Malleability is a function of the stressor and the ecosystem. In one study, ant colonization was followed over 30 rehabilitated bauxite mines (Majer et al. 1984). One site had been accidentally cleared and revegetated with pines, with no mining having taken place. Ten years after restoration the species richness of ants in this plot was high relative to that of mined plots of similar age that had also been planted with pines (means of 12 and 10.5 species per transect respectively). Preservation of the original soil profile may have reduced that site's malleability.

Yet who is to say that temporary periods of stasis will not give way to further convergence of disturbed sites on control sites? Data cited in the next section should make one view short-term dynamics with caution.

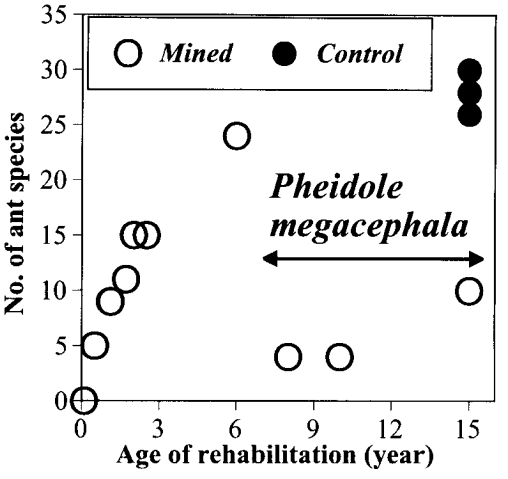

Figure 7.6. Pattern of recolonization of ants in rehabilitated sand-mined areas on North Stradbroke Island, Queensland. The arrival of the tramp ant *Pheidole megacephala* appears to have dramatically restructured the system, lowering diversity relative to three controls. Adapted from Majer (1985).

Oscillations and Other Nonlinear Behavior

Just as a perturbed spring may oscillate before reaching an equilibrium, so may an ecosystem's properties fluctuate following a perturbation. Species richness in particular may be highest at intermediate time periods following perturbation (Connell 1978). If so, then remediation projects that use species richness alone to gauge success may end prematurely.

Ant assemblages in postmining ecosystems commonly show sharp fluctuations in species richness, as dominant species are lost and replaced. In the next two examples, species richness on recovering mining sites shows opposite yet symmetric relationships between age and species diversity.

One site, a dune system in Queensland, Australia, increased in species richness from the cessation of mining up to year 8 (Fig. 7.6). In that year there was an abrupt increase in the population of the multiple-queen tramp ant *Pheidole megacephala.* Like other introduced species (see Chapters 2 and 4), *P. megacephala* frequents disturbed ecosystems and can have major effects on the local ant assemblage. The arrival of *P. megacephala* at this site was accompanied by an equally abrupt decrease in species richness and the introduction of new species into the newly depauperate assemblage (Majer 1985).

In another dune-heath system in New South Wales, Australia, Fox and Fox (1982) found a gradual decrease in species diversity after the cessation of mining. The cause was another dominant ant, a territorial *Iridomyrmex* that gradually increased in abundance for 8 years. Then, in year 9, this species was replaced by another *Iridomyrmex* species. This dramatic switch was accompanied by an increase in species diversity. In both cases, species diversity seemed to hinge on the identity of the dominant species. Succession in ant assemblages, then, may not always represent the gradual accumulation of species (Haskins and Haskins 1988).

Oscillations and nonlinearities in ecosystem properties create problems for the design of