

Some Economic Consequences of State Reforestation Regulations in the United States

by

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Abstract

This paper focuses on the effectiveness and efficiency implications of mandatory state reforestation regulations in the United States which require private landowners to reforest their lands to meet certain reforestation standards within a specified period of time after timber harvesting. Based on the von Thunen (1966) theory, we argue that such regulations are ineffective and unnecessary at best and could be counterproductive as they may reduce economic benefits to landowners and society, cause forest land area to decline, and have unintended environmental consequences. Other policy tools such as financial assistance, technical assistance, and tax incentives are better alternatives to reforestation regulations.

Keywords: Reforestation regulations, economic consequence, forest policy, incentive, forest practice law.

Introduction

Government regulations of private forest practices have been controversial in the United States and elsewhere. In the 1920s, the first Chief of U.S. Forest Service Gifford Pinchot began to advocate federal regulation of private forestry. Today, regulatory programs are administered at all levels of government, but it is primarily the states that oversee forest practices (Ellefson 2000). Regulations typically seek certainty about forest practices, make demands of landowners and harvesters, and frequently involve administrative and enforcement processes that are legalistic and cumbersome. Regulation of private forestry exists in most countries with private forest landownership (e.g., developed countries) and where market-based economic reforms are underway (e.g., China, Russia and east European countries).

Government regulations are often justified by market failure (and thus purport to be in public interest). Alternatively, regulations can be explained by “interest group theory” or “capture theory,” which states that the suppliers of regulations—politicians and bureaucratic officials are captured by the demanders of regulations—interest groups in pursuit of personal, not public, benefits (Stigler 1971).

The purpose of this paper is to call into question the efficacy of mandatory state reforestation regulations, which may be intended to increase timber production, enhance recreation and wildlife habitat, and protect environmental values such as water quality. This issue is important as reforestation requirements and other forest practice regulations have been on the rise across the U.S. during the last few decades (Ellefson et al. 1995). Some guidance is needed for state policy makers when they are in a position to select specific reforestation policies. Furthermore, insights drawn from our analysis might facilitate informed debate about state reforestation policy in the U.S. and have some implications elsewhere in the world.

Several authors have discussed state forest practice laws that apply to private landowners. Issues raised include the history and extent of the laws (Green and Siegel 1994; Ellefson and Cheng 1994; Ellefson et al. 1995), their effectiveness (Boyd and Hyde 1989) and enforcement (Rose and Coate 2000), as well as their threat to private property rights (Louisiana SAF 1996). With the exception of Boyd and Hyde (1989), none have addressed the general economic and environmental implications of state forest practice laws. However, the conclusions drawn from these articles are quite different regarding whether society will benefit from such laws. For example, Boyd and Hyde (1989) doubt the effectiveness and merits of existing state forest practice laws in general, while Rose and Coate (2000) conclude: “as the nation (the U.S.) seeks to obtain more wood from fewer and fewer acres in a sustainable manner, the need to ensure compliance with state reforestation rules will become more critical.”

The focus of this paper is on private lands whose owners may have different objectives to those of public landowners. We assume that private landownership is relatively secure (at a minimum a government’s physical taking of private property requires fair compensation) and that markets function relatively smoothly in the U.S., an assertion supported by Zhang (2002). We argue that under these conditions, mandatory reforestation regulations are ineffective and unnecessary at best and could be counterproductive to the stated objectives of the regulations. Our contention is that reforestation requirements necessarily impose compliance and enforcement costs, and consequently, have an impact on private landowner behavior and could influence the intensive and extensive margins of production in ways that reduce the total forest land base. However, this reduction in the forestland base may result in less cutting of some so-called “old-growth” forests. While some environmental benefits may be produced at the local level, they are diminished in a more global context. In other words, holding world demand for timber constant, a regulation-induced decline in harvesting in one location inevitably will lead to increased

harvesting somewhere else. In the mean time, landowners incur additional production costs, and both consumers and taxpayers absorb the costs of administering and enforcing the regulations. Therefore, the putative benefits of reforestation requirements (in the form of increased timber production along with the associated environmental amenities) may, in practice, fail to materialize as targeted landowners adjust their behavior such that society is worse off with the regulations than without them.

The Nature of State Reforestation Regulations

Sixteen states in the U.S. had early versions of forest practice laws, which merely require the maintenance of seed trees to promote natural regeneration (Boyd and Hyde 1989). In recent decades ten states (Alaska, California, Connecticut, Idaho, Maine, Nevada, New Mexico, Oregon, and Washington) have passed comprehensive forest practice laws that require forest landowners to undertake reforestation activity on a specified time schedule after timber harvesting and mandate desired outcomes such as successful reforestation (Rose and Coate 2000). Ostensibly, the purpose of the regulations is “to encourage economically efficient forest practices that assure the continuous growing and harvesting of forest tree species and the maintenance of forestland for such purposes as the leading use on privately owned land, consistent with sound management of soil, air, water, fish and wildlife resources and scenic resources within visually sensitive corridors” (Oregon Forest Practices Act of 1971). In other words, these regulations intend to address negative externalities associated with timber harvesting and forest management and enhance social welfare, but our questions are whether they are necessary and effective.

Reforestation regulations typically address three time-linked objectives: (1) initiation of reforestation (which includes site preparation and acquisition of seedlings, if necessary), (2) planting or natural regeneration, and (3) establishment of a minimum density of young trees in a free-to-grow condition. Although not as cumbersome as timber harvesting regulations in most

states (Shatter 1991), reforestation regulations impose costs on private landowners that may inevitably influence their land-use decisions. Therefore, whether reforestation regulations likely will encourage private landowners to act in a manner consistent with the putative objectives of the regulations is of key interest to the forestry community, policy-makers, and the public in general.

Economic Implications of Reforestation Regulations

Mandatory reforestation requirements are a command and control form of dictating behavior. Those who are regulated must comply with the regulation and pay for the expenses (transaction costs such as paper works and inspection, and reforestation costs). Thus, it may be argued that reforestation regulations are not concerned with the implications on landowners' financial feasibility. The economic impacts of reforestation regulations are primarily associated with changes in economic returns to landowners and in both the intensive and extensive margins of forestry operations.

Intensive Margins and Extensive Margins

The intensive margin refers to the point at which land is transferred from a lower-valued use to a higher-valued use. Typically the high-valued alternative uses of forestlands are residential/commercial development and agriculture. The extensive margin is the economic frontier beyond which forestry generates either a higher return than other uses of the land or cannot generate a positive return.

The capability of land to generate economic returns depends on a variety of factors—fertility, distance from markets, topography and accessibility, and so on. The quality of land, or the determinant of its economic potential, can be viewed as a bundle of characteristics, which have varying importance for different uses (Pearse 1992).

Figure 1 illustrates the extensive and intensive margins of forestry operations among competing uses considering one such characteristic in isolation—distance from an urban center

(von Thunen 1966) and the impacts of reforestation regulations on economic returns and both intensive and extensive margins. Assuming all other characteristics of land are identical, it shows how the potential land rent or net value under various uses declines at progressively greater distance from an urban center. Commercial and residential uses yield a higher return than all others close to the urban center (point “o”). This return declines relatively quickly as you get farther away from the urban center. Because it does not make economic sense to build a shopping mall far away from the people who ordinarily might patronize it, at distance greater than “a” from the urban center the return from using the land for residential/commercial development drops below the return from using the land in some other capacity, for example growing agricultural crops. Since food is perishable and transport costly, the returns from farming the land also decline when moving farther and farther away from the urban center where those crops are consumed. At distance from the urban center greater than “b,” the return from using the land to grow crops falls below the return to using the land for timber production. Thus, point “c” is the intensive margin for forestry operations.

Two extensive margins of forestry operations are relevant. One identifies the extent of the forest land base which will be managed for continuous (i.e., plantation) timber production, and figures directly into the reforestation calculus of landowners when they decide to cut their timber. The other defines that part of the original stock of timber (referred to by some as old growth forest) which is considered merchantable, but whose owner(s) consider it uneconomical to artificially reforest the sites once the timber is cut. We will refer to these margins, respectively, as the extensive margin of the managed forest and the extensive margin of the timber stock.

If both margins were determined by conventional economic efficiency criteria, where, as in Ricardian theory, the net return is just equal to opportunity costs of production, they would be unlikely to coincide. This is because on the extensive margin of the timber stock trees that have

been growing essentially for years without accumulation of silvicultural expenses may be economically recoverable from land that is not capable of yielding a positive net return under plantation/cultivation of a new timber rotation. That is, on the extensive margin of the timber stock it pays to harvest timber once, but not to replant artificially, and the land is left for natural regeneration. As a result, the extensive margin of the managed forest can be expected to be smaller than the extensive margin of the timber stock. In Figure 1, the extensive margin of the managed forest and that of the timber stock are represented at points “c” and “d”, respectively.

Figure 1 can be reproduced with any other quality characteristics of land that determine its capacity to generate rent. All these qualities blended together result in complicated patterns of efficient land allocation. Nevertheless, Figure 1 can help illustrate changing land use patterns over time. One important observation is that the allocation of land to its highest use ultimately depends on the value of the outputs and the cost of the inputs in each alternative use. When the net value (or land rent) of forestry operation is higher relative to that of agriculture—whether due to rising timber prices, high valuations placed on non-timber amenities, reductions in forest management costs, low agricultural prices or yields, or reductions in government subsidies to agricultural production—more agricultural land will be converted to forestry use, and vice versa. In terms of Figure 1, conversion of land from agricultural use to forestry occurs when the returns to forestry increase (line “hd” shifts outward) and/or the returns to agriculture decline (line “lk” shifts inward).

Reforestation Regulations Lower Economic Returns to Landowners

Everything else being equal, reforestation regulations necessarily increase the cost of timber production (including transaction costs) by forcing all landowners to spend money on reforestation. Some landowners would institute the desired behavioral responses voluntarily as

their benefit and cost calculus dictates.¹ For these landowners the increased costs mainly are in the form of transaction costs. In turn, these higher production costs drive down the return to using the land for timber production relative to the returns from other uses such as residential/commercial development and agriculture.²

It might be argued that reforestation requirements differentially affect large industrial timberland owners as compared with small non-industrial timberland owners. Specifically, the argument we've heard is that because of economies of scale, the burden imposed by reforestation requirements on large industrial landowners is, essentially, negligible and therefore does not have a significant impact on land use decisions. That is to say, for these producers the requirements are non-binding thus compliance is voluntary. In contrast, the burden on small NIPF owners is non-negligible, with the implication that their land-use decisions may well be affected. However, as the forest industry only owns 13 percent of the U.S. timberland and non-industrial landowners owns 58 percent (Smith et al. 2001), the acreage affected by this former group as compared to the latter is relatively small. Therefore, the overall impact of such requirements on industrial lands is inconsequential, but that on non-industrial lands might be significant.

It also has been argued that mandatory reforestation requirements may not lower the returns to forestry as the increased cost of planting may be offset by harvesting trees sooner and/or the increased yields implied by the availability of genetically improved stocks that produce

¹ A survey by Kaiser and Royer (1983) shows that when reforestation is not conducted in the southern United States, landowners often assume or perceive that their sites will reforest themselves, the reforestation costs are high, the returns from reforestations are low and far in the future, and that they have other uses of harvesting revenues. It has been argued, based on land ethics that reforestation should happen irrespective of landownership (and thus regulations are needed to force landowners to reforest after harvesting). We adopt an economic approach to address this (reforestation) regulation issue.

² Obviously many factors influences land use changes. Cost, whether induced by regulations or altered by market forces, is one of them.

high volumes of better quality wood in shorter rotations. However, this confuses cause and effect. Technological advances that improve yield make forestry more profitable regardless of the regulatory environment. Conversely, regulations that increase costs make forestry less profitable for landowners regardless of technology. Put differently, if economic considerations are favorable private landowners will plant trees without mandatory reforestation requirements. Moreover, they will plant trees quickly after harvest. All other things equal, mandatory reforestation requirements that make economic considerations less favorable must reduce the private incentive to plant trees.

This altered structure of returns gives some landowners an incentive to clear-cut the existing timber and take the land out of timber production entirely. By so doing, the owners can escape the expense of reforestation. Whatever new use the land is put to must have a return lower than that obtained from timber production in the absence of the regulations, but higher than the return in timber production burdened by them. In this case, reforestation regulations would make other uses of forestlands relatively more profitable, and some forestland would be either developed or put into agricultural uses. Regardless of the specific alternative use to which the land is put, the point is that some land is removed from timber production or forestry uses, which clearly seems inconsistent with the stated goal of the reforestation regulations. The critical question is how much existing timberland is taken out of timber production because of reforestation requirements and how much non-timberland is not put into timber production because of reforestation requirements. That is, how responsive are landowners to the higher production costs imposed on them by regulatory fiat at both the intensive and extensive margins?

Reforestation Regulations Alters the Intensive Margin

Both of the changes to the intensive margin induced by reforestation regulations— forestlands being converted to other uses and less marginal agricultural land being converted to

timberland—reduce the total forest land base. Of perhaps greater import for the total land base in forest production, mandatory reforestation requirements deter the conversion of marginal agricultural land to timberland. In the last 50 years, a substantial portion of the increase in timber supply in the U.S. has derived specifically from converting agricultural land to timberland. Much of the increased production of timber in the southeastern United States results directly from private landowners' conversion of marginally profitable and unprofitable agricultural land to more profitable timberland (Alig et al. 1998). Alabama, for example, is much more heavily forested today than it was in 1950, while the total acreage in agricultural production has been declining.

In Figure 1, if the impact of the reforestation requirements is represented by a lowering of the returns to forestry (e.g., the “hd” curve falls to “gc”), the intensive margin of forestry changes from “b” to “e.” That is, land that would be put to use growing trees in the absence of the reforestation requirements is left in relatively unprofitable agricultural production. Exactly how much the “hd” curve shifts is an empirical question and dependent on many variables.

Reforestation regulations do not impact land use per se for lands that lie between the intensive margin and extensive margin of the managed forest (the portion from “e” to “c”, as shown in Figure 1), although landowners' economic returns change. It pays them to reforest, irrespective of the reforestation regulations. With respect to the millions of acres of managed forestland, the only effects of reforestation regulations are to increase transaction costs to private landowners of doing what they would do in the absence of the regulations and to establish an unnecessary enforcement bureaucracy, the costs of which are borne by taxpayers.

Reforestation Regulations Change the Extensive Margins

Clearly, the designers and proponents of reforestation regulations want to make sure that landowners whose lands lie between these two extensive margins reforest their lands after timber

harvesting. The question is whether the hoped-for response from landowners, in terms of increasing the amount of forested land, actually materializes. Again, the answer arguably is “no” because reforestation regulations make some forestland sub-marginal—as one moves beyond to the extensive margin of the managed forest (points “c” on the forestry rent line), active management (reforestation) becomes a money losing proposition. This means a smaller land base will be used to produce managed forests and a smaller land base will be able to afford to one initial timber cut. Less timber will be cut from land that lies between these two extensive margins. This may be desirable from the perspective of certain environmentalists because less managed forestland will exist and more old growth will be saved. Whether the net environmental benefit is positive or not by losing forestlands to agricultural use and saving additional old growth is an empirical question. This conclusion is consistent with Ellefson et al. (1995), who find that regulatory programs are the least effective measure of five policy options in promoting reforestation—the order of others in terms of effectiveness is technical assistance, fiscal incentives, tax incentives, educational programs.

Market Reactions When Forestland Decreases

Everything else being equal, when changes in both the intensive margin and two extensive margins result in a smaller forest land base, the regulations designed to promote forestry as a “leading-use” on private timberland generate just the opposite result—land that might have remained in or could have been converted to timber production in the absence of such regulations is taken out of timber production because of them. How will the increasing U.S. demand for forest products be met with less forestland?

One way is to import more forest products. The U.S. is the largest forest products importer in the world. In recent years, net U.S. forest products imports have set record after record (Bourke and Leitch 1999), and forest products have come from countries as far away as New Zealand.

Reforestation regulations may save certain old-growth forestland in the United States, while condemning more ecologically sensitive old-growth forests elsewhere in the world (Sedjo 1994). This result may not be what the pro-environment supporters of reforestation regulations envisioned when pushing for adoption of these regulations.

It might be argued that, as a consequence of reforestation requirements, timber prices would rise high enough to offset the costs imposed on landowners. This may or may not be the case, but let us consider all of the scenarios. First, if timber prices rise to a higher level that completely offset the costs imposed on landowners (which means moving the “gc” curve back to “hd” in Figure 1), the laws have done nothing but imposing costs to all landowners and forcing a small fraction of landowners (whose land is beyond the point of “c”) to comply with the regulations. The U.S. will not need more forest products imports. Whether the costs to landowners and the public will justify the benefits that resulted from the regulations is an empirical question.

Similarly, if timber prices rise enough to bring the “gc” curve above the original curve, “hd”, the forest land base will expand at the expense of agricultural land, and both the extensive margins of managed forests and timber stock will move beyond their original points, “c” and “d.” Landowners as a group will be better off, and environmental benefits will accrue if forestry operations are more environmentally benign than agricultural operations. As the forestland base is increasing in the U.S., the country will need less forest products imports in the long run. The only drawbacks are administrative and enforcement costs and the environmental damage caused by logging on additional, previously sub-marginal forestlands and by expanding the land bases used for managed forests.

The more likely scenario is that timber prices will rise, but not to whatever level offsets completely the impacts of the regulations. This means that the “gc” curve will move up, but it

will still be below the “hd” curve. The rise in timber prices and the increasing import of forest products are indications that this is the likely scenario as no additional forest products imports are needed in the other scenarios.

As discussed earlier, everything else being equal, the impacts of the reforestation regulations under this scenario include:

- (1) The economic returns to forest landowners declines,
- (2) the forestland base decreases as both the intensive and two extensive margins shrink,
- (3) environmental impacts of forestry may be reduced at local levels, but not at the global level, where they are exacerbated,
- (4) consumers pay higher prices for timber,
- (5) the public gains amenity value generated from requiring landowners who have land beyond the extensive margin of managed forests to reforest; these gains could be offset by any administrative and enforcement costs of the laws, as well as the costs imposed on private landowners.

Ellefson et al. (1995) document that the costs of administering regulatory programs (which include reforestation regulations) increased 159 percent between 1985 and 1991 in the ten states with comprehensive forest practice regulatory programs while the total state forestry budgets in those states increased only 45 percent. Whether these states can control the cost and whether the public is willing to foot the bills in the future remains to be seen.

Conclusions and Discussion

With the understanding that forest regulations are needed and may be efficient in some cases, our theoretical analysis shows that mandatory reforestation regulations are ineffective and unnecessary at best and may be counterproductive as economic and environmental policy when property rights are relatively secure and market functions smoothly. Everything else being equal,

they do not affect plantation activity on the majority of private forestlands, but reduce the economic returns to all forest landowners and likely mitigate the conversion of agricultural land into timberland and accelerate conversion of certain timberland into agricultural use or for development. This reduces the stock of forestlands in the U.S., with predictable consequences—increased logging activities outside of the U.S.

An interesting question derived from our analysis is why public policy takes the form of regulations that punish *all* landowners and are costly to both consumers and taxpayers. After all, the objective of reforestation regulation is relatively modest—making a small number of landowners who own lands between the two extensive margins reforest their lands after timber harvesting. Arguably, a targeted state reforestation incentive program—provided to landowners who have limited resources (such as low annual income), who own acreage that falls between the two extensive margins (which can be assessed approximately by using location, slope and, soil quality), and whose lands have high amenity value—may be a more effective policy strategy.

The political incentive to adopt a regulatory approach is understandable, because the costs of the regulation are borne almost wholly by a relatively small number of private landowners, whereas financial incentives create a new tax burden on most citizens, who tend to vote against politicians who raise their taxes. This seems to confirm the special interest theory of public policy formation in state reforestation regulations.

Our analysis could be applied to other countries where property rights are relative secure and market functions well. In countries where public ownership of forest lands dominates, the government could use secure property right arrangements and market mechanism to encourage private parties to reforest lands within the extensive margin for managed forests. The government could then concentrate limited public financial resources in reforesting areas beyond the extensive margin for managed forests if reforestation on all harvesting sites is a desirable public objective.

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Figure 1. The relationship between land rent under alternative use and distance from urban center

