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Multiple-use forestry vs. forestland-use specialization revisited

Yaoqi Zhang*

School of Forestry and Wildlife Sciences, Auburn University, AL 36849, USA

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Abstract

Based on the comparative advantages of forestland in providing a variety of products and services, it is not arguable that different kinds of forestland should produce different compositions of outputs. To investigate the issue regarding forestland-use specialization or the pursuit of multiple uses on same piece of land, this paper starts by revisiting Vincent and Binkley's paper 'Efficient Multiple-Use Forestry May Require Land-Use Specialization' (see Land Economics 69 (3):370–376. I would like to argue that their reasoning may not be entirely correct, but their conclusions may be right for the following reasons: (1) the constraints of input factors (including time), (2) cross-spatial interaction, (3) changes in technology and relative prices and (4) ecological and economic thresholds of production and management. Some evidence related to and trends in forestland-use specialization from New Zealand, the USA, Canada and China are presented. It is suggested that to promote forestland-use specialization, it is necessary to re-allocate research funding, to implement various sustainable forest management criteria and forest ownership reforms, to zone land for priority use, and to promote market development.

Keywords: Multiple use; Forestland-use specialization; Forest zoning; China; Canada; USA; New Zealand

1. Introduction

It is not arguable that forestland should provide multiple uses. However, how to do so has been debated for a century (Gorte, 1999). Some researchers suggest that multiple uses require the production of several goods and services simultaneously from the same land (e.g. Dana, 1943; McArdle, 1953). This group seems to be widely supported by the general public and ecologists (e.g. Franklin, 1989; Booth et al., 1993). Other researchers argue that multiple uses should be applied to large areas, while managerial subdivisions of the total area should be devoted to specialized uses (see, e.g. Pearson, 1944). This approach seems to be favored by many forest economists (e.g. Clawson, 1975; Hyde, 1980; Sedjo, 1983; Bowes and Krutilla, 1989; Binkley, 1997). According to Sahajananthan (1994), the first group has been dominating. But as Gregory (1955) pointed out, 'as an idea, multiple use has met with almost universal acceptance; as a working tool of management, it has had far less success.' Stagner (1960) also suggested that multiple use 'is sometimes used so loosely that one wonders if it has any meaning at all'.

This issue is still increasingly debated and will be important in determining future directions and policy making in forest management. Against this background, an interesting article entitled 'Efficient Multi-

* Tel.: +1-334-8441041; fax: +1-334-8441084.
E-mail address: yaoqi.zhang@auburn.edu (Y. Zhang).

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ple-Use Forestry May Require Land-use Specialization' by Jeffrey Vincent and Clark Binkley was published in Land Economics in 1993. It challenged, in theoretical terms, the increasing pressure for the demand for multiple uses of forest management on the same land. This article has received a good deal of attention and has been frequently cited in forest economics literature since its publication. Given the importance of this issue, this paper attempts to point out some problems by revisiting this article, and then extends this issue more explicitly in terms of three different elements: (1) cross-spatial interaction, (2) changes in technologies and relative prices and (3) ecological and economic thresholds of production and management. Forestland-use specialization in New Zealand, the USA, Canada and China are examined. Finally, some policy implications of forestland-use specialization are raised.

2. One stand vs. two stands revisited

Vincent and Binkley (1993) assumed that two identical forest stands can produce two products simultaneously: timber and non-timber, under a fixed management effort (E^*). One alternative is to evenly divide E^* between these two stands, while another is to unevenly divide E^*. Vincent and Binkley (1993) demonstrated that the latter strategy is superior to the former one. The conclusion was initially derived from constant return (*timber* and *non-timber* outputs) to effort. Their argument was then extended under the condition of diminishing returns. They argued that specialization might be more necessary when the two stands differ. Therefore, it was concluded that efficient multiple-use forestry might require land-use specialization.

There is nothing apparently wrong with the argument, but many readers (e.g. see, Helfand and Whitney, 1994) might feel that their conclusions contradict basic neoclassical economics theory: the assumptions of *revenue* function of the efforts (E) should be $\partial R/\partial E>0$ and $\partial^2 R/\partial E^2<0$, so $R(E^*/2+\Delta E)-R(E^*/2)<R(E^*/2)-R(E^*/2-\Delta E)$ and consequently $2R(E^*/2)>R(E^*/2+\Delta E)+R(E^*/2-\Delta E)$. Since the assumption of diminishing returns made by Vincent and Binkley (1993) refers to *timber* and *non-timber outputs* rather than *revenue,* it may appear that $\partial^2 R/\partial E^2>0$ at *some* period of E as a result of changing the production structure between timber and non-timber at constant and even diminishing returns of the two goods to E, but it is impossible that $\partial^2 R/\partial E^2>0$ holds for the whole production period[1], especially when it is approaching the optimum (increasing return, either revenue or production, to effort cannot go on forever).

The problems in Vincent and Binkley's analysis have been pointed out in Helfand and Whitney (1994), mainly in terms of nonconvexities and diseconomies of scales (see also Vincent and Binkley, 1994). Their arguments are right, but probably also overlook an even more important point: the assumption of a fixed E and the fact that E is not at an optimum in the first place (the one stand case). Under this constraint, $\partial^2 R/\partial E^2>0$ may hold around E, which is not optimum. Otherwise, if $E^*/2$ is already an optimum or close to an optimum E, then any reallocation of E^* would not turn out to be more efficient. In other words, if E^* is relaxed, two issues arise: (1) seeking an optimum combination of timber and non-timber outputs that are determined by the relative price and the production possibility frontier and (2) seeking an optimum effort E that is determined by the marginal revenue of the efforts. If so, the final management of the identical two stands must be the same. Therefore, it is hard to argue that identical stands should have various specializations, at least in terms of neoclassical economics. From this point, Vincent and Binkley's conclusion may be wrong, at least some assumptions have been violated (see Appendix A for a detailed explanation).

However, assuming efforts (for instance capital, labor) as well as time as fixed is not totally unrealistic. Even though the efforts may not be a strict constraint, the unit cost of effort may increase with an increase in

[1] Marginal timber or non-timber return, or even revenue, to efforts, is not necessarily diminishing at some range of E (see, e.g. Yin and Sedjo, 2001). Forest management implies a long-term commitment and requires a long-term strategy; a well-planted forest without later appropriate tending can be poorer than naturally grown forests. At the least, minimum efforts to prevent illegal access are necessary throughout the whole rotation. This means that not only spatial but also temporal allocation of investment is important. A long-term strategy becomes critical. In other words, concentrating funds on a small area and managing it well may be more efficient than spreading out limited efforts over a larger area.