isolated plants only were apparent. Over the period 1949-1953, the species increased markedly, became abundant in gardens and other cultivated land, and acquired the local popular name "potato weed" from its economic significance as a smothering weed of potato crops.

Water speedwell, *Veronica anagallis-aquatica* L., (Hooker, 1854, East Coast, North Island) was not reported again until 1924 when Allan recorded the species from the Manawatu River. The species is now not uncommon along the lower Manawatu River, occurs along various rivers on the east coast of North Island south to Wairarapa, and is occasional to abundant, and spreading along most rivers and streams from Blenheim southwards along the east coast of South Island.

GROUP VIII: Populations large, showing rapid increase over short period; species of recent introduction.

Bromegrass, *Bromus carinatus* Hook. et Arn., (Allan, 1940, Wellington, Lincoln), while abundant about Wellington at the time of formal recording and therefore domiciled some years earlier, has showed a marked increase in other localities since that time. In the Upper Hutt locality the species was rare as a plant of roadsides and waste places in 1945, and by 1953 it was abundant.

Male fern, *Dryopteris filix-mas* L., Schott. This species constitutes the only introduced fern to persist and spread in the adventive state, all previously reported species of Filices having been collected on one occasion only. As yet not formally recorded from New Zealand, this horticultural species has escaped from cultivation and spread at Wellington and Christchurch. There appears a rapid increase in populations, plants at all stages of development being noted in suitable habitats.

Nasella tussock, *Nasella trichotoma* (Nees) Hack., (Allan, 1931, Waipara River, Canterbury) has demonstrated in localities in Marlborough and North Canterbury what must be the most "explosive" fluctuation in population over extensive areas which has occurred in New Zealand for many years. The change from scattered individuals to a state of complete dominance occurs in less than a decade.



B. *Fluctuations in population in relation to specific habitats and units of vegetation.*

1. WASTE LAND COMMUNITIES:

An unused cinder dump (still smouldering beneath and with heated surface material) showed for the first three years after disuse increasing populations of the annuals *Amaranthus albus* L., *Chenopodium pumilio* R. Br., *Portulaca oleracea* L., and *Vulpia dertonensis* (All.) Volk., but over the subsequent three years the populations of these annuals decreased with the assumption of complete dominance of the perennial *Cynodon dactylon* (L.) Pers.

Littoral swamps in North Auckland and Hawke's Bay in process of reclamation show fluctuations in population numbers of the composite *Aster subulatus* Michx. and *Erigeron* sp. in the earlier stages.

2. CULTIVATED LAND COMMUNITIES:

The populations of *Juncus bufonius* L., *Polygonum persicaria* L., *Stachys arvensis* L., and

*Veronica persica* Poir. in cultivated land in Wellington Province show marked fluctuations from season to season, being particularly large in wet seasons.

3. PERMANENT CROP COMMUNITIES:

*Medicago sativa* L. (perennial) shows decrease in population, with increase of the annuals, *Bromus* spp., *Erodium* spp., *Vulpia* spp., and perennial *Agrostis tenuis* Sibth.

4. GRASSLAND ASSOCIATIONS:

Newly-sown artificial grassland often shows for one or more seasons significant populations of annuals as *Sisymbrium officinale* (L.) Scop, and biennial *Cirsium vulgare* (L.) Savi, which may fluctuate for a period, then disappear completely.

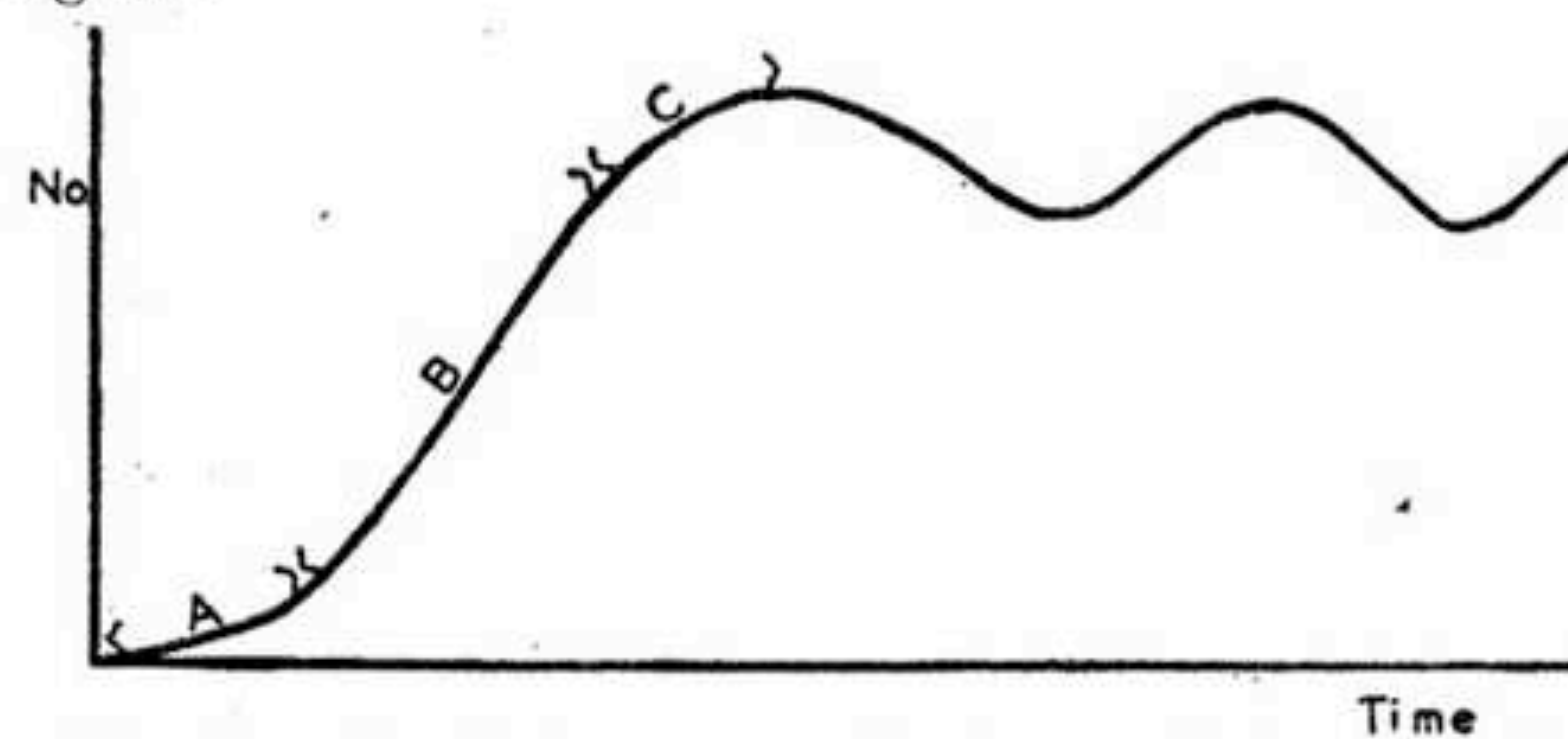
Population fluctuation involving change from species of perennial grass to other species of perennial grass is instanced with replacement of *Lolium perenne* L. etc. by species as *Agrostis tenuis* Sibth. and *Pennisetum clandestinum* Hochst.

## Population Growth in Some Introduced Insects in New Zealand

Dr. W. Cottier

Whereas experimental patterns of population growth can be satisfactorily determined in the laboratory, their application under field conditions is not easy, although it has been done to a limited extent, e.g., Davidson in Australia on thrips in roses. This contribution is a rather general account of the progress of three newly-introduced species with observations on some factors considered to have influenced population growth.

In general the population growth curve of these introductions is shown in the following figure.



Section A of the curve is the period of establishment after which, under favourable environ-

mental conditions, there is a period of rapid increase B, until numbers reach near stability at C, and thereafter attain an equilibrium in which there are numerous fluctuations. The pattern of the graph covered by periods A, B and C forms a sigmoid curve. Features of the growth patterns of the following three insects will be considered in relation to the curve.

1. THE WHITE BUTTERFLY—*Pieris rapae* L.

Two specimens of the insect were recorded in New Zealand at Napier, Hawke's Bay, in March, 1930, i.e. A in figure. In the season 1931-32 there was a period of rapid increase, i.e. B in figure, when specimens were recorded 100-120 miles from the original points of discovery. As a result of abundant food sources and favourable climate, by 1932-33 numbers were immense, and the insect had spread as far north as Auckland. By the 1934-35 season the infestation of the North Island was complete. The insect was first recorded in the South Island in 1931-32, had covered the north-eastern area of the island as far south as Timaru. Spread was continuous and rapid, and by 1935-36 the invasion of the two islands was