Factors influencing early vegetation establishment following soil-scarification in a mixed forest of northern Japan

Toshiya YOSHIDA, Field Science Center for Northern Biosphere, Hokkaido University
Yoko IGA, Graduate School of Agriculture, Hokkaido University
Megumi OZAWA, Field Science Center for Northern Biosphere, Hokkaido University
Mahoko NOGUCHI, Graduate School of Environmental Science, Hokkaido University
and
Hideaki SHIBATA, Field Science Center for Northern Biosphere, Hokkaido University

Scarification is widely conducted in northern Japan to remove understory dwarf bamboo species in degraded forests for replacement with tree species. To explore ways to enhance species diversity and restoration of mixed forest at the treated site, we clarified the mechanisms that lead to compositional heterogeneity of plant species. We evaluated the relative importance of environmental factors (scarification properties, soil properties, light conditions, litter cover, and presence of canopy trees) for the demography of tall tree species (emergence, mortality, and growth) and whole vegetation structure (species diversity and composition) over the two growing seasons immediately following scarification.

Of tall-tree species, *Betula* spp. were dominant (60% in total density), followed by *Abies sachalinensis*, *Acer mono* and *Phellodendron amurense* (Figure 1). Light intensity was an important factor, having mostly negative effects on the demography of these species. Soil factors (e.g. nitrogen content, moisture) affected the demography mainly of shade-intolerant or hygrophilous species. In general, extreme environmental conditions led to the dominance of grasses, forbs and lianas rather than tall trees. Maintenance of canopy cover, which limits light and supplies seeds as well as litter, proved to be most important in promoting plant species diversification on the scarification site (Table 1).

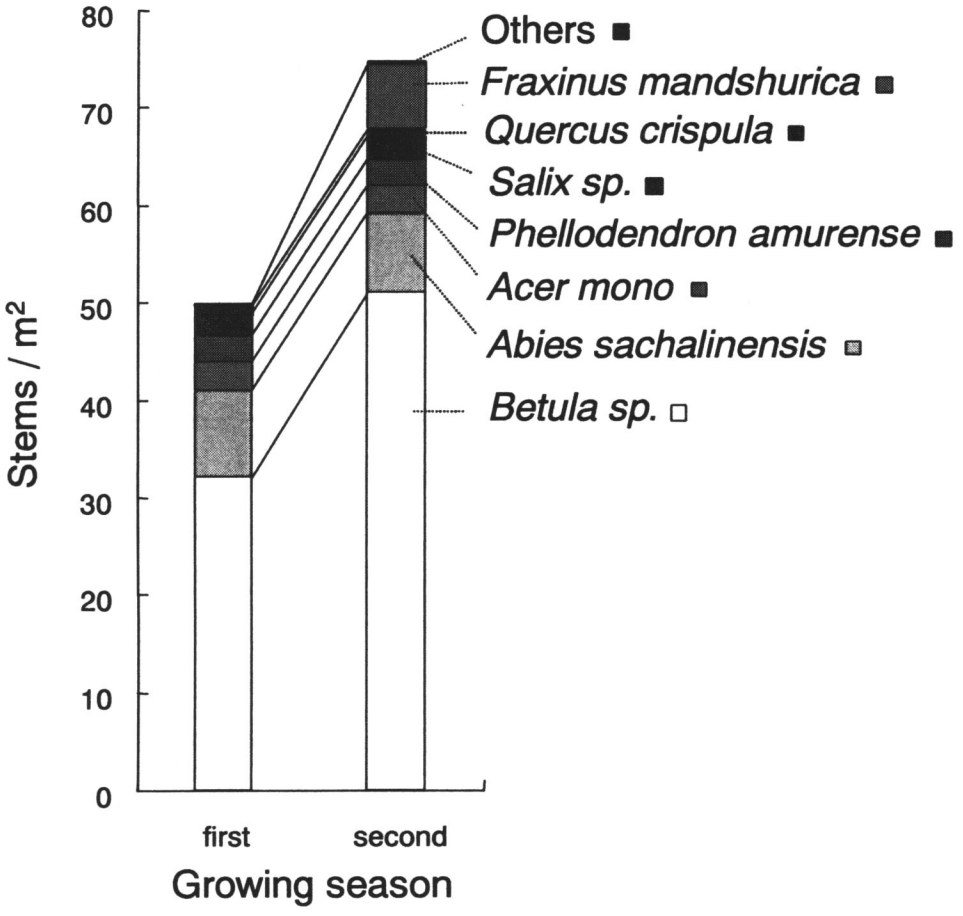

Figure 1. Mean densities of tall-tree seedlings per quadrat (1 m^2) at the end of the first and second growing seasons.

Table 1. Results of stepwise multiple regression analyses, explaining species diversity. Partial regression coefficients and their statistical significance (p-values in the parentheses; 0.00 indicates <0.005) are shown. SCAR1, SOIL2, LIGHT and CANOP represent scarification intensity, soil pH condition, light intensity and presence of canopy, respectively.

	R^2		SCAR1		SOIL2		LIGHT		CANOP	
Species diversity in the first year										
Species richness	0.272	(0.00)	-0.202	(0.16)	0.203	(0.09)	-0.282	(0.09)	0.226	(0.12)
Shannon index H'	0.100	(0.02)	-		0.269	(0.04)	-		0.295	(0.02)
Species diversity in the second year										
Species richness	0.343	(0.00)	-		-		-0.326	(0.02)	0.343	(0.01)
Shannon index H'	0.177	(0.00)	-		-		-0.261	(0.09)	0.240	(0.12)