



Forest economics in an increasingly urbanized society: The next frontier[☆]



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ABSTRACT

Changing societal values due to accelerating urbanization will likely shape the next frontier of forest economics in several important ways. First, as a growing number of urban dwellers become wealthier, their desire for greater forest recreational opportunities will increase, resulting in higher values being placed on forest ecosystem services. Second, urban citizens will demand a significant shift in forest management away from high-ecological-impact operations towards environmentally benign practices, resulting in higher costs of timber production and wood delivery. Third, while the forest sector's output of commodity products could decline, wood fibre may find new uses to satisfy human needs for improved standards of living. These developments call for a better understanding of the role of forests in providing multiple streams of benefits simultaneously to different segments of society. Maslow's hierarchy of needs serves as a useful framework for examining the factors underlying stratified human needs with respect to forests. Correspondingly, a stratified framework may be useful for examining diverse forest management objectives, along with a consideration of the stages of economic development.

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1. Introduction

Forests are fundamental to the well-being of humanity, society and the environment. Forests not only provide raw materials for rural livelihoods and industrial manufacturing, but also contribute to improved quality of life for urban dwellers around the world. Specifically, apart from producing fuelwood for energy purpose, timber for construction and wood for processing into a variety of products in satisfying a long list of human needs, forests supply an array of non-timber products. As distinct ecosystems, forests provide clean air, wilderness attributes, wildlife habitat, water regulation functions, carbon storage, and spiritual respite. In particular, forests provide an ideal setting for outdoor recreation.

The multiplicity of forests has been recognized for a long time, as far back as the Middle Ages (Deegen and Seegers, 2011). Over the past two centuries, the development of forest economics has reflected the evolution of gradual shifts from timber-centric, stand-level rotation analysis to a broad consideration of a myriad of goods and services associated with forest ecosystems. As societal values change regarding the role of forests, new analytical approaches emerge and the new developments result in the expansion of the scope of forest economics. The objective of this paper is to present a perspective on the next frontier of forest economics. The next section provides an overview of several important components of mainstream forest economics. Then, a framework regarding the next frontier of forest economics is

proposed. The validity of the suggested framework is discussed in the fourth section. The paper ends with a summary of the arguments and a pointer on possible future directions in forest economics.

2. Several important components of mainstream forest economics

Forest economics is broadly understood as a discipline that examines forests as scarce resources in meeting human needs. As such, forest economics involves the employment of relevant economic analysis tools to address issues pertaining to forests. It is necessary to review the evolutionary path of mainstream forest economics by way of briefly revisiting several important traditions.

2.1. Von Thünen's framework and the Faustmann–Hartman rotations

Contemporary forest economics is deeply rooted in Von Thünen's framework of value differentials across locations, with strong linkages to the classical theory of land rent. Given the understanding that land should be allocated to the use that would yield the highest rent, in his "Isolated State", Johann Heinrich Von Thünen (1826), a German economist, developed a treatment of spatial economics concerning land value. His analytical approach recognized that, apart from spatial variations in land value on account of marginal differences in productivity, the distance of the land from the market should be viewed as a crucial determinant of land value. In a nutshell, geographical location of a piece of land relative to the market is key to land value in Von Thünen's framework.

While Von Thünen's analytical framework provided insight on the spatial variation of land use patterns, the temporal dimension of

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using land for timber production received considerable attention from economists with an interest in viewing forests as a form of capital. The fountainhead of contemporary forest economics pertaining to timber rotations can be traced to the financial model pioneered in the mid 19th century by *Martin Faustmann (1849)*, who was a German forester. The Faustmann model advised the woodland manager to select when to cut timber by maximizing the discounted sum of income, taking into account the growth rates of a forest stand, the prevailing interest rate plus the opportunity cost of carrying the land for timber production purposes (*Mitra and Wan, 1985*).

Since its formulation in the 19th century, the Faustmann model has served as a powerful tool for guiding forest economic analyses. Timber rotation analysis has evolved over time, thanks to shifting societal perceptions of the values associated with forests, particularly due to rising concerns for the need to conserve nature, minimize adverse effects of timber harvesting on habitats and protect public goods attributes of forest ecosystems (*Wang and Wilson, 2007*). Recognizing the importance of various non-timber values, *Hartman (1976)* modified the Faustmann model by articulating that many non-timber values, such as amenity values, have the effects of delaying timber harvest. Hence, the Hartman rotation tends to be longer than the Faustmann rotation. However, it needs to be pointed out that the prolongation of a timber rotation is not the only way of increasing non-timber values. Strictly speaking, the degree of biodiversity in a forest serves as an important indicator of non-timber values. In view of this factor, some early-succession habitat may require a reduction in optimum rotation age. Meanwhile, the issue of determining the optimal timber rotation age has attracted attention from economists within the circle of forestry, e.g., *Pearse (1967)*, and from outside forestry, e.g., *Samuelson (1976)*. The forest rotation model that Faustmann advanced has become a classic tradition for all professionals who wish to study the economics of forests worldwide.

2.2. The theory of forest transitions

Since the 1970s, widespread environmental degradation has become a global concern. The alarming rate of deforestation in the tropical areas has caught international attention. The driving forces behind massive deforestation have become subjects of debate. Meanwhile, reforestation has occurred in a number of countries and regions. An interest in understanding the conditions under which forests contract and expand has led to the emergence of a body of theory known as 'forest transitions', which was advanced by *Mather (1992)* and augmented by *Mather and Needle (1998, 1999)*, *Grainger (1995)*, and *Rudel (1998)*. Changes in a jurisdiction's forest cover become a question of changes in land uses, which boil down to the issue of rent differentials underlying shifts in using the land for forests versus other uses. *Angelsen (2007)* suggests that an increase in agricultural land rent is the key driving force behind deforestation.

Since the dawn of agriculture some 10,000 years ago, the world has lost a great deal of forests due to human activities (*Williams, 2006*). Based on the theoretical framework that Mather and others developed, *Angelsen (2007)* categorized the process of forest transitions into four stages: (i) Undisturbed forest – low deforestation, (ii) Forest frontiers – high deforestation, (iii) Forest/agriculture mosaics – beginning of forest recovery, and (iv) Forest/plantations/agriculture mosaics – accelerated forest recovery: lower deforestation and rapid reforestation. In broad terms, the state of forest transitions seems to reflect the economic stage of a jurisdiction. Specifically, phenomena of 'land race' or 'race to the frontier' tend to occur in underdeveloped economies (*Hyde, 2012; Angelsen, 2007*). Historical evidence from a number of European countries lends support to the argument that, over time, the determinants of forest transitions drive land use change. The experience of Germany suggests that forests declined initially due to population pressures and overexploitation, but rebounded later, eventually embarking on a path of regional recovery

(*Lazenby, 1913*). The experience of France indicates that society learned from past mistakes and searched for mechanisms to respond to crises and, as a result, deforestation eventually gave way to net reforestation (*Mather et al., 1998, 1999*). The experience of Denmark shows that forest transitions would not take place without satisfying certain social conditions unique to the national and local situations. *Frederick and Sedjo (1991)* provided a historical examination of the changes in the use and management of American forests. The forest transitions theory has become a dominant theory in contemporary forest economic analyses, especially in cases involving deforestation and land use shifts on national and regional scales (*Hyde, 2012; Park et al., 1998*).

2.3. The total economic value approach

It is increasingly recognized that the economic values of forests comprise benefits ranging from timber and various non-timber products to a host of less commonly measured services and functions including eco-tourism, water conservation, carbon sequestration and biodiversity. *Howard (1999)* described the evolving role of a myriad of green resources in influencing Japanese citizens' attitude towards the significance of forest conservation. *Kant et al. (1996)* examined the role of forests in economic welfare in the context of developing countries. They focused on non-timber contributions of forests to villagers and concluded that financial returns from non-timber uses played a crucial part in rural economies. One of the thorny issues in understanding the role of forests in economic development and human welfare improvement is related to difficulties of correctly estimating the values of forest-related goods and services. *Peters et al. (1989)* demonstrated the important steps in the valuation of an Amazonian rainforest in Brazil. Their results confirmed the importance of tropical forests to local residents.

To assess the flows of benefits that arise from forests, a new approach known as Total Economic Value (TEV) has emerged recently, which seeks to evaluate overall economic values of forests on a large scale. TEV is warranted by the multiplicity of forests, i.e., the capacity for generating a range of direct and indirect use values and non-use values that entail option values, bequest values and existence values. *Merlo and Croitoru (2005)* applied the TEV approach to assessing the comprehensive values of the Mediterranean forests.

3. The next frontier of forest economics

Forest economics is, in essence, concerned with the role of forests in meeting human needs in the context of changing land uses. Fundamentally, 'land rent' constitutes a core concept of forest economics. The 'golden rule' is universally applicable, that is, land should be allocated to the use that yields the highest rent (*Newman, 2002*). The Von Thünen analytical approach used space (i.e., distance of a piece of land from the market) as an organizing framework. Treating timber as capital asset, the Faustmann model provides a basis for determining timber harvesting age to maximize streams of benefits within a spatially defined forest estate. The Hartman model represents an extension of the Faustmann rotation by explicitly considering the effect of non-timber values on timber harvesting age. The forest transitions theory places jurisdiction-level shifts between forest decline and expansion on a broad temporal scale. *Angelsen (2007)* argues for a need to combine the Von Thünen approach and the forest transitions framework. While Angelsen's proposal represents an important step forward, I wish to use Angelsen's integrated approach as a stepping stone to propose a stratified framework for considering forest problems and the choice of analytical approaches in light of the prevailing stages of forest transitions.

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