

Applied Ecology of Succession in Pine Forests of western Japan

Michiro Fujihara, Yoshio Hada, and Gentaro Toyohara

Introduction

One of the most representative vegetation types in western Japan is *Pinus densiflora* forest, given that most primary evergreen, broad-leaved forests have been largely destroyed by human activities. Pine trees regenerate and persist at sites where forest cutting, land clearing, and fire have occurred, because *P. densiflora* requires full sunlight and bare mineral soil for seed germination. For a long time, pine trees have been used for timber and fuel; shrubs for fuel; and litter, for compost. However, after the 1960s, petrochemicals such as propane gas and chemical fertilizer became widely used in Japan. Since then, pine forests have been abandoned and have gradually been replaced by broad-leaved forests. In addition, pine forests have suffered from mass dieback due to pine wilt disease, which is caused by epidemic attacks of the nematode *Bursaphelenchus xylophilus* (Steiner et Buhner) Nickel, vectored by the beetle *Monochamus alternatus* Hope (Kiyohara and Tokushige, 1971; Morimoto and Iwasaki, 1972). Many pine forests in Japan suffer from pine wilt disease except in northern areas such as Hokkaido and Aomori Prefecture (Kishi, 1995; Rutherford et al., 1990). One-fourth of pine forests in Japan have been infested by the disease (Mamiya, 1983).