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Ecological Indicators 5 (2005) 109–115

ECOLOGICAL INDICATORS

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Miscanthus sinensis grassland is an indicator plant community to predict forest regeneration and development on ski slopes in Japan

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Accepted 4 October 2004

Abstract

Most ski slopes in Japan are established by forest clearcutting, scraping off the ground surface and thereby artificial seeding in well-developed forests. Recently, some ski slopes have been abandoned owing to economical failure, and more skis resorts will go bankrupt. To restore abandoned ski slopes, therefore, we have to find out appropriate indicators to restore forest cover with low cost. Vegetation data were collected in Yuzawa, central Honshu, Japan (500–760 m elevation), where ski slopes are over-concentrated. To predict the possibility of forest development, relationships between tree stem density and vegetation characteristics were examined. Trees did not establish in areas where the introduced plant cover was more than 40%. Of native grasslands, *Miscanthus sinensis* grassland showed the highest stem density but did not show high species richness. In particular, stem density increased with increasing *M. sinensis* cover. To indicate advanced successional sere towards forests, therefore, *M. sinensis* cover is a more appropriate indicator rather than species richness.

Keywords: Ecosystem restoration; Forest regeneration; Landscape degradation; *Miscanthus sinensis*; Mountainous area; Ski slope vegetation

1. Introduction

Ski slopes in Japan tend to be concentrated in certain areas, due to accessibility from urban areas and the cost of ski resort construction and maintenance (Kawai, 1994). For example, Yuzawa, which is the one of the most popular ski resort areas in Japan, comprises 42 ski resorts because of convenient accessibility from Tokyo, the capital city of Japan (Tsuyuzaki, 1994). Climax vegetation, where most ski resorts are constructed, consists of needle-leaved and broad-leaved forests. Ordinarily, ski slopes in Japan are constructed within forests by the forest clearcutting (Nakamura, 1988; Tsuyuzaki, 2002). The ground surface is then modified mechanically to remove obstacles including plant underground organs to make comfortable slopes for users. Since not only nutrient-rich surface soil but also seedbank is removed mostly during this process, the vegetation recovery from seedbank cannot be expected on most ski slopes in Japan. The depth of soil removal is occasionally more

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1470-160X/$ – see front matter
doi:10.1016/j.ecolind.2004.10.002

than 1 m (Tsuyuzaki, 1990). Seedbank on mechanically graded ski slope in Swiss Alps accounts for only 2% of that on un-graded slopes (Urbanska and Fattorini, 1998). Finally, exotic plant seeds are sprayed to prevent soil erosion. However, most ski slopes develop barelands and grasslands, due to ground surface instability (Tsuyuzaki, 1990, 1995). In Europe where ski areas are usually constructed in the pastureland and heathland of montane and subalpine areas, ski slopes result in the destruction of those ecosystems and landscapes (Pignatti, 1993; Williams and Todd, 1997). However, ski slopes are recently machine-graded and machine-leveled in Europe (Urbanska, 1997; Ruth-Balagankaya and Myllynen-Malinen, 2000). Large-scaled ski slopes are distributed in West Coast, USA, but are often established above timberlines (Titus and Tsuyuzaki, 1998, 1999). Therefore, human disturbance is more intense in Japan to construct ski slopes. The comparison of ski slopes between Japan and the other countries suggest that environmental fragmentation and deterioration resulting from ski slope construction take place more in Japan.

While, the concentration of ski slopes causes excessive competition among ski resorts to get users and the subsequent financial deficits and bankruptcies occur (Kawai, 1994; Tsuyuzaki, 1999). After the abandonment, most ski slopes have been left as they were (Tsuyuzaki, 1994, 2002). Therefore, it is prerequisite that the abandoned ski slopes are restored with low cost for decreasing environmental deterioration. One approach is finding out ecological indicators that predict the prompt recovery of forests. If we detect the indicators, then we can contrive suitable techniques to lead revegetation faster. Therefore, we firstly have to know what vegetation characteristics promote forest development. In the present study, I examined: (1) finding out the relationship between tree stem density and plant community patterns, i.e., species diversity and composition, and then (2) confirming what characteristics on ski slope vegetation predict forest development.

2. Study area and methods

I selected six ski areas in Yuzawa, all of which were closely located within a 6 km circle (Fig. 1) but different with establishing age (36°70′–36°80′N, 138°52′–138°73′E) (Table 1). The altitude of ski slopes ranged

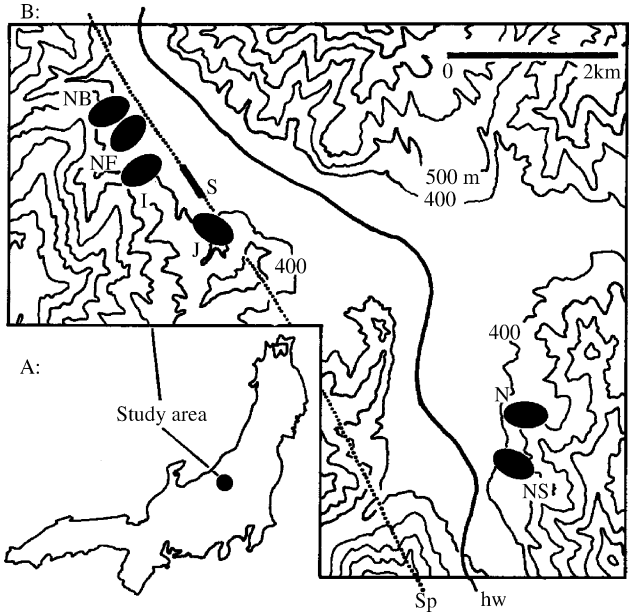

Fig. 1. Locations of six ski slopes surveyed in Niigata Prefecture, Japan. NB = Nunoba, NF = Nunoba Family, I = Ipponsugi, J = Jodaira, N = Nakasato, NS = Nakasato Snowwood. Sp: Jo-etsu Super Express. Hw = Kan-etsu Highway.