ELSEVIER

Ecological Economics 40 (2002) 411–419

ECOLOGICAL ECONOMICS

www.elsevier.com/locate/ecolecon

ANALYSIS

Restoration of the longleaf pine ecosystem on private lands in the US South: an ecological economic analysis

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Received 4 September 2001; received in revised form 26 December 2001; accepted 28 December 2001

Abstract

The longleaf pine ecosystem is one of the most biologically diverse in North America, supporting hundreds of plant and animal species. Because of its timber and many non-timber benefits, there is strong interest among forestry professionals, conservation groups, and the public at large in restoring longleaf pine ecosystems. However, many landowners are reluctant to grow longleaf pine on their lands on a commercial basis because the economic returns from longleaf pine timber production are usually less than those of slash pine. In this study, we develop a model that determines the profitability of longleaf and slash pine timber production after consideration of carbon sequestration, habitat for the endangered red-cockaded woodpecker, and other amenity benefits. Results suggest that internalizing carbon sequestration benefits and red-cockaded woodpecker habitat benefits alone is not enough for landowners to switch from slash pine to longleaf. Additional payments of $16 to 33 per ha per year, reflecting extra amenity benefits associated with longleaf pine relative to slash pine, make longleaf production financially competitive. Incentives that reflect carbon, biodiversity, and amenity benefits associated with longleaf production may be the optimal way of restoring longleaf pine ecosystems on rural private lands in the US South.

Keywords: Biodiversity; Carbon sequestration; Habitat restoration; Longleaf pine; Red-cockaded woodpecker

1. Introduction

1.1. Longleaf pine

The longleaf pine (*Pinus palustris*) ecosystem was once the predominant forest community in the southeastern coastal plain of the United States (US) before European settlement, covering over 36 million ha (Lander et al., 1995). At present, less than 1.2 million ha of longleaf pine remain since most mature longleaf stands are not being adequately regenerated after harvest (Delly and Gechtold, 1990). Humans have had a significant impact on this ecosystem for several hundred years. During colonial times longleaf pine was harvested mostly for its valuable wood. However, large-scale logging of longleaf pine forests occurred in the 19th and early 20th centuries. Longleaf pine forests were further reduced during the

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0921-8009/02/$ - see front matter
PII: S0921-8009(02)00012-5

1950s when timber and pulp and paper industries started to use faster growing loblolly pine (*Pinus taeda*) and slash pine (*Pinus elliottii*) on land that used to support longleaf pine. Lack of reforestation and government policies that encouraged the exclusion of fire also contributed to the decline of longleaf pine. Finally, the conversion of cut-over lands to agricultural use led to further reductions in longleaf pine forests in the US South. Today, virgin longleaf stands exist only in a few isolated areas (Abrahamson and Hartnett, 1990).

Longleaf pine ecosystems are rich in biodiversity, supporting hundreds of plant and animal species. The dramatic decline of this ecosystem has had significant negative environmental consequences—over 30 plant and animal species that occur in this ecosystem are now threatened or endangered (Lander et al., 1995). The most notable example is the red-cockaded woodpecker (RCW, *Picoides borealis*), which was listed as endangered in 1970. The RCW needs mature pine, preferably longleaf pine at least 25 years old for foraging habitat, and at least 60 years of age for nesting habitat (Wood and Kleinhofs, 1995). Because of its wide range and the high proportion of forest land in private ownership in the southeastern US, restoration on private lands is essential for the recovery of the RCW.

One of the consequences of replacing old growth longleaf pine with alternative fast growing tree crops, agricultural crops, and urban development is significant changes in the amount of carbon stored in forest biomass. With public concerns over the rapid rise in CO_2 levels, this represents the loss of a significant environmental benefit. In addition to environmental benefits, longleaf forests have unique characteristics that may translate into potential economic benefits to landowners. First, longleaf is much more resistant to fire than other commercial timber species such as loblolly or slash pine. In fact, regular occurrence of low intensity ground fires reduces competition from other plants and improves the biodiversity in the herbaceous ground cover (Dennington and Farrar, 1983). Second, it is more resistant to fusiform rust and bark beetle attacks than other pine species.

1.2. Challenges to restoring longleaf pine on private lands

Because of the above environmental and economic benefits associated with longleaf pine, there is a strong interest among forestry professionals and conservation groups in restoring this ecosystem. For instance, in Geneva County, AL, over 2000 ha of marginal agricultural land were planted with longleaf pine through the Conservation Reserve Program. The Florida Division of Forestry has made it a top priority to restore longleaf pine on state forest lands. Non-governmental organizations such as The Longleaf Alliance and many government organizations including the USDA Forest Service have been providing forums to exchange information and conduct research on various issues related to longleaf pine restoration.

Although they prefer to see longleaf, many landowners are reluctant to grow longleaf pine on their land on a commercial basis. The main reason for this is that the economic returns from longleaf pine are generally less than those of loblolly or slash pine.[1] However, these returns do not account for environmental benefits such as carbon sequestration and biodiversity. In the absence of established markets for these services, private forest landowners generally perceive them as public goods and do not consider them in their land-use decisions. However, developing markets for these services may increase economic returns, thereby stimulating landowners to restore longleaf pine on their land. If environmental benefits are internalized, it is quite possible that longleaf pine may become financially competitive with slash and loblolly pine. In the absence of such information, initiating policy development to promote longleaf pine on private lands is difficult. This study is aimed at exploring economic strategies to restore longleaf in the US South. The specific objectives are:

1. Develop an economic model that incorporates timber and carbon sequestration benefits associated with longleaf pine and slash pine.

[1] On some xeric sites longleaf pine is financially superior to slash pine without internalizing any environmental benefits.