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Comparison of Floristic Diversity between Young Conifer Plantations and Second-Growth Adjacent Forests in California's Northern Interior

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ABSTRACT

There is concern that intensive even-aged forest management in conifer plantations has resulted in the decline of plant species diversity and contributed to the rise of invasive species in western forests. This 3-year study assessed plant species richness, composition of vascular plant species, and presence of rare and nonnative plant species in 73 survey units (2,528 ac) on industrial forestland in northern California. Survey units were evenly divided between conifer plantations and adjacent managed uneven-aged forests in three regions of northern California: Sierra Nevada, Southern Cascades, and Klamath Mountains. We surveyed two forest types within these regions: mixed conifer and true fir. There was no significant difference in species richness between plantations and adjacent forests. Plantations tended to be richer in forbs and graminoids, whereas forests were richer in trees and shrubs. Herbicide applications in plantations significantly reduced shrub species richness, but the effect was short-lived. Rare plant species were equally distributed between plantations and adjacent forests, but plantations contained one additional nonnative plant species. Overall, our findings demonstrate that managed, even-aged conifer plantations maintain plant species richness at a level similar to adjacent managed, uneven-aged forests.

Keywords: species richness, clearcut, forest matrix, rare plant, nonnative plant

Concern over the loss of plant species diversity from intensively managed forests, particularly in areas where clearcut regeneration methods are used in plantation management, has increased in recent years. Critics argue that clearcutting alters the floristic composition of ecosystems, causing a net loss of species, a failure of plantations to return to preharvest levels of species richness, loss of rare species, and the spread of undesirable nonnative species across the forest landscape.

To evaluate the effect of management regimes on plant species diversity in conifer plantations (artificially regenerated, even-aged stands) and managed conifer forests (naturally regenerated, uneven-aged stands), managers need to understand how floristic composition varies between plantations and managed forests. Only then can they determine which regimes best balance timber production and biological diversity. Roberts and Gilliam (1995) reviewed plant diversity in forest landscapes and reported a wide range of findings based on different ecosystems, roles of disturbance, temporal and spatial scales, and models. It is not well understood whether the temporal pattern of species richness found in managed plantations is similar to that of uneven-aged, naturally regenerated forest matrixes (Halpern and Spies 1995), whether species richness levels in intensively managed plantations will return to preharvest levels (Gilliam 2002, McDonald and Fiddler 2006), whether rotation age is sufficiently long enough for understory plant species to recover to preharvest levels in managed plantations (DiTomaso et al. 1997, Battles et al. 2001, Roberts 2002), whether plantation management reduces rare species diversity, whether plantation management encourages the spread of undesirable nonnative species (US Forest Service 2004), or whether managed forests with multiple harvest entries can maintain species richness (Edwards et al. 2010).

This study addresses these issues by examining initial impacts of plantation management practices on plant species richness and by comparing species richness in plantations less than 12 years old to that in adjacent 60- to 90-year-old, uneven-aged, managed forest matrices. As recommended by several researchers (Halpern and Spies 1995, Roberts and Gilliam 1995, Thomas et al. 1999, Jules and Shahani 2003), we chose to focus on species richness for all vascular plants within four plant life form groups (forbs, graminoids, shrubs, and trees) at the plantation scale because plantations are the working basis for forestland management decisions. We sampled 73 survey units covering 2,528 ac across a diverse and broad forested area of northern California to provide both local and regional contexts for examining floristic differences. Our study had four objectives: (1) to quantify local species richness for plantations and surrounding uneven-aged managed forest matrices; (2) to compare and evaluate species richness among individual survey units across the study area; (3) to examine how uneven-aged forest matrix attributes and plantation treatment histories influence differences in survey unit species richness; and (4) to assess the incidence of rare plants and nonnative species in plantations and adjacent forest matrices.

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