Questions: How do different substrate types and soil nutrient levels influence species composition and successional sequences, as represented by different life-history traits? Is the rate of succession increasing or decreasing along a gradient from low to high fertility?

Location: Ecological field station Dahlem in Berlin, Germany.

Methods: A 18-year permanent plot study of succession on soils of differing fertility. The original substrates were a nutrient-poor sandy soil from a sandpit, a ruderal subsoil of moderate fertility and a nutrient-rich topsoil.

Results: In plots with sand, monocarpic perennials were dominant at the beginning, which were then replaced by perennial grasses, and those being then replaced by woody perennials. On ruderal soil, monocarpic perennials were co-dominant with perennial herbs at first, then were replaced by perennial herbs, which were then also replaced by woody plants. Dominance of woody species was attained after about ten years, both on sand and on ruderal soil. In plots with topsoil, there was a short phase at the start where monocarpic perennials were co-dominant with perennial herbs, followed by a relatively long period of perennial herb dominance. There were about twice as much woody species growing on the substrates of low and intermediate fertility compared to the nutrient-rich soil. If we compare the time necessary for woody species to reach 10% and 50% cover, woody colonization was much slower on the resource rich site. DCA ordination revealed a clear separation of samples along the nutrient gradient. It also showed slower community change with increasing soil fertility.

Conclusions: This study demonstrates that woodlands can be created on bare ground in temperate climate by natural colonization in relatively short time, if substrates are not too nutrient-rich. The assumption, that the rate of succession increases with increasing productivity could not be confirmed. Succession towards woodland can be rapid on soils of low and intermediate fertility. On the contrary, a nutrient-rich substrate favours perennial herbaceous vegetation which inhibits woody colonization and arrest succession.

Keywords: Community change; Ellenberg indicator values; Inhibition; Life history; Rate of Change; Restoration; Species density; Species turnover; Spontaneous succession; Woody colonization.