FORESTRY AND THE ENVIRONMENT

Forests are an important source for many environmental services. Carbon sequestration and biological diversity are well-known global environmental services. At the local level habitat for wildlife and recreational opportunities constitute the main examples. Forestry affects these services in many ways. For example, clear cutting of an area temporarily reduces carbon sequestration, and have ambiguous impacts of biological diversity. Locally, clear cutting increases food availability for some species like moose and deer, while other species may experience a decline in their habitat quality. The welfare economic term for such an unintended side-effect is an externality.

Managing forests solely or mainly for the purpose of maximizing the profits from timber harvesting adversely affects some of these environmental services. This influences human well being. Therefore, forest management practices affect societal welfare. Tinbergen's famous condition to ensure that multiple objectives are met implies that one generally needs one instrument per objective. Devising environmental policies for forest management is therefore a complex undertaking if one seeks to correct for all the external effects. From a welfare economic perspective one should only correct Pareto relevant externalities. These occur when expected benefits from regulation exceed expected costs, including regulatory costs. Hence, it is not optimal to correct all the external effects from forestry.

Environmental regulations come in many forms. A recent feature in forestry is environmental requirements brought about by manifistations of consumer demand or retailer requirements. The Forest Stewardship Council (FSC) is one example of such consumer driven "environmental regulations". Its gist is that forestry practices need to meet certain minimum criteria to gain access to the market. Thereby, such regulations "weed out" the worst forest practices. However, one cannot expect that "market" driven standards provide optimal outcomes as perceived in welfare economics. There are three main reasons for this. From an information perspective, consumers of forest products may have poor knowledge of what constitutes environmentally sound forestry. This information problem may arise because forestry conditions differ between regions. For example, consumers or retailers in Europe may have difficulties in assessing the soundness of various tropical forest practices. Second, retailers may look for certification systems that help them market their products, not to achieve more sound forest practices. Third, such standards do not entail the conventional marginal benefit — marginal social cost tradeoff of welfare economics.

FSC and similar standards are likely to remain despite their shortcomings. As such, they constitute an important back drop for other environmental regulations. Forest products are traded globally.

Recent developments in the negotiations in the World Trade Organization imply that environmental regulations need to be targeted, transparent and tractable (the TTT principle). TTT concerns become particularly important if payments are used to provide incentives to promote environmentally more sound forest practices. One reason for this is that such payments could be used as hidden subsidies of the domestic forest industry.

Another key issue regarding environmental aspects of forestry is asymmetric information. As such these cases fit the major setup of principal-agent models. Forest owners and operators (agents) often are more well informed than the authorities (the principal) about local conditions. Under these settings it is important that regulatory schemes induce *truth-telling*, i.e., that it is in the self interest of agents to voluntarily reveal information the principal needs. There are two main categories of models. *Adverse selection models*, where the principal cannot observe the agent's type. *Moral hazard models*, where it is costly, but possible, for the principal to observe the agent's effort. Auctions and menu based regulations are well suited to resolve *adverse selection* problems. For example, in the case of restricting forest practices in environmentally sensitive areas, forest owners can bid, using an auction format, on the compensation they need to be indifferent between continuing current forestry practices and adopting some socially desired regime.

Moral hazard issues involve the need for some sort of monitoring mechanism. The purpose of any monitoring scheme is to deliver the desired level of compliance at the least cost to society. In the case of forestry, forest owners can be mandated to file self reports or inform the authorities of forest practices undertaken or major incidents, like building a road. Filing a false self report, or failing to report incidents that require reporting trigger a penalty. Combined with third party reports of any irregular activities, such self reporting mechanisms have proven promising in non-forest settings. In forestry, self reporting becomes particularly interesting as current certification regimes require that forest owners keep records of much of the same information.

Environmental regulation in forestry is likely to consist of a mix of voluntary (market driven) and mandatory polices. The theoretical literature on regulation and procurement contains a wide array of possible regulatory formats. With some modification some of these schemes could promote environmentally more sound forest practices at far lower costs to forest owners and society than many of the current command-and-control regimes. In the years to come, this will be an important area of research for forest and environmental economists.

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