

**ANALYSIS OF THE EFFICIENCY, EQUITY, AND ADEQUACY  
OF A FOREST SITE VALUE TAX**

by

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## **(ABSTRACT)**

Forest property taxes play an integral role when private landowners make land use and management decisions. Economists often suggest that taxes should be neutral, thus causing no change in land use or management decisions compared to the pre-tax condition. The traditional ad valorem property tax has long been criticized, particularly as it pertains to forestry, because of its distortionary properties and inherent bias against long-rotation investments. Alternatives to the traditional forest property tax include current use assessment, productivity, yield, and site value taxes.

The site value tax is a property tax on the market value of bare land only, exempting improvements. In theory, the site value tax has been championed as the only neutral property tax alternative; however, in actual application, a forest site value tax may prove to be non-neutral and, by certain measures, inequitable. The degree of the tax's neutrality can be linked to the method of tax administration and the ability of assessors to accurately determine bare land market values for a wide range of site qualities.

This paper reviews literature on forest property tax alternatives and theoretically examines the efficiency of an applied forest site value tax. The adequacy and equity of a proposed forest site value tax are examined in detail and compared for two study areas: Western Oregon and Alabama; in light of local governmental budget constraints. Although the site value tax may represent a less-distortional vehicle for collecting local taxes, it is unlikely to be politically or administratively feasible. Also, given the existence of other distortions in the economy, a site value tax may not prove to be the most efficient tax in application, despite its neutral properties.

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## **Chapter 1: Introduction**

### ***Justification***

Private forest land covers 358 million acres in the U.S., about 16% of the total land base (USDA 1993). In the Eastern U.S. over 32% of all land is private forest. In some regions private forest land makes up the majority of the property tax base. Thus, many local governments depend heavily upon forest taxes as a source of revenue. Private forest land also provides many recreational and environmental benefits that governments must consider when designing forest taxation policies.

Many different strategies for taxing forests exist, yet no strategy has ever been perfected. One theory suggests that legislators should strive to achieve a forest tax policy that is efficient and would not distort the market allocation of resources, if such an allocation is desired. Such a tax would be considered neutral, meaning that the highest and best use for land before the tax would remain so after the tax. It is often difficult for local governments to implement such a tax policy because of political preferences and budget constraints.

The most common types of forest taxes include ad valorem taxation, yield taxes, current-use assessment and productivity taxation. However, none of these taxes are neutral with respect to land use decisions. As an alternative to these traditional taxes some analysts have suggested that local governments consider the site value tax. Site value taxation involves an annual tax on only the bare land market value, exempting timber and other improvements.

Theoretically, a true site value tax would be neutral; however, this does not necessarily make the site value tax an attractive alternative to traditional tax systems. Little research has been conducted to address the ability of a site value tax to raise sufficient revenue for local governments. Nowhere within the U.S. has a true site value tax on forest land ever been implemented. As a result, many questions about the site value tax remain unanswered. How adequate is the land value base for generating sufficient tax revenues? How does the manner in which the tax is administered affect its degree of neutrality? If site value taxation were instituted, what would be the implications for land use, the environment, and income distribution? What are the administrative costs of a site value tax? What is the most efficient way to adjust existing policies toward a system that includes the site value tax?

### ***Objectives***

The overall objective of this study is to examine the implications of instituting site value taxation on forestlands in the United States under the general property tax. The following are sub-objectives:

- 1) For selected study areas, examine the adequacy of a forest site value tax to replace existing local government forest tax revenues.
- 2) Contrast the theoretically neutral forest site value tax with possible non-neutralities resulting from its actual administrative application.

- 3) For two regional study areas, investigate the pros and cons of reform to a forest site value tax from current regional tax structures.
- 4) Examine the implications for equity when shifting from existing tax policies to a forest site value tax.
- 5) Examine variations of the site value tax for forest property where pure site value taxes may not be feasible or politically acceptable.

## Chapter 2: Literature Review

### *Background*

For many years foresters have debated the issue of local property taxes. Due to the long-term nature of forest investments, the effects of annual property taxes on forestry are seemingly magnified in comparison to land uses that produce annual incomes. The traditional ad valorem property tax has gained many opponents who claim that it distorts the efficient allocation of land away from its highest and best use. One of the earliest critics of the ad valorem property tax was Fairchild, who in 1935 determined that the “property tax as measured by tax ratios deals unequally with different types of investment” (Fairchild, 1935). Fairchild concluded that an annual property tax on full market value is always biased against deferred yield forestry.

This assessment by Fairchild has sparked some controversy over the inherent bias of the annual property tax. Trestrail (1969) disagreed with Fairchild, claiming that there is no justification for the preferential tax treatment of forest land. Trestrail emphasized that the effect of a property tax on investment value is equivalent to a proportional increase in the rate of interest. Therefore, Trestrail argued that a property tax causes no more distortional allocation of resources than does an equivalent increase in the rate of interest. Pasour and Holley (1976) supported Trestrail’s claims and demonstrated that the effects of property taxes are not unique to forestry. Klemperer (1974), however, argued that the property tax is biased against capital intensive land uses which would include many types of forestry. Klemperer (1977) also pointed out that Pasour and Holley’s conclusions were based on the assumption that property taxes are fully shifted into higher stumpage prices, and that because of the competitive market that timber faces, local property taxes are more likely to be shifted into lower land values. Bentick (1980a) analyzes these arguments and concludes that the issue is yet unclear.

Due to arguments about the possible bias of the ad valorem property tax against certain land uses, much research has been directed at examining tax alternatives. Most states now rely upon modified forest property taxes such as current use assessment, yield and severance taxes, or productivity taxes for revenue collection (Clements et al. 1986). However, questions of neutrality and equity exist as well for these types of taxes. For example, the yield tax may provide uneven revenue flows and prove to actually be biased in favor of forestry, relative to property taxes on other enterprises, for any given amount of regional tax revenue raised (Klemperer 1977).

The following sections review common forest property tax alternatives. These include the yield tax, current use assessment, productivity taxes, and the site value tax. Site value taxation, although rarely practiced, is emphasized because of its theoretical neutrality. The subsequent section outlines various guides to achieving forest tax equity with regard to efficiency. In the conclusion, the paper reviews methods that can be used by forest tax planners to analyze the efficiency of forest property tax alternatives.

## **The Yield Tax**

The yield tax is an alternative to, or an addition to, the ad valorem tax, and has been widely implemented throughout the U.S. As of 1986, 16 states had yield taxes, with an additional 15 states having proposed legislation (Clements et al. 1986). In practice, the advantages and disadvantages of yield taxes have been discussed in states ranging from Washington to New York (Conklin 1988, Greason 1988, Stier 1988, and Teegaurden 1988). In addition to these states, many states have enacted timber severance taxes that are equivalent in effect to yield taxes (Haines, 1995). Yield taxes defer the taxation of timber as property and are assessed as a percentage of the stumpage value at harvest time. Ideally, for administrative simplicity, yield taxes are determined as a percent of the sale or purchase price of harvested timber. Unfortunately, this approach is frequently difficult, because often a large percentage of a region's annual harvest occurs on industry lands where sales of stumpage do not exist (Conklin, 1980). Consequently, many states use the average market value of stumpage rather than the actual stumpage price when assessing the taxable value of harvests.

Because yield taxes are levied on stumpage rather than land value, instituting a yield tax does not require the difficult process of forest land valuation. However, due to the nature of yield taxes, local governments may have difficulty in establishing even revenue flows, especially in regions where timber age-class distributions are skewed. Such fluctuations in revenue are an important consideration for many local governments which are hesitant to enact yield tax legislation; however, strategies do exist to help moderate revenue flows (Klemperer and Clements, 1988).

The yield tax has a far different effect on the management of forest land than the ad valorem property tax. Most forest economists agree on the impacts of both ad valorem and yield taxes on the optimal rotation length for forest management. In general, ad valorem property taxes tend to reduce the optimal rotation age, while yield taxes tend to slightly increase the optimal rotation age (Bare 1990, Chang 1982 1983, Englin and Klan 1990, Gamponia and Mendelsohn 1987, Jackson 1980).

## **Current Use Assessment**

Many states which recognize the bias of ad valorem property taxation have modified their property tax systems to allow for current use assessment (Hickman 1983). Under current use assessment, property owners are taxed annually on the market value of their land based only on the current use. For example, a property designated as forest would be taxed only on its timber income potential rather than for its value as agricultural land or its development potential. This modification of the property tax is most evident and effective in areas where development pressures are highest; for example, Massachusetts and Vermont both report success with retaining open space and productive forests (Borie 1987, Dennis and Sendak 1991 1992). Other states, such as Tennessee, report less enrollment in current use valuation programs (Hickman 1982). Much of the success or failure of such programs depends on legislatures' goals and the system of implementation, for example, whether or not forest management plans are required and enforced, and whether penalties exist for withdrawal from the program (Borie 1987, Dennis and Sendak 1991, Franklin 1982).

How landowners respond to current use valuation varies depending on the system implemented (Max 1983, Rodgers 1984, Siegel and Haney 1983). If the penalties for withdrawing from a program are not severe enough to prevent future development of the forest land, then it will be difficult to prevent speculators from earning an undeserved tax break (Conklin 1980). Alternatively, if the penalties and restrictions for changing the current land use are too severe, then few land owners will enroll in the program. Consequently, current use taxation may initially help to maintain open space, but the effect is likely to only temporarily delay development (Borie 1987). Critics of current use valuation claim that it is economically inefficient by taxing land only on its value for a certain use rather than for its highest and best use, resulting in a distorted market allocation of resources. As a result, states are continually looking for more market sensitive approaches to assessing forest property (Doherty 1994).

### **Productivity Taxes**

Productivity taxes are another alternative to the unmodified ad valorem property tax. Several states have enacted different forms of this tax, such as Florida and West Virginia (Brett 1978, Stewart 1988). Under productivity taxation, the forest assessed value is based on a formula which considers expected harvest income, according to site quality. As a result, bare land and fully stocked land of identical site quality receive the same assessment and tax. The advantages of a productivity tax are that it may avoid unfair assessment of forest land, will provide for even annual revenue flows, and tends to be relatively less expensive to administer in the long run (Klemperer 1983). A common criticism of the productivity tax is that it is inequitable because equal site quality land has the same assessment regardless of stocking. Also, Klemperer (1983) points out that a productivity tax could reduce bid prices for bare forest land by more than an equal-revenue-raising ad valorem or yield tax would.

The productivity tax, although often regarded as more neutral than the ad valorem tax, is not a neutral tax. Problems exist in the methodology used to generate productivity values. For example, in order to assess the value for a given site under the productivity concept, assumptions must be made about typical management practices. Results can vary widely depending upon what interest rates, stumpage values, rotation lengths, species, or stocking levels are utilized (Klemperer 1983). In order to achieve accuracy, productivity assessment needs to take into consideration revenues generated from non timber sources as well (Williams and Canham 1972). Despite the best efforts of assessors, disagreement will remain over methodology, and landowners will often press for more favorable calculations. Sometimes productivity assessment will underestimate the land value, as methods are constructed to generate some level of preferential treatment for forest land. Because a formula-based rather than a market-based valuation approach is utilized, productivity taxation is more than likely to foster inefficient resource allocation (Klemperer 1983). For an example of a typical productivity valuation formula, see “Alabama’s Current Use Tax” in Chapter 4.

## ***The Site Value Tax***

### **General Background**

Over a century ago Henry George popularized the idea of a single land tax as an annual property tax levied on the value of bare land alone, exempting improvements (George 1879). Yet even today the idea of a land tax, or site value tax, remains a topic of discussion; however, the focus of this discussion has changed considerably from that which George originated. George championed the land tax as a replacement for all other taxes, which he deemed to be “socially unjust.” In more recent years most of the interest in the site value tax has been sparked by criticisms of the ad valorem property tax, especially as it pertains to forest land.

A pure site value tax is an annual percentage tax rate applied only to the market value of land for its highest and best use, and not to improvements such as timber or roads. A true site value tax is allegedly neutral under competitive conditions and thus should encourage efficient land use. Theoretically, given a perfect land market, a site value tax would be capitalized into lower land values, reducing land bid prices (Turner et al. 1991). Under such assumptions, the tax would not distort the market allocation of land uses. Nor would the tax cause land to be removed from production, since lower valued land would receive a proportionally lower tax (land with zero value consequently would pay no tax, see Gaffney, 1970).

### **Experience with Site Value Taxation**

Some regions in Australia and New Zealand have implemented site value taxation in the past, but experience with site value taxation in the U.S. has been limited (Edwards 1984, Reece 1993). In the U.S. most attention has focused on the potential improvements that a site value tax may offer cities. As a response to urban sprawl, some areas, such as Pittsburgh, have adjusted their property tax to more resemble a site value tax, hoping to encourage centralized downtown development (Bourassa 1987). This was achieved by steadily lowering the tax rate on improvements while increasing the property tax rate on land value (Bourassa 1987, Pollock and Shoup 1977). However, efforts to enact site value taxation in many cities are often discouraged by the public’s attitude that it is unfair to tax unrealized income from bare land (Kochanowski 1991, Netzer 1984). One of the common criticisms of the site value tax has been that, by removing improvements from the tax base and taxing land value alone, too high a percentage of the tax base would be removed (Heilbrun 1966). Consequently, in regions with a high ratio of capital value to land value, the required site value tax rate may be so high that it would be politically unacceptable (Douglas 1980, Kochanowski 1991). And in some cases the, the bare land value may be too low to raise required revenues. Conversely, areas that have a relatively low capital to land value ratio may be able to more easily adjust to a site value tax from an unmodified property tax. As a result, some rural areas may be better candidates than highly developed urban areas to make the transition from full property taxation to site value taxation.

## Site Value Taxation and Forestry

Nowhere within the U.S. has a true forest site value tax, based on accurately measured bare land market values, been implemented in lieu of the traditional property tax. Several states have enacted forest productivity taxes which are similar to the site value tax in that the taxable value of a property remains fixed regardless of stocking or improvements (Williams and Canham 1972). However, the formulas used to compute taxable value have little to do with the actual market value of bare land (Amacher et al. 1991, Klemperer 1983).

Little research has concentrated on reform toward a forest site value tax alone, although several studies have considered the impacts of administering a land tax in combination with a timber tax (Turnbull and Boyd 1985, Klemperer 1976, Kovenock 1986). Variations of the site value tax have also been discussed where the tax would be applied to bare land value plus forest establishment costs, exempting maturing timber (Bare 1990, Klemperer 1982, Utz 1985). These examples, however, do not represent true site value taxation and as a result do not represent a tax alternative that would guarantee neutrality among land uses. Bare (1990) examined a tax levied only on the bare land value plus the establishment costs for western Washington state and demonstrated that this type of tax does not exhibit substantial bias either for or against forestry. It was shown, however, that this type of tax is not neutral and may allow for some sub-marginal forest land to remain in the tax base by encouraging landowners to reduce establishment costs (Bare 1990; also see "Taxing Bare Land Value Plus Establishment Costs" in Chapter 5).

Unlike the ad valorem property tax, a site value tax would not penalize full and early forest stocking and thus shouldn't discourage rapid regeneration investment after harvest (Gaffney 1978). Gaffney (1978) also points out that a site value tax is consistent with Heinrich Von Thunen's location theory because it encourages intensive forest management on better sites, while discouraging the overuse of remote marginal sites. Because the tax would be levied on the bare land value alone, land use or management practices would have no effect on the tax, resulting in consistent revenues that are independent of rotation length and stocking levels (Gaffney 1978). Thus a site value tax is not only neutral between agriculture and forestry but also between different forest uses, for example pulpwood and timber production, and between different management practices within one forest use (Bentick 1980, Merz 1987).

Although analysts are intrigued by the neutrality of the site value tax, they still may doubt the ability of this tax to raise sufficient revenue for local governments. Gaffney (1970) discussed the adequacy of land as a tax base economy-wide but did not address the forest sector specifically. As a result, questions remain about the feasibility of a site value tax, especially in rural areas that rely heavily on forests as a tax base. By removing taxes on capital and taxing only the land value, the rate of a site value tax would have to be higher than that of the prior system in order to raise sufficient revenue (Douglas 1980). In areas where a high improvement value to land value ratio exists, a site value tax rate may need to be significantly higher than the current property tax rate. As a result, an individual's tax would be more sensitive to the assessed land value. This implies that, under a site value tax, local governments would face substantially greater pressure to accurately determine bare land value (Bentick, 1979). However, this is not to say that the cost of administering a site value tax would be greater than that of the current system.

Conklin (1980) points out that forest inventory valuation is probably the largest impediment to effective property tax administration. Under a site value tax, once accurate site qualities are determined for forest land, there would be no need to resurvey land to take inventory of growing stock. Thus, land use reclassification would only be necessary to account for changes in highest and best use. However, periodic reassessment of the bare land market value for each site quality of land would still be necessary in order to reflect changes in the land's market value. Reassessment would also be required to account for changes in bare land values that result from other exogenous parameters such as the construction of new roads or mills within the region.

### **Land Valuation**

In order to effectively administer a true site value tax, local governments must be able to accurately determine market-based bare land values. This is difficult because the majority of land transactions include timber and other improvements (Bare and McKetta 1977, Klemperer 1979 and 1981, Pasour 1973, Rickard 1976). Rarely do transactions of bare unimproved forest land occur, and in most cases where they do occur, the details of the transactions are not reported publicly. Few studies have provided accurate data on bare land market values nationwide, but some have addressed regional values (Oregon Forest Industries Council 1993).

Methods for segregating bare land values from forest property sales that include timber do exist but have not been perfected (Klemperer 1981, 1979). Often the simplest approach, the abstraction method, entails subtracting the stumpage value of timber from the price of the sale, but Klemperer (1981) points out that this is inappropriate in the case of immature timber. Also, the abstraction process often doesn't account for the value of various non-timber amenities. Klemperer (1981) utilized a model that combined market and income approaches to valuing land, and reported some degree of accuracy. However, segregating timber values from forest land sales remains an inexact procedure and questions over the best methodology still exist (Bare 1978, Klemperer 1981, Rickard 1976). To cite an example of the issue, note the numerous land valuation lawsuits filed in Washington State during the late 1970's. In particular, two 1977 lawsuits dealt with the issue of whether bare land values estimated by multiple regression analysis were as accurate as those estimated by abstraction analysis (Bare 1978, Bare and McKetta 1977, Rickard 1976). These lawsuits involved the forest industry and the counties, with the industry claiming that values were overestimated by multiple regression analysis, and the counties asserting that land values were underestimated by abstraction analysis (Conklin 1980).

Because of the difficulty in determining market-based assessments, many taxing districts now attempt to establish bare land value from a formula based approach. The problem with this is that results are highly sensitive to input assumptions and may be as controversial as those obtained from market data.

### **Loss of Open Spaces**

Some concern has been expressed that taxing the full market value of bare land with development potential near cities could result in a loss of surrounding forest land. Many see this as a possible environmental disadvantage of a site value tax (Bentick

1980b). This has led to application of the property tax under current use valuation methods in many states (Dennis and Sendak 1992, Hickman 1982, Borie 1987, Flick et al. 1989). How such attempts to curb the development of open spaces would be administered within the context of an efficient site value tax is unclear. Analysts often suggest that applying a land tax only to forest land while taxing most other properties on both land and improvement values, could address the issue of retaining forest land in the tax base. This approach, however, would be biased in favor of forestry (Klemperer 1982). Critics of current use assessment suggest that highest and best use assessment would encourage more centralized development and help to deter urban sprawl.

In addition to the issue of bias, exempting improvements for forestry and not for other uses may result in increased tax burdens for non-forest property classes. Generally, if a taxing district lowers the tax on one particular land use, they will need to increase the tax on the remaining properties (Klemperer 1978). Thus the level of tax burden on forest use may have some correlation with the level of tax burden shared by non-forest properties (Stier and Chang 1983).

### **Discouraging Land Speculation**

In certain instances, a site value tax may help to curb land speculation. Because the tax is independent of the actions of landowners, idle use of land will be discouraged under a site value tax. Land would be taxed at highest and best use, thus pressuring landholders to manage their property more efficiently. Also, in the presence of imperfect information, a site value tax could discourage individuals that have strong expectations about the potential future value of property from holding land (Tideman 1995).

### ***Analyzing Forest Tax Alternatives***

Having summarized the most common alternatives to the unmodified property tax for generating local revenue, it is essential to determine how these alternatives should be evaluated in relation to one another. It is important to consider a tax's effect on both landowners and the allocation of resources, as well as the feasibility of a tax to generate sufficient revenue and be administered cost effectively.

What is and is not a "fair" and efficient forest tax policy is often difficult to delineate, especially when considering that local governments face revenue constraints and have to consider positive environmental attributes that are associated with forest land (Amacher 1994, Condrell 1983, Englin and Klan 1990, Hellerstein 1986, Kronrad 1984). Achieving the desired policy can also be made more difficult due to the local nature of forest property taxes, where questions arise over revenue sharing and the inconsistency between competing states (Hickman et al. 1985 1986, Hickman 1989, Stewart 1983). Despite these constraints, most analysts agree that the optimal forest tax policy should strive to be economically efficient, having no effect on forest management decisions or land use relative to the pre-tax condition when the latter is deemed socially desirable (Klemperer 1987 1989, Gamponia and Mendelsohn 1987, Merz 1987, Waggener et al. 1983).

## Equity Guidelines

Much of the literature analyzes the equity of forest tax alternatives. When policy-makers consider equity, essentially they are attempting to achieve some degree of fairness, with or without efficiency. The problem with many of these approaches, however, is that one guide may deem a particular tax to be equitable, but not neutral, resulting in inefficient resource allocation. Also, many of the equity guidelines conflict with one another, making it impossible for policy planners to achieve all of them. Klemperer (1980) outlines various guides to achieving forest tax equity, and the following sections examine five of these and also the often-used tax ratio originated by Fairchild (1935).

**Tax the same percent of market value for all properties.** The traditional guide for achieving equity suggests that for a given district, all properties should be taxed annually at the same percentage of market value. In reality this guideline represents the unmodified property tax, which is not neutral and is biased against capital-intensive land uses.

**Equalize after-tax rates of return.** Another equity guideline is to allow the after-tax forestry rate of return to be equal to that in other enterprises. The problem with this theory is that if the rate of return for a certain land use is low and taxes are decreased in response to this low rate, then the decrease in tax will be shifted into higher land values due to the tax capitalization effect. The net result of this would be no change in the rate of return for the investment if the adjusted land value is used. Again this would not represent an efficient equity guideline. A low rate of return in a forest sector should be a market signal to produce less in that sector, rather than a signal for the government to lower the tax.

**Keep forest tax burden similar to that in other states.** This tax equity guideline attempts to make forest land use competitive with respect to other regions under different tax jurisdictions. This may not be a very pertinent concern, however, if full tax capitalization is assumed. If a particular forest region has a higher tax burden than surrounding areas, it should exhibit a lower land value, enabling it to remain competitive.

**Allow the new tax to raise the same revenue as the old.** Klemperer (1980) points out that this guideline, although popular, does not necessarily account for equity. If questions of fairness concerning the old system exist, they may very well persist for the new tax system.

**Tax the same percent of annual income from all properties.** By utilizing this equity guide, local governments attempt to set taxes so that each class of property pays the same percentage of annual income. Such a tax would assess the value of property based solely upon income, excluding wealth from taxation. In practice, regional averages of the percentage of income taxed from various properties would be calculated in order to determine a “fair” percentage of income to tax from forest land. Once the “fair” percentage of income has been set, policy planners would have some flexibility in choosing a vehicle of taxation to extract that percentage from forest properties.

**Equalize the tax ratio.** Another measure of tax equity is the burden a given tax system creates in relation to alternative systems. Fairchild (1935) evaluated equity in terms of the tax ratio. The tax ratio is defined as the ratio between the present value of property taxes at rotation-start and the present value of income and reforestation costs (Fairchild 1908 1935). However, Klemperer (1974), pointed out that this is not the most

effective system for comparing alternative tax systems because it does not focus on land value alone. Even if a particular type of tax provides equal tax ratios for all hypothetical land uses this does not guarantee neutrality, and the tax may reduce social welfare by causing a distortion in the optimal allocation of resources.

### Examining Equity to Achieve Neutrality

The previous section outlined many of the equity guidelines that policy makers could use in developing tax systems, but none of these guidelines consider neutrality. Assuming that there are no preexisting distortions in other sectors (e.g. see Kovenock 1986), an efficient tax system should be neutral, allowing for the optimal market allocation of resources. This section examines measures of tax equity which consider neutrality.

**Site Burden.** A reexamination of Fairchild’s work led to the development of the “site burden” concept for comparing alternative tax systems (Klemperer 1974 1978 1982, Rideout and Hof 1986, Stier and Chang 1983). Site burden represents the percent reduction in before tax theoretical bid price caused by the introduction of the tax (Klemperer 1974). For a given tax to be neutral, the site burden would have to be equal for all land uses. The site burden concept hinges on the assumption that property taxes are capitalized into lower land values. This is conceivable for industries such as forestry and agriculture because individual producers face a broad regional market and cannot pass taxes forward into higher product prices (for evidence of tax capitalization in agriculture and forestry see Pasour 1973 and Turner et al 1991). Klemperer (1978) reviewed how the site burden concept can be used to evaluate forest tax equity and defined site burden as in equation (1) below.

$$SB = \frac{L_b - L_a}{L_b} \quad (1)$$

Where,  $SB$  = Site Burden (percent/100)

$L_b$  = bid price for land before taxes

$L_a$  = bid price for land after taxes

Building upon the prior analysis of Gaffney (1970 1975) and Neutze (1969), Klemperer (1982) shows the theoretical neutrality of the site value tax utilizing the concept of site burden. Given the assumptions of a site value tax, the annual tax levied would be equivalent to  $tL_a$ . This would yield an after-tax land bid price equal to the before-tax bid price minus the present value of the tax, assuming full tax capitalization :

$$L_a = L_b - tL_a / i$$

where  $t$  = the site value tax rate

and  $i$  = the real market rate of interest

Solving for  $L_a$  results in:

$$L_a(1 + t / i) = L_b = L_a(i + t) / i$$

$$L_a = \frac{i}{i + t} L_b \quad (2)$$

By substituting the values for  $L_a$  and  $L_b$  from eq. (2) into the site burden equation (eq. 1) and simplifying, Klemperer (1978) showed that the site burden of a tax on land value alone is equal to

$$SB = \frac{t}{i + t} \quad (3)$$

This demonstrates that the site burden of a site value tax, given full tax capitalization, would have no effect on land use or management decisions. The effect of a pure site value tax will be to reduce the bid price of land for all uses by the same percentage (Klemperer 1982). The site burden in this case is a function of the tax and interest rate, independent of any assumptions about land use or management intensity. Of all the alternatives previously discussed, the site value tax is the only tax that can claim not to distort the market allocation of resources.

**Excess Burden.** Preliminary studies utilizing the site burden concept did not allow for property tax-induced changes in management regime and intensity. Preceded by many studies of the comparative statics of alternative forest taxes (Chang 1982 and 1983, Jackson 1980, Rideout 1982, Small 1984, Stier and Chang 1983), Rideout and Hof (1986) compare the site burden concept with excess burden to compute site burden error, which results from tax-induced changes in management regime and intensity. This gives more reliable estimates than the site burden. Rideout and Hof (1986) explained that, when utilizing the assumption of fixed management, the effects of a forest tax will be overestimated. Later studies expand upon the site burden as an equity and efficiency guide by formally using the concept of excess burden (Bare 1990, Gamponia and Mendelsohn 1987). Excess burden represents the additional reduction in the present value caused by a tax-induced change in management regime such as rotation length or establishment effort (Gamponia and Mendelsohn 1987). By determining the excess burden, analysts have some measure of the reduction of social welfare generated by a proposed tax. In theory, a correctly applied site value tax would generate minimal excess burden because it would have no effect on the optimal management practices for a given site. Also, under a site value tax, any reduction in the net present value of land caused by the tax would be fully recovered by the local government as revenue. In one sense this makes the site value tax very attractive to tax policy planners. On the other hand, because site value taxation relies solely on the market to determine resource allocation, local governments can not use the tax system to foster the positive externalities that forests and open space provide. Nor could the site value tax be used as a policy tool to correct negative externalities and encourage open space. Local governments would have to use other tools, such as zoning regulations or eminent domain, to prevent unwanted development.

### **Theory of the Second Best**

Despite the belief by many tax analysts that property taxes should be neutral, achieving neutrality in only one sector of the economy may do little or even reduce welfare in the economy as a whole. This phenomenon is described by the theory of the second best. The theory of second the best states that attempting to improve the efficiency of one sector of the market, given that there may be existing distortions, could actually have a negative effect on the economy as a whole (Lipsey and Lancaster 1957). In summary, attempting to achieve efficiency in the presence of unaccounted-for externalities may lead to a second best solution.

### **Single Acre Versus Regulated Forest**

Despite a general acceptance of site burden as a way to measure forest tax impacts, some disagreement exists about the implications of the site burden in a multi-age-class forest. Gamponia and Mendelsohn (1987) examined tax burden using only a single-acre model, while others also examined multi-acre regulated forests (Klemperer 1982, Dowdle 1980). Bare (1990) pointed out that theoretically, from a land use impact perspective, a given tax's site burden should be identical in both models, due to the fact that a regulated forest model is essentially a combination of single-acre models. Klemperer (1987), however, pointed out that two forest taxes which equally reduce rotation-start present value on one acre will not necessarily raise the same regional tax revenue per year. For example, in a region with many timber age classes, a yield tax would generally raise more revenue than an ad valorem tax, even if both had the same effect on rotation-start present value. For this reason Klemperer suggests that both single-acre and regulated forest models should be utilized when analyzing forest tax alternatives (Klemperer 1987).

## Chapter 3: Data and Methods

### *Data and Study Areas*

We will use spreadsheets to empirically examine the adequacy, equity, and efficiency of forest tax alternatives and to model the effects of property taxes as discussed below. For selected regions in Oregon and Alabama, we will simulate tax effects and revenues from various forms of a forest site value tax and compare the results to the current status in each region.

#### **Western Oregon**

We will focus on Western Oregon because it is an important timber producing region and has reliable data available for our purposes. The majority of forest tax revenues in Oregon are collected via a yield tax. We will model the site value tax and the existing yield tax based on the current forestland tax-classification system in Western<sup>1</sup> Oregon, and assume for forest land use that Douglas-fir is the only species. We will utilize existing tax revenue data from the Oregon Department of Revenue and 1991 bare land market values generated by Cascade Appraisal Services (Granvall, 1992).

For single acre and regulated forest models, growth and yield data will need to be generated to model the yield tax. The Douglas-fir stand projection model, S.P.S. 2.3, will be utilized for this purpose (Arney, 1989). A site value tax will be simulated by making necessary assumptions about management regimes and site index classification systems.

#### **Alabama**

In the same manner we will simulate the effects of a forest site value tax for the state of Alabama where loblolly pine is the major commercial timber species. Unlike Oregon, Alabama does not apply a yield tax, and therefore we will not have to make assumptions about management regimes in order to simulate a forest site value tax. Site class distribution will be determined from Forest Service forest inventory analysis data for the state (USDA 1990). Current tax revenue will be simulated based on data provided by the state revenue department and estimates of bare land market value. Bare land market values from 1990 to 1996 have been provided by Sizemore and Sizemore Appraisal for this region. We will utilize a similar procedure for simulations in Alabama as that used in Western Oregon.

#### **Model Types**

In order to facilitate our simulations, various models will be incorporated to look at the adequacy, efficiency, and equity of a forest site value tax. A spreadsheet model that calculates rotation-start net present value will be utilized. Model results will be used to examine the adequacy and efficiency of a forest site value tax. To determine tax impacts on the forest owner's annual revenues, we will use a multi-acre regulated forest. We will use both a regulated and a single acre model when examining equity criteria, which will be

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<sup>1</sup> As a tax district in Oregon, Western Oregon refers to all counties west of the Cascade range. Specifically: Benton, Clackamas, Clatsop, Columbia, Coos, Curry, Douglas, Hood River, Jackson, Josephine, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill.

examined as a percent of annual income and site burden respectively. Specific models are discussed in more detail under the following sections.

## ***Methods***

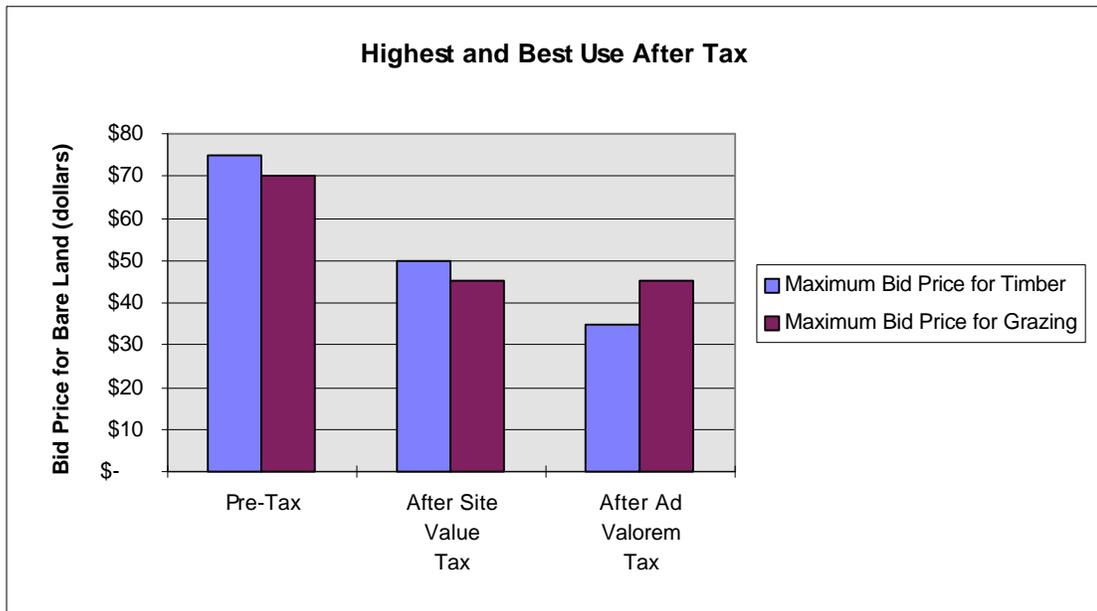
### **Adequacy**

Empirically we will examine the adequacy of a forest site value tax to generate revenue for the two selected regions. This will entail comparing receipts under the current forest tax system to those under a proposed forest site value tax, and looking at the sensitivity of land values to various levels of revenue. We will examine the adequacy of the land base alone to generate the same amount of tax revenue as the current system. The effect of tax capitalization will be analyzed in detail.

### **Efficiency**

We will calculate the percent tax-induced reduction in the theoretical bid price for bare land (site burden) under a site value tax. Recall that a tax imposing equal site burden on all land uses is neutral with respect to land use.

We will empirically compare the effects of a site value tax on land use for two study areas: Western Oregon and Alabama. Simulated land use effects of the site value tax will be examined and compared to the current tax systems. We will theoretically examine the alleged neutrality of a site value tax. A neutral tax will not distort the market allocation of resources. Highest and best use before the tax will be so after the tax. Figure 3-1 demonstrates a hypothetical example of how a non-neutral ad valorem tax can cause a change in the highest and best use for marginal land. In Figure 3-1, timber production is a more profitable land use than grazing before any tax is applied. Given a site value tax, the relative ranking of the bid price for land between timber and grazing remains the same as that in the pre-tax condition. However, given an ad valorem tax, timber production receives a substantially higher burden and grazing becomes the highest and best use for the site.



**Figure 3-1. Highest and Best Use Before and After Tax**

We will also examine possible non-neutralities of the site value tax with regard to its actual application. Theoretically the site value tax is neutral with respect to both land use and management decisions, based on the assumption that the assessed land value truly reflects the market value of land in its highest and best use. However, in its actual application it is not feasible to design a system that provides perfect assessment for each individual property. Considering this point, we will attempt to show possible non-neutralities that would arise under various designs of a site value tax system. We will analyze the site value tax under different degrees of site index class designation. We expect to find that the degree of neutrality associated with an applied site value tax will increase as the degree of assessment accuracy increases.

### **Equity**

The literature review examined the equity of a proposed site value tax using the site burden concept. Based on current and projected cash flows from hypothetical single acre forests in Western Oregon and Alabama, we will simulate the site burden imposed by the current tax system. Then we will compare this to the theoretical site burden generated by a site value tax rate that raises the same annual revenue as raised with the current system.

**TABLE 3-1. Hypothetical model to equate a 1.26% site value tax rate necessary to raise the same annual revenue as a 5% yield tax.**

<i>Site Class</i>	<i>Acreage</i>	<i>Rotation</i>	<i>Yield at Harvest (\$/acre)</i>	<i>Annual Yield (\$/year)</i>	<i>Land Value (\$/acre)</i>
1	200	30	\$5000	\$33,333	\$871
2	500	40	\$5000	\$62,500	\$486
3	300	50	\$5000	\$30,000	\$271

<i>Site Class</i>	<i>Acreage</i>	<i>Rotation</i>	<i>Annual Taxes: 5% Yield Tax</i>	<i>Annual Taxes: 1.26% Site Value Tax</i>
1	200	30	\$1,667	\$2,197
2	500	40	\$3,125	\$3,067
3	300	50	\$1,500	\$1,028
<b>TOTAL:</b>			<b>\$6,292</b>	<b>\$6,292</b>

For example, Table 3-1 depicts a hypothetical model of regulated forests used to equate the total annual tax revenue from a yield tax and a site value tax. In this example each site class represents a fully regulated forest, thus the number of acres harvested from each site class every year is equal to the total acreage in each site class divided by the rotation. Annual yield from each class is calculated as the number of acres divided by the rotation length multiplied by the harvest value per acre. Land values are calculated as present values for each site class from assumed harvest values at rotation length, given a 6% real rate of interest, with no costs or other taxes calculated for this simple example. Although the total annual tax from all site classes is \$6,292 under each tax, the two taxes impose different burdens on each site class.

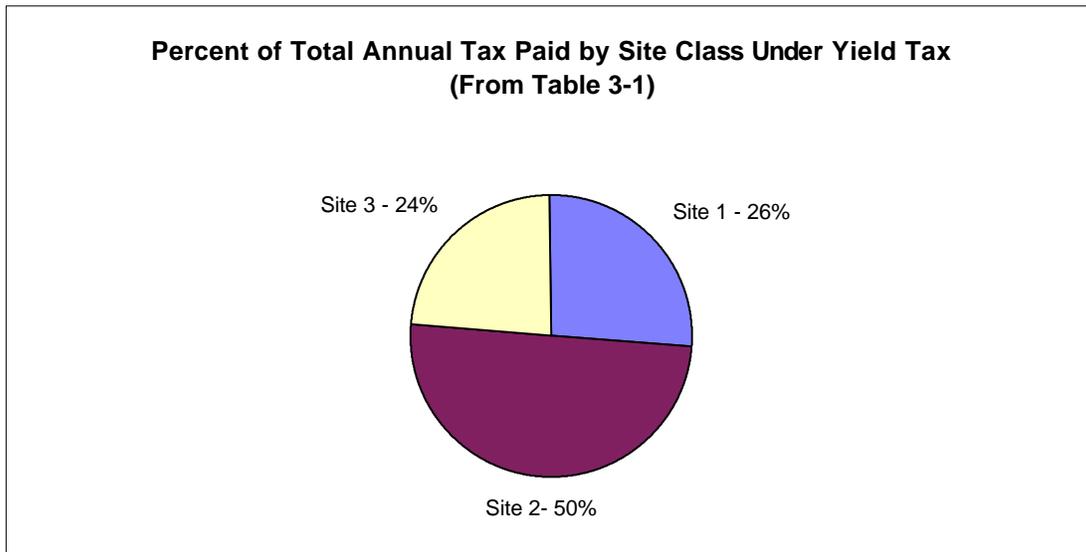
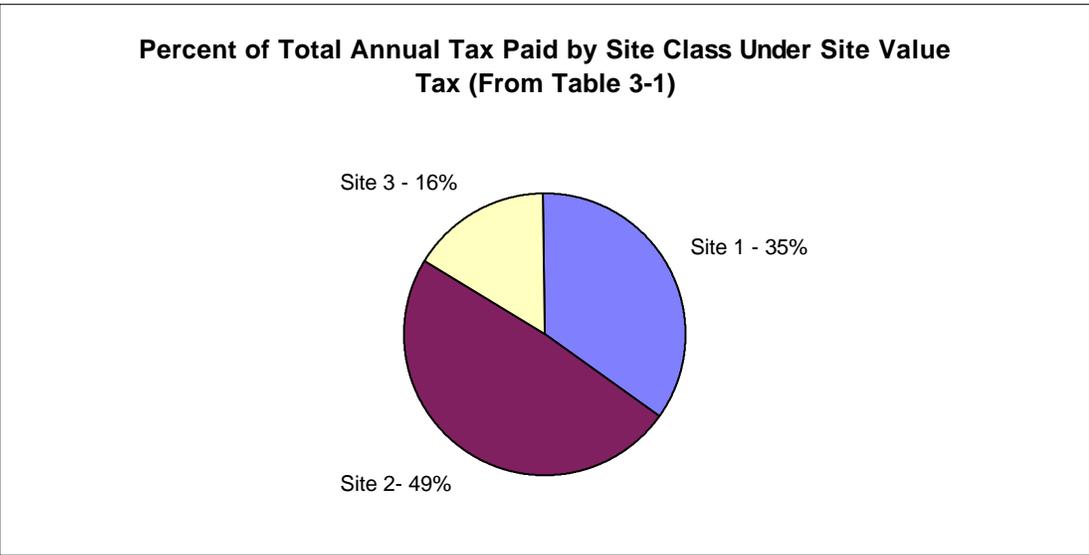


Figure 3-2. Percent of Total Annual Tax Paid by Site Class Under Yield Tax.



**Figure 3-3. Percent of Total Annual Tax Paid by Site Class under Site Value Tax.**

Figures 3-2 and 3-3 follow from the model in Table 3-1. Figure 3-2 shows the percent of total annual tax paid by each of the three site value classes under a yield tax. Figure 3-3 shows what the percent of total annual tax paid per site class would be if a 1.26% site value tax replaced the yield tax. In this hypothetical example, if the yield tax was replaced by an equal-revenue-raising site value tax, the highest value site class (Site 1) would receive an increase in tax burden, while the lowest value site class (Site 3) would receive a decrease in tax burden.

The second equity criterion used will be to simulate the average annual tax per acre for a fully regulated forest. This will require using a regulated forest model to represent a landowner and determining the average annual tax per acre caused by a site value tax. For comparative purposes we will simulate the percent reduction in annual income from a yield tax as well. In order to determine what an equal revenue raising tax would be for each study area we will model each area as a collection of regulated forests with the associated actual distribution of site classes. Using this model we will determine what site value tax rate will generate the same amount of annual revenue as an assumed yield tax. We will examine landowner equity by showing which classes of landowners will face increased annual taxes and which face decreased taxes under a proposed site value tax compared to the status quo.

**Phasing in the Site Value Tax**

We will examine the need for gradually shifting to a site value tax from the current yield tax structure, for the study area in Western Oregon. We will consider both landowner equity and revenue generation for local government. Because a yield tax is levied only at the time of harvest, the landowner welfare effect of a switching to a site value tax will vary depending upon the age class distribution in each ownership.

## **Administration**

We will address the administrative costs of implementing a site value tax. No data exists on what the exact cost of a transition to a site value tax will be, but some estimates can be made by examining the costs incurred by states that shifted to a similar tax. For example, West Virginia and Georgia have instituted productivity taxes and have relative data reflecting the costs of land classification and the cost savings accumulated by eliminating the need for valuing inventories or harvests.

Analyses will examine different forms of site value tax administration as well. The number of assessed land value classes and the method of determining bare land values affect the actual degree of neutrality that a site value tax has in practice. For example if the site value tax is administered only on forest land as opposed to all land, some degree of neutrality would be lost.

## **Discussion of Improvements**

Classical discussion of the site value tax has always maintained that a pure site value tax will exempt all improvements and will therefore not discourage the latter. However, this is not necessarily the case. Some permanent improvements can actually change the bare land market value and assessed land value of a property. Thus, a site value tax could, in practice, discourage certain improvements. For example, drainage can often greatly increase the bare land value of a forested property. Bare land values can also be affected by changing exogenous parameters such as the location of a mill or a road. We will examine what exogenous parameters and improvements can change bare land market values and discuss them in the context of forest site value tax administration and tax neutrality.

## Chapter 4: Adequacy of a Forest Site Value Tax

Generally speaking, the local property tax is instituted solely for the purpose of collecting revenue, enabling local governments to provide necessary services such as public education, safety, and infrastructure. Thus, for any proposed tax to be feasible it has to generate enough revenue to fund local governments. Although the site value tax may prove to be a non-distortive vehicle for collecting revenue with respect to market allocation and optimal management, it may sometimes not meet revenue needs when the tax base is reduced by exempting improvements. If the assumption is made that property taxes are capitalized into lower bare land market values, local governments will face a finite maximum level of annual tax revenue that the land base can generate.

### *Example: Western Oregon*

In order to determine the adequacy of any proposed tax, one must first determine the revenue that the local government budget requires. Although budgets often vary from year to year, and revenue is usually collected from many different sectors of the local economy, this study will assume that a certain revenue goal exists for each region, in order to evaluate the adequacy of a proposed site value tax within that region. The need for stable revenue is especially relevant in regard to taxation of forestland in Western Oregon because it represents a very significant sector of the local economy.

Table 4-1 displays the total amount of yield and property taxes collected from private forestland in Western Oregon from 1991 to 1995. These tax receipts indicate the amount of annual revenue that a forest site value tax would need to raise. However, it can be noted that receipts varied by as much as 15 million dollars during this period. This variation can be attributed to a number of factors such as annual fluctuations in harvests, changing stumpage prices, and recent property tax reform legislation. Recent property tax reform may be the most significant factor in determining revenue constraints based upon property tax relief legislation passed in 1993. As a result, yield tax rates are currently being phased down, and future receipts are expected to be significantly lower than those observed in 1995 (OFIC, 1993). For the analysis of a forest site value tax in Western Oregon, based on a rough estimate from recent receipts, we will assume a required annual revenue of 50 million dollars.

**TABLE 4-1. Western Oregon Forest Tax Receipts 1991 to 1995\***

<i>Fiscal Year</i>	<i>Receipts</i>
1991	\$ 53,908,648
1992	\$ 48,885,051
1993	\$ 46,052,486
1994	\$ 55,473,895
1995	\$ 61,080,175

\*(Oregon Department of Revenue, 1995)

**TABLE 4-2. 1991 Total Bare Land Market Value For Western Oregon**

<i>DOR Site Class</i>	<i>*Bare Land Market Value Per Acre (\$/acre)</i>	<i>Acreage per Site Class</i>	<i>Total Bare Land Market Value</i>
FA	\$350	184,291	\$ 64,501,850
FB	\$300	1,139,392	\$ 341,817,600
FC	\$250	1,677,460	\$ 419,365,000
FD	\$200	936,543	\$ 187,308,600
FE	\$150	813,651	\$ 122,047,650
FF	\$125	564,445	\$ 70,555,625
FG	\$75	198,507	\$ 14,888,025
FX	\$50	30,484	\$ 1,524,200
<b>TOTAL :</b>		<b>5,360,482</b>	<b>\$ 1,222,008,550</b>

\*Granvall, 1992.

In determining the adequacy of a proposed forest site value tax, the first step is to determine the short run tax rate that would be necessary to raise the required revenue (50 million dollars) from the total bare land market value for the region. Table 4-2 shows the calculation of the total land value in Western Oregon based on bare land market values and total acreage for the 8 Western Oregon Department of Revenue (DOR) site classes (Granvall, 1992; see Appendix A). Based on these estimates, the total 1991-1992 bare land market value for private forestland in Western Oregon was approximately 1.2 billion dollars. Dividing the revenue requirement of 50 million dollars by the total bare land value indicates that a 4.09 percent site value tax rate would be necessary. However, this rate reflects only the short-run equivalent annual revenue raising rate. In the long-run, the equilibrium rate would be higher assuming that the tax is capitalized into lower bare forestland market values. Table 4-3 shows the amount of tax per acre that would be levied on each site class in the short run if a 4.09 % site value tax were instituted.

**TABLE 4-3. Tax per acre for a 4.09 % site value tax, Western Oregon.**

<i>DOR Site Class</i>	<i>Bare Land Market Value (\$/acre)</i>	<i>Annual Tax (\$/acre/year)</i>	<i>PV of Tax @6% (\$/acre)</i>
FA	\$ 350.00	\$ 14.32	\$ 238.58
FB	\$ 300.00	\$ 12.27	\$ 204.50
FC	\$ 250.00	\$ 10.23	\$ 170.42
FD	\$ 200.00	\$ 8.18	\$ 136.33
FE	\$ 150.00	\$ 6.14	\$ 102.25
FF	\$ 125.00	\$ 5.11	\$ 85.21
FG	\$ 75.00	\$ 3.07	\$ 51.13
FX	\$ 50.00	\$ 2.05	\$ 34.08

## Long Run Adequacy

What would be the long run effect of a 4.09 percent site value tax on bare land market values? Would the full amount of the tax be capitalized into lower bare land market values? The exact answer to this question is yet unclear and needs to be addressed. Certainly some or the majority of the tax would be capitalized into lower bare land market values (for studies showing tax capitalization in agriculture see Pasour 1973, in forestry see Turner et al. 1991). Because the market for forest products is competitive across state and even national borders, landowners are unlikely to be able to pass expected future property taxes into higher stumpage prices (Klemperer, 1981). As a result much of the tax will eventually be capitalized into lower land values. For simplicity, assume initially that taxes are fully capitalized into the market bid price for bare land.

In order to determine what the site value tax's effect on land values would be in the long run, we will first have to determine what the before-tax<sup>2</sup> land values for each site class would be, assuming full tax capitalization today. Using the current bare land market values for the region we can estimate the amount of local tax currently being capitalized into lower bare land market values. In order to determine these values, some assumptions must be made about optimal rotation age, discount rate, establishment costs, and the current tax system.

In order to estimate land values before property taxes, a spreadsheet model was developed to estimate the amount of yield and land tax assumed to be capitalized into the current after-tax bare land market values. The model calculates a land value based on assumptions about current taxes, optimal rotation age, establishment costs, discount rate, the deductibility of local property taxes, and harvest value. Full tax capitalization is assumed and land value, as given in equation (4) below, is calculated as net present value on a perpetual time horizon. The model solves for the harvest value which yields a land value equal to the current bare land market value. Then by setting the yield and land tax rates equal to zero in equation (4), we can calculate the before-property-tax bare land market value.

$$LV = \frac{H - Hy - H(1-d)(1-y) - Ed}{(1+i)^R - 1} - E - \frac{ld}{i} \quad (4)$$

Where,

$LV$  = computed bare land value

$H$  = harvest value at rotation age

$R$  = optimal rotation age

$E$  = establishment cost

$i$  = real rate of market interest (percent/100)

$y$  = current yield tax rate (percent/100)

$l$  = annually assessed land tax

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<sup>2</sup> For the purpose of this study, "before-tax" implies the estimated value of land given no local or property taxes; it does not represent the estimated value before federal and state income taxes.

$d = \text{deductibility reducer}^3 = (1-s)(1-f)$   
 $s = \text{state income tax rate (percent/100)}$   
 $f = \text{federal income tax rate (percent/100)}$

To calculate the estimated before-tax land values for each DOR site class we assumed that the average landowner faces a federal income tax rate of 34% and a state income tax rate of 9%. These rates were assumed because the majority, 60%, of all private forestland in Western Oregon is owned by the forest industry<sup>4</sup> (Newport, 1993). Less than 8% of all privately held forestland in Western Oregon belongs to income tax exempt pension funds and trusts. Based on the 1989-1991 period when the land transactions used to determine the bare land market values took place, we will assume that potential bidders for the land expected to face a yield tax rate of 6.5% at the time of harvest, and a land tax rate of 1.5% on 20% of the bare land assessed market value. The model assumes that both yield and land property taxes are currently deductible against state and federal income taxes.

**TABLE 4-4. Model assumptions for 8 DOR site classes, Western Oregon.**

<i>DOR Site Class</i>	<i>Optimal Rotation (years)</i>	<i>Establishment Cost (\$/acre/year)</i>
FA	35	\$ 195.00
FB	40	\$ 185.00
FC	40	\$ 172.00
FD	40	\$ 162.00
FE	45	\$ 145.00
FF	45	\$ 120.00
FG	50	\$ 115.00
FX	NA	\$ -

Table 4-4 shows the assumptions made for both optimal rotation length and establishment costs for the 8 DOR site classes. The optimal rotation, to the nearest five years, was that which maximized rotation-start net present value based on SPS yield projections for Douglas-fir plantations planted at a density of 300 trees per acre using a 6% real rate of market interest (Arney, 1989; see Appendix B). For simplicity, no intermediate costs or thinnings were assumed. Establishment costs reflect the estimated costs of reforestation and site preparation for each DOR site class (Newport, 1993). For the DOR site class FX, which represents non-productive forestland, no assumptions were made about rotation, and establishment costs were set at zero based on the assumption that no harvesting would occur. The site class FX was assumed to be exempt from yield taxes, and the before-tax bare land value was simply calculated as the after-tax bare land value plus the present value of expected future land taxes.

<sup>3</sup> This formula models the typical case where state income taxes are deductible for federal tax purposes but not vice versa. The effective federal and state tax rate is thus  $x=f+s(1-f)$ . Any deductible expense is thus multiplied by  $(1-x)$ , which reduces to  $d$  above.

<sup>4</sup> These rates are the maximum rates under federal and state income taxes in Oregon, and were chosen to reflect the majority of forestland owners in the state. If the lower rates were assumed in the model calculations, before-property-tax land value and site burden estimates would be slightly higher.

It is important to note that an assumption of neutrality is inherent in this model. We assume that optimal rotation ( $R$ ) and establishment cost ( $E$ ) are fixed variables in equation (4), and thus are not subject to tax-induced changes. This assumption is reasonable because such changes would be small<sup>5</sup> and thus negligible relative to the accuracy of our estimates of optimal rotation and establishment cost. Furthermore, the model estimates of before-property-tax bare land value are not highly sensitive to optimal rotation, and reliable data are not available to estimate tax-induced changes in establishment cost.

Given the before-mentioned assumptions and using the procedure explained above for equation (4), we estimated the before-property-tax bare land market values from the

**TABLE 4-5. Estimated 1991 impacts of Western Oregon yield and land taxes\*.**

<b>DOR Site Class</b>	<b>Current After-tax Bare Land Market Value (\$/acre)</b>	<b>Estimated Before-Property-Tax Bare Land Market Value (\$/acre)</b>	<b>Site Burden (percent)</b>
FA	\$ 350.00	\$ 400.35	12.58%
FB	\$ 300.00	\$ 344.18	12.84%
FC	\$ 250.00	\$ 288.14	13.24%
FD	\$ 200.00	\$ 232.32	13.91%
FE	\$ 150.00	\$ 175.80	14.68%
FF	\$ 125.00	\$ 146.44	14.64%
FG	\$ 75.00	\$ 90.89	17.49%
FX	\$ 50.00	\$ 51.50	2.92%

\* 6% real rate of interest.

**TABLE 4-6. Long-run after-tax land values under a 5.48 % site value tax, generating 50 million dollars in annual revenue in Western Oregon\*.**

<b>DOR Site Class</b>	<b>Current After-tax Bare Land Market Value (\$/acre)</b>	<b>Calculated Before- Property-Tax Bare Land Market Value (\$/acre)</b>	<b>Long-run After-tax Bare Land Market Value (\$/acre)</b>	<b>Site Burden<sup>6</sup> (percent)</b>
FA	\$ 350.00	\$ 400.35	\$ 258.46	35.44%
FB	\$ 300.00	\$ 344.18	\$ 222.20	35.44%
FC	\$ 250.00	\$ 288.14	\$ 186.02	35.44%
FD	\$ 200.00	\$ 232.32	\$ 149.98	35.44%
FE	\$ 150.00	\$ 175.80	\$ 113.49	35.44%
FF	\$ 125.00	\$ 146.44	\$ 94.54	35.44%
FG	\$ 75.00	\$ 90.89	\$ 58.68	35.44%
FX	\$ 50.00	\$ 51.50	\$ 33.25	35.44%

\* 6% real rate of interest

<sup>5</sup> For examples of tax effects on optimal rotation and establishment cost, see Amacher et al. 1991, Bare 1990, and Klemperer 1975.

after-tax bare land market values determined for the 8 DOR site classes (for sample calculation see Appendix C). For the 8 DOR site classes, column 3 of Table 4-5 shows the estimated before-property-tax land values. Column 4 of Table 4-5 shows the percent reduction in the pre-property-tax bid price for land caused by the yield and land tax in Western Oregon at the time of the land value study, a period when annual tax revenue was roughly \$50 million per year (see Table 4-1).

By using a spreadsheet model, assuming full tax capitalization and a 6% real rate of interest, we can solve for the long-run equilibrium site value tax rate that will generate 50 million dollars in annual revenue, the approximate amount raised by Western Oregon forest taxes in the early 1990's. This rate was calculated to be 5.48%. Table 4-6 shows the long-run effect on bare land market values for the 8 DOR site classes, assuming full tax capitalization. Under a site value tax, the site burden for each site class is equal to 35.44%. By removing timber from property taxation, bare land market values would be reduced on average by 3 times more than they would be reduced under the 6.5% yield tax and 1.5% land tax on 20% of bare land market value shown in Table 4-5.

**TABLE 4-7. Long-run revenue from a 5.48% site value tax in Western Oregon\*.**

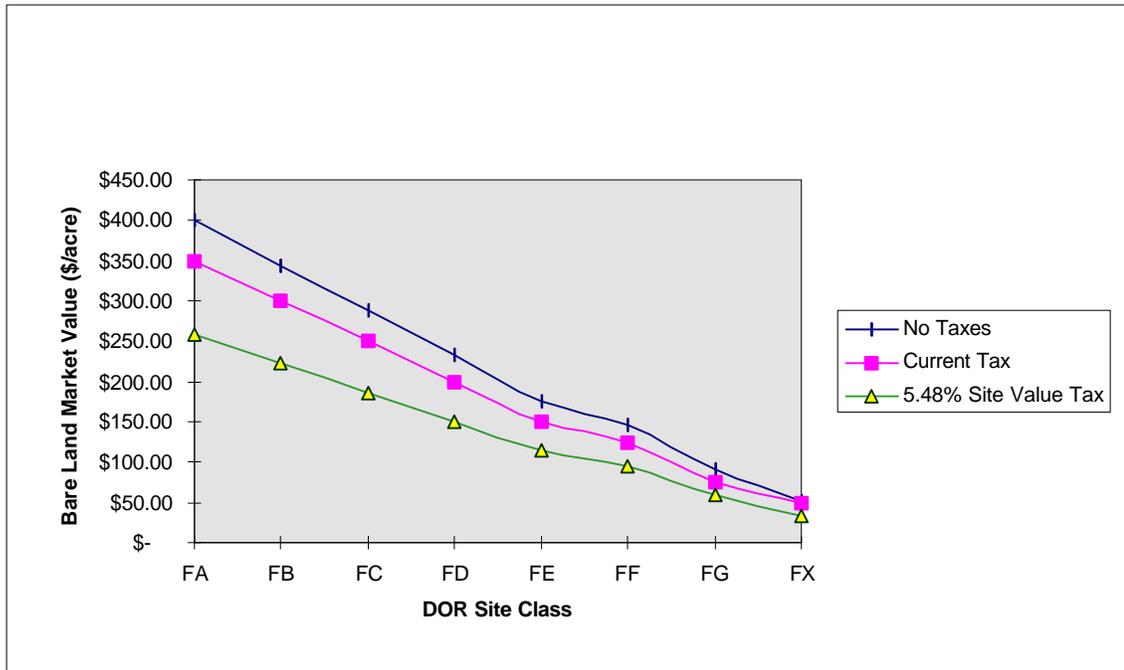
<i>DOR Site Class</i>	<i>After-tax Bare Land Market Value (\$/acre)</i>	<i>Annual Tax (\$/acre)</i>	<i>Acreage per Site Class</i>	<i>Annual Total Tax Revenue</i>
FA	\$ 258.46	\$ 14.17	184,291	\$ 2,612,304
FB	\$ 222.20	\$ 12.19	1,139,392	\$ 13,885,035
FC	\$ 186.02	\$ 10.20	1,677,460	\$ 17,113,498
FD	\$ 149.98	\$ 8.23	936,543	\$ 7,703,598
FE	\$ 113.49	\$ 6.22	813,651	\$ 5,064,545
FF	\$ 94.54	\$ 5.18	564,445	\$ 2,926,596
FG	\$ 58.68	\$ 3.22	198,507	\$ 638,837
FX	\$ 33.25	\$ 1.82	30,484	\$ 55,587
<b>TOTAL:</b>			<b>5,360,482</b>	<b>\$ 50,000,000</b>

\* 6% real rate of interest

Table 4-7 shows the annual tax per acre that would be paid by each DOR site class under a 5.48% site value tax generating 50 million dollars in annual tax revenue. Under this scenario landowners would no longer pay yield taxes at the time of harvest, but would face a substantial increase in annual land taxes.

Figure 4-1 summarizes the long-run effect on bare land market value that would be associated with instituting an equal-revenue-raising site value tax in Western Oregon. Instituting a 5.48% site value tax to replace the current tax system would cause a significant reduction in the value of bare forestland in Western Oregon. Note that the slope of the line indicating land value under the site value tax is less steep than that of the current system. This suggests that more of the burden will be shifted to the higher valued site classes than to the lower value site classes under the proposed site value tax, relative to the current tax.

<sup>6</sup> Note that due to the interaction of state and federal income taxes in equation (4), the site burden calculated in this example is lower than would be calculated using equation (3).



**Figure 4-1. Effect of Property Taxes on Bare Land Market Value in Western Oregon.**

**TABLE 4-8. Reduction in bare land market value due to tax capitalization.**

<i>Tax Scenario</i>	<i>Total Bare Land Market Value</i>	<i>Reduction</i>
No Tax	\$ 1,412,168,446	\$ -
Current Tax	\$ 1,222,008,550	\$ 190,159,896
5.64% SVT	\$ 911,668,446	\$ 500,500,000

Table 4-8 shows the reduction in land value that would result from instituting the equivalent-revenue-raising 5.48% site value tax, assuming full tax capitalization. This points out the problems associated with reducing the tax base to include only the bare land market value. By attempting to raise the same amount of annual revenue through a site value tax, the taxable bare land market value for the region is reduced by over 500 million dollars. For any given revenue target to be satisfied via a site value tax, one can theoretically estimate the reduction in total bare land value using equation (5):

$$RLV = \frac{A dc}{i} \quad (5)$$

Where,

*RLV* = reduction in total bare land market value, \$ for region

*A* = annual revenue to be raised (budget constraint), \$ for region

*d* = deductibility reducer for state and federal taxes, percent/100 (see equation (4))

*c* = percent of tax capitalization, percent/100

*i* = real market rate of interest, percent/100

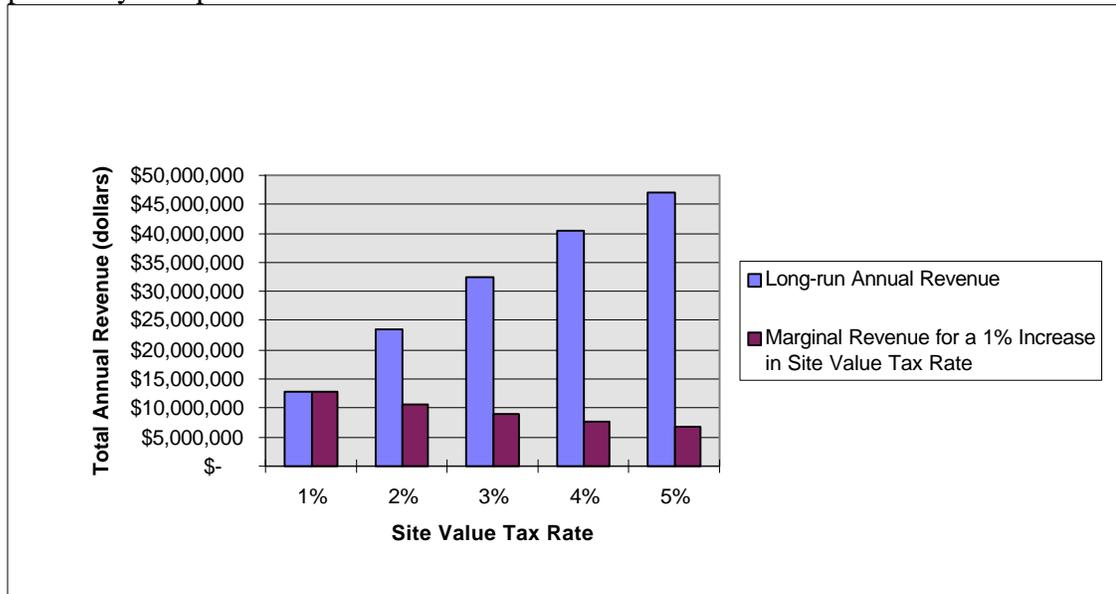
Equation (5), an adaptation of the site burden concept (equation (2)), provides a simple test to determine the adequacy of a site value tax for any region in which the pre-tax bare land market value is known, given assumptions about capitalization and the real rate of interest. For any revenue need, if the reduction in land value is greater than or equal to the total pre-tax bare land market value for the region, then a site value tax could not raise the required revenue. Table 4-9 projects the maximum annual revenue that could be raised by a site value tax in Western Oregon, given various assumptions about tax capitalization. At this maximum revenue collection, the site value tax rate and the land value would asymptotically approach infinity and zero respectively. For this example,  $d$ , the deductibility reducer, is held constant at .6006 reflecting state and federal income tax rates of 9% and 34% respectively.

The analysis shows that a forest site value tax could be implemented to raise \$50

**TABLE 4-9. Effect of capitalization on maximum revenue that can be generated for the total before-property-tax land value of Western Oregon (using a 6% ROR).**

<i>Maximum annual revenue given rate of capitalization and interest</i>		
<b>100% Capitalization</b>	<b>75% Capitalization</b>	<b>50% Capitalization</b>
\$ 141,075,769	\$ 188,101,025	\$ 282,151,538

million for Western Oregon. However, the rate necessary to achieve this revenue goal is significantly higher than current property tax rates in Oregon, and thus may not be politically acceptable.



**Figure 4-2. Long-run Annual Revenue Generated by Different Site Value Tax Rates in Western Oregon.**

Figure 4-2 shows the effect on revenue for various site value tax rates, given long-run equilibrium and full tax capitalization. The additional increase in revenue for a 1% increase in site value tax rate decreases as the site value tax rate increases. This is due to the capitalization of the tax into lower long-run equilibrium land values.

### **Example: Alabama**

In contrast to Western Oregon, Alabama presents a different situation with respect to property taxation. The overall current property tax burden in Alabama is much lower than that in Western Oregon, especially with regard to the taxation of forests. Unlike Oregon, Alabama does not have a yield tax, and timber is exempt from property taxation.<sup>7</sup> Forestland, since 1982, is taxed only on bare land market value or by current use assessment. Forestland in Alabama is assessed at 10% of market value, or 10% of current use value statewide. The property tax rate varies locally from county to county with a statewide rural average of 30 mills or 3% was reported by the Alabama state ad valorem tax division. Local tax rates vary from as low as 21 mills to as high as 99 mills in some municipal districts.

#### **Alabama's Current Use Tax**

In 1982, Alabama instituted a current use assessment for agricultural and forestland. Statewide, landowners have the option of having their property assessed at a current use value as opposed to bare land market value. The current use value for forestland is determined by a productivity value for the land that varies annually with statewide averages for stumpage prices and interest rates. Alabama's current use tax is

**TABLE 4-10. 1995 current use values for forestland in Alabama.**

<b>Site Value Class</b>	<b>Avg. Production (cords/acre/year)</b>	<b>1995 Current Use Value (\$/acre)</b>
Good	1.38	\$ 494
Average	1.05	\$ 375
Poor	0.75	\$ 268
Non-productive	0.60	\$ 214

administered in a manner similar to forest productivity taxes in other states. Forestland is lumped into one of four value classes based on the average annual cord production of the land. Table 4-10 shows the 4 recognized site value classes, assumed annual production of each site class, and the determined forestland value for each site class in 1995.

Current use values in Alabama are determined annually by a simple fixed formula. Equation (6) shows that value is determined by dividing the annual value growth minus costs by a fixed interest rate. Growth is the mean annual increment in cords per acre per year from column 2 of table 4-10. Price per cord is determined from the weighted statewide average stumpage price paid for hardwood and softwood pulpwood. For 1995 the average pulpwood stumpage price was \$ 24.76. Costs are fixed at 15% of growth

<sup>7</sup> Alabama does have a timber severance tax which is applied as a nominal rate per unit harvested by product class. This tax, however, is not considered a property tax (but rather a privilege tax) because revenues are specifically earmarked for forest research and protection.

value per acre per year. The interest rate used is equal to the 10 year average loan rate from the state Farm Credit Bank minus 4.5%. For 1995 this 10 year average was 10.38%, so an interest rate of 5.88% was used to calculate current use value.

$$CUV = \frac{gp(.85)}{i} \tag{6}$$

where,

*CUV* = Current Use Value (\$/acre)

*g* = growth (cords/acre/year)

*p* = statewide weighted average pulpwood price (\$/cord)

*i* = average statewide farm loan interest rate minus 4.5% (percent/100)

**TABLE 4-11. Calculation of average tax per acre per year for forestland under current use assessment in Alabama, 1995.**

<b>Site Value Class</b>	<b>1995 Current Use Value (\$/acre)</b>	<b>1995 Assessed Value (\$/acre)</b>	<b>1995 Tax (\$/acre/year)</b>
Good	\$ 494	\$ 49.40	\$ 1.48
Average	\$ 375	\$ 37.50	\$ 1.13
Poor	\$ 268	\$ 26.80	\$ 0.80
Non-productive	\$ 214	\$ 21.40	\$ 0.64

Table 4-11 shows the average tax per acre per year that would be applied to a given acre of forestland under current use assessment in Alabama for 1995, given an average state property tax rate of 3%. Column two of Table 4-11 shows the assessed value per acre under current use assessment which is equal to 10% of the current use value.

Current use assessment generally only offers a tax break to individuals whose property's highest and best use is something other than forestry. As a result, enrollment in the current use assessment program in Alabama has been relatively low (Flick et al 1989). Part of the reason for this is that the formula utilized to determine current use value does not compute the bare land value but rather the average value of a single acre in a fully regulated forest including land and timber. For example, assume a 20 acre fully regulated forest of the average site value class, managed at a rotation age of 20 years. Based on the current use value formula, each year a landowner would harvest one acre of land with 21 cords (equal to the rotation age, 20 years, times the mean annual increment of 1.05 cords/acre/year) times the stumpage price of \$24.76, giving a net annual revenue of approximately \$520. Thus, total net revenue minus costs (15% of net revenue) divided by the interest rate (5.88/100) would yield a total value of \$7,516 for the fully regulated forest. Dividing this total value (\$7516) by the total acreage (20) yields an average per acre value of \$375, which is equal to the 1995 current use assessment value for average sites. Calculating bare land value by using the same assumptions yields a value of \$207:

$$BLV = \frac{(\$520)(.85)}{(1.0588)^{20} - 1} = \$207$$

This bare land value is significantly lower than the current use value of \$375 calculated for average forestland. Thus, in theory, some timber value is reflected in the current use value, which is a potential situation with productivity taxes in general. The market for bare forestland in Alabama also suggests bare land values lower than current use assessment values as well. Table 4-12 displays the average bare forestland value for 4 forest cover-types in Alabama. The average values were determined from 600 sales of forestland properties in Alabama from January 1, 1990 to February 11, 1997 (see Appendix D). The data were provided by Sizemore & Sizemore Inc., a forest appraisal

**TABLE 4-12. Average bare forestland market value per acre, Alabama.**

<i>Cover-type Site Class</i>	<i>Bare Land Market Value (\$/acre)</i>
Pine	\$ 308
Pine/Hardwood	\$ 292
Hardwood	\$ 160
Bottomland Hardwood	\$ 146

and management firm in Tallassee, Alabama.

The bare forestland values in Table 4-12 reflect statewide averages, yet the assessed market value will vary from county to county. If forest property were locally assessed at a value higher than the current use value, then the landowner would have the option of enrolling in the current use assessment program and receive a lower assessed land value, or shifting the property out of forest production. Essentially, current use in Alabama provides a ceiling level of forest land value for assessment purposes.

#### **Adequacy of a Site Value Tax in Alabama**

For the purpose of determining the adequacy of a forest site value tax in Alabama, a determination of total bare forestland value must be made. By using the average after-tax bare land values reported in Table 4-12 and Forest Inventory Analysis survey results estimating the acreage in each cover-type site class (USDA 1990), we can calculate the total bare forestland value for the state of Alabama. Table 4-13 shows a total bare after-tax forestland value of 4.8 billion dollars for the 20.8 million acres of privately owned forestland in Alabama.

**TABLE 4-13. Calculation of total after-tax bare forestland market value, Alabama.**

<i>Cover-type Site Class</i>	<i>After-tax Bare Forestland Market Value (\$/acre)</i>	<i>Acreage</i>	<i>After-tax Bare Forestland Market Value (\$/class)</i>
Pine	\$ 308	7,062,757	\$2,175,329,153
Pine/Hardwood	\$ 292	4,288,336	\$1,252,194,161
Bottomland Hardwood	\$ 160	2,194,196	\$ 351,071,307
Hardwood	\$ 146	7,254,711	\$1,059,187,831
<b>TOTALS</b>	<b>\$ 233</b>	<b>20,800,000</b>	<b>\$4,837,782,452</b>

**TABLE 4-14. Calculation of total before-property-tax bare forestland value, Alabama.**

<i>Cover-type Site Class</i>	<i>After-tax Bare Forestland Market Value (\$/acre)</i>	<i>Before-property-tax Bare Land Value (\$/acre)</i>	<i>Acreage</i>	<i>Before-tax Bare Forestland Market Value (\$/class)</i>
Pine	\$ 308	\$ 318.53	7,062,757	\$2,249,725,410
Pine/Hardwood	\$ 292	\$ 301.99	4,288,336	\$1,295,019,201
Bottomland	\$ 160	\$ 165.47	2,194,196	\$ 363,077,946
Hardwood	\$ 146	\$ 150.99	7,254,711	\$1,095,412,055
<b>TOTALS</b>	<b>\$ 233</b>	<b>\$ 240.54</b>	<b>20,800,000</b>	<b>\$5,003,234,612</b>

At the average state property tax rate of 3% of 10% of fair bare land market value (equivalent to a 0.3% site value tax<sup>8</sup>), total annual state property tax revenue would be 14.5 million dollars per year. Assuming this average tax rate, before-property-tax bare forestland market values for the four cover-type site classes can be calculated by adding the present value of future property taxes to the after-tax bare land market values. Column 3 of Table 4-14 shows the estimated total before-property-tax bare forestland values, calculated from the after-tax values shown in column 4 of Table 4-13. For determining this value we assumed a 6% real rate of interest and that property taxes would be deductible against an average federal income tax rate of 28% and state income tax rate of 5%. We assumed these rates because the majority of forestland in Alabama is owned by the non-industrial private sector and is generally treated as capital gains, while only 34% of forestland in Alabama is held by corporate industry.

Based on these estimates of the before-property-tax bare land values in Alabama, forest property in Alabama has an average site burden of 3.3% for all site classes. Because the property tax rates are relatively low in Alabama, and the current tax system already somewhat resembles a site value tax, there would be little impact on bare forestland market values if a site value tax were implemented at current property tax rates. However, if the property tax revenue goal were to increase, the impact of a site value tax on bare forestland market values could become significant. This is important to consider because, despite an overall average property tax rate of 0.3%, locally the rate may be up to three times higher.

Table 4-15 shows estimated long-run equilibrium bare forestland market values under various increased revenue goals in Alabama, given the assumption that the non-deductible portion of the property taxes would be fully capitalized into lower bare land market values. Table 4-15 uses a 6% real market rate of interest. The sixth row of Table 4-15 shows the site value tax rate that would be necessary to satisfy each revenue goal, and row seven shows the resulting site burden. Even if the revenue goal were to more than triple, from the current estimated \$14.5 million to \$50 million, the overall tax burden on forestland in Alabama would be lower relative to the current situation in Western Oregon.

<sup>8</sup> Property tax and site value tax rates pertaining to Alabama will be expressed as a percent of full market value in this report, hence a 3% rate at 10% of market value will be expressed as a 0.3% tax rate.

**TABLE 4-15. Effect on bare land market value per acre under a site value tax for various revenue goals, Alabama, given full tax capitalization.**

<b>Cover-type site class</b>	<b>\$ 0</b>	<b>\$20 million</b>	<b>\$30 million</b>	<b>\$40 million</b>	<b>\$50 million</b>
Pine	\$ 319	\$ 304	\$ 297	\$ 290	\$ 282
Pine/Hardwood	\$ 302	\$ 288	\$ 281	\$ 274	\$ 268
Bottomland Hardwood	\$ 165	\$ 158	\$ 154	\$ 150	\$ 147
Hardwood	\$ 151	\$ 144	\$ 141	\$ 137	\$ 134
<b>Site Value Tax Rate:</b>	<b>0.00%</b>	<b>0.42%</b>	<b>0.64%</b>	<b>0.88%</b>	<b>1.13%</b>
<b>Site Burden<sup>9</sup> :</b>	<b>0.00%</b>	<b>0.46%</b>	<b>0.68%</b>	<b>0.91%</b>	<b>1.14%</b>

### ***Comparing Site Value Tax Adequacy in W. Oregon to Alabama***

It appears conclusive that the taxing of bare forestland market value alone can raise sufficient revenue for local governments in each region. This suggests that the potential does exist for each region to implement a forest site value tax. This does not, however, suggest that implementing a site value tax in either region would be necessarily politically feasible or preferred. W. Oregon and Alabama represent two very different situations with regard to the current systems in place for taxing forestland, and each region represents different advantages and disadvantages considering the institution of a forest site value tax. Highlighting the differences between these two regions may give some indication of the suitability factors necessary for any region to successfully shift to a forest site value tax.

One apparent difference between the two regions exists within the forests themselves. Forestland in Western Oregon, unlike Alabama, is dominated by a single species, Douglas-fir. Although loblolly pine is the major commercial species in Alabama it does not dominate forest production to the same degree that Douglas-fir does in Western Oregon. In fact, hardwood or mixed hardwood/pine stands comprise nearly two-thirds of the land area in Alabama. As a result, forestland in Western Oregon has been classified on its ability to grow Douglas-fir and can be related to a distinct site-index. Eight separate site classes exist and have been surveyed extensively. In contrast, Alabama would find it impractical to classify all of its forestland by site index for loblolly pine because of the degree of variation in stand species suitability. It is may also be difficult to determine the site index for a particular species when it doesn't grow certain sites. Soil classification can be used to estimate site index, but soil classification maps are often outdated and unreliable. Consequently, Alabama has a relatively vague system of site classification and simply recognizes four different species cover-types for comparable sales analysis, and four different classes based on mean annual increment of pulpwood production for the purpose of current use assessment. Because Western Oregon has a more detailed system of site classification than Alabama, one could assume that less variability exists within each site class in Western Oregon than in Alabama.

<sup>9</sup> Note that due to the interaction of state and federal income taxes outlined previously, that the site burden calculated in this example is lower than would be calculated using equation (3).

Land ownership patterns also differ between the two regions. In Alabama, 95% of all forestland is privately owned. The majority of this land is held in small non-industrial private ownerships. There are over 440,000 forestland owners in Alabama, 89% of which own less than 50 acres. Only 34% of the forestland in Alabama is owned by industry or corporations. The large number of small tracts presents a problem for the value assessment and classification of forestland. However, in Western Oregon less of the total forestland is held privately, and of the private holdings, 60% belong to the forest industry. Consequently, forestland tends to be more consolidated with fewer ownerships to deal with administratively.

The ownership characteristics of each region affect the capitalization of property taxes as well. When ownerships are larger and held by corporations or wealthy individuals, the average income tax rate tends to be higher. Since property taxes are generally deductible against income as annual management costs, large landholders may be impacted less by annual property taxes than small landholders. In Oregon, the state income tax rate is higher than Alabama and may have some effect on the deductibility of property taxes as well.

The markets in each region vary sharply as well. In Western Oregon the majority of forestland is dedicated to growing Douglas-fir sawtimber, while in Alabama a higher percentage of the land is managed for short-rotation pulpwood with rotations as short as 15 years. Thus, under a site value tax, the inventory value of timber that would be exempted from taxation in Western Oregon would represent a greater percentage of the taxable base than in Alabama.

The current forest tax structures contrast as well. In Western Oregon the majority of forest tax revenue comes from the taxation of timber rather than land, while Alabama exempts timber from property taxation. A site value tax may be more suited to Alabama for this reason, because Oregon would have to exempt a very large timber value from taxation. The overall property tax burden in Alabama is much lower than that in Western Oregon as well. If Western Oregon were to exempt timber from taxation, a substantially higher tax would have to be levied on bare land. One advantage that Oregon does have, however, is that the region has a greater degree of administrative uniformity.

Western Oregon already has some revenue sharing in place and only a small portion of the revenue is actually collected by county assessors. In Alabama, all property taxes on forests are administered solely at the county level with little statewide uniformity.

## **Chapter 5: Equity of a Forest Site Value Tax**

An important component to consider when evaluating any proposed change in property taxation is the equity of the tax. There are many theories related to tax equity, and a summary of these equity guidelines was discussed in the literature review. This study will focus on several different measures of tax equity. The first equity measure suggests that a redesigned property tax system should leave the burden on each landowner unchanged. Thus, there should be no shifting of the tax burden between each forestland class, nor any shifting of the tax burden to other land uses. Under this equity guideline, tax collection can change, but the burden for individual property owners should not. However, this guideline does not address the issue of equity with regard to the prior system of taxation. If the prior system was inequitable, so will be the new one. For this reason we will also examine the equity of the prior system compared to the proposed system by examining both the site burden of a tax on a single acre of bare land, as well as the average annual tax per acre on a fully regulated multi-acre forest. Timing of the tax is also an important consideration. Because forestry involves long rotations with variable timber inventories, we must compare tax impacts at rotation-start with burdens just before harvest. Finally, we will briefly look at the equity of imposing two different forms of an adjusted forest site value tax. We will look at a tax levied on the bare land value plus establishment cost, and also a tax exemption where the value of the lowest “non-productive” class is subtracted from the taxable value of all forest site classes.

### ***Site Value Tax Equity: Western Oregon***

#### **Comparing Equity by Site Burden**

After determining the site value tax rate that would be necessary to raise a given revenue goal approximately equal to that of the current tax system in Chapter 4, we can now examine the equity involved in shifting from a current tax on mostly timber, to a site value tax on bare land market value alone. Let’s first re-examine the estimated site burden imposed by the 1992 tax system in Western Oregon. Table 5-1 shows the estimated site burden, or percent reduction in the bid price for bare land, imposed by the 1992 Western Oregon yield and land tax (for derivation of Table 5-1 see Table 4-5). Based on these estimates, site burden increases as site quality decreases from class FA to FG. The site burden for the poorest site value class, FX, is the lowest because it represents non-productive forestland that is not subject to yield taxation.

**TABLE 5-1. Estimated 1992 impacts of Western Oregon yield and land taxes.**

<i>DOR Site Class</i>	<i>Current After-tax Bare Land Market Value (\$/acre)</i>	<i>Estimated Before-Property-Tax Bare Land Market Value (\$/acre)</i>	<i>Site Burden (percent)</i>
FA	\$ 350.00	\$ 400.35	12.58%
FB	\$ 300.00	\$ 344.18	12.84%
FC	\$ 250.00	\$ 288.14	13.24%
FD	\$ 200.00	\$ 232.32	13.91%
FE	\$ 150.00	\$ 175.80	14.68%
FF	\$ 125.00	\$ 146.44	14.64%
FG	\$ 75.00	\$ 90.89	17.49%
FX	\$ 50.00	\$ 51.50	2.92%

Table 4-6 showed that under a 5.48% site value tax that all site classes would receive an equal site burden of 35%. Recall from Chapter 4 that a 5.48% site value tax would raise roughly the same annual revenue as the tax outlined in Table 5-1. Table 5-2 shows the estimated percent reduction in the 1991 after-tax bare land market value for each site class that would occur when shifting to a 5.48% site value tax. This suggests that owners of bare forestland would experience a substantial increase in property taxes if Western Oregon were to shift from the current tax system to a site value tax. Also the timing of the tax would be shifted more toward rotation-start, creating additional hardship for small landowners who can't offset annual property taxes with timber income. The timing of the tax could become even more burdensome for small landowners who would be forced to borrow to pay property taxes, especially when borrowing rates exceed lending rates, sometimes forcing the landowner to face a higher discount rate.

**TABLE 5-2. Long-run percent reduction in 1991 after-tax bare land value due to a 5.48% site value tax.**

<i>DOR Site Class</i>	<i>1992 After-tax Bare Land Market Value (\$/acre)</i>	<i>After-tax Bare Land Market Value Under a Site Value Tax (\$/acre)</i>	<i>Reduction in After-tax Bare Land Value Due To Site Value Tax (percent)</i>
FA	\$ 350	\$258	26.15%
FB	\$ 300	\$222	25.93%
FC	\$ 250	\$186	25.59%
FD	\$ 200	\$150	25.01%
FE	\$ 150	\$113	24.34%
FF	\$ 125	\$95	24.37%
FG	\$ 75	\$59	21.76%
FX	\$ 50	\$33	33.50%

### **Tax Impacts in Fully Regulated Forest Models**

Not all landowners are faced with the situation of owning only bare land. A cross-section of land ownership would include a variable mix of stands at different stages of maturity. For this reason we need to also look at the average per acre tax burden

generated on a fully regulated forest. We can determine this by utilizing the harvest values solved for in equation (4) (Chapter 4) for the optimal rotation age for each site class. Harvest per acre per year in a fully regulated forest is equal to the total harvest value divided by the rotation age. In this study, in order to simulate annual yield taxes, we make the assumption that each of the 7 “productive” DOR site classes are fully regulated. Given full regulation, the number of acres annually harvested in each site value class equals the total acreage divided by the rotation age. This assumption is necessary because of a lack of data pertaining to the actual age-class distribution within each site class. Table 5-3 shows the estimated average tax burden per acre per year for each DOR site class under the 1991-92 Western Oregon yield and land taxes. Yield taxes are calculated as 6.5% of harvest value, and land taxes are equal to 1.5% of 20% of the assessed bare land market value. The lowest site class, FX, is not subject to a yield tax because it represents non-productive forestland.

**TABLE 5-3. Calculation of average annual tax per acre from a 6.5% yield tax and a 1.5% land tax at 20% of assessed bare land market value for a fully regulated forest in Western Oregon.**

<i>DOR Site Class</i>	<i>Rotation Age (years)</i>	<i>Solved Harvest Value (\$/acre)</i>	<i>Assessed Bare Land Market Value (\$/acre)</i>	<i>Land Tax (\$/acre/year)</i>	<i>Yield Tax (\$/acre/year)</i>	<i>Total Tax (\$/acre/year)</i>
FA	35	\$6,823	\$ 350	\$ 1.05	\$ 12.67	\$ 13.72
FB	40	\$8,367	\$ 300	\$ 0.90	\$ 13.60	\$ 14.50
FC	40	\$7,286	\$ 250	\$ 0.75	\$ 11.84	\$ 12.59
FD	40	\$6,258	\$ 200	\$ 0.60	\$ 10.17	\$ 10.77
FE	45	\$6,963	\$ 150	\$ 0.45	\$ 10.06	\$ 10.51
FF	45	\$5,783	\$ 125	\$ 0.38	\$ 8.35	\$ 8.73
FG	50	\$6,087	\$ 75	\$ 0.23	\$ 7.91	\$ 8.14
FX	0	0	\$ 50	\$ 0.15	\$ -	\$ 0.15

It is important to account for the fact that yield taxes will fluctuate depending upon the value of each year’s harvest. In order to better compare the two tax systems, one system needs to be adjusted to raise the same total amount of revenue as the other. Recall (from Chapter 4) that the \$50 million revenue goal is simply a rough figure based on revenue receipts from 1991 to 1995. Considering this point, we will compare a 5.48% site value tax to a yield tax that has been adjusted to raise the same amount of annual revenue given the assumption of a fully regulated model.

Table 5-4 compares the average tax burden per acre per year in a fully regulated forest between a 5.48% site value tax and a yield tax rate that has been adjusted to raise the same total annual revenue. A yield tax rate of 4.88%, combined with a constant land tax, would raise \$50 million in annual revenue.<sup>10</sup> By shifting from a land and yield tax to an equal annual revenue raising site value tax, the average annual tax burden per acre on a fully regulated forest would increase for the three highest site value classes, FA through

<sup>10</sup> This yield tax rate is lower than the 6.5% rate which raised roughly \$50 million in 1991. This results from our fully regulated model estimating a higher total harvest value than actually occurred in 1991.

FC, as well as for the lowest site value class, FX. The burden would decrease for site classes FD through FG. Thus it appears that by shifting from a yield tax to a site value tax will generally shift the tax burden from the lower value to the higher value classes.

**TABLE 5-4. Average tax per acre per year under a site value tax and a yield and land tax each generating \$50 million per year, Western Oregon (each site class is a fully regulated forest).**

<b>DOR Site Class</b>	<b>Site Value Tax (\$/acre/year)</b>	<b>Yield+Land Tax (\$/acre/year)</b>	<b>Acreage</b>	<b>Revenue: Site Value Tax</b>	<b>Revenue: 4.88% Yield+Land Tax</b>
FA	\$ 14.17	\$ 10.57	184291	\$ 2,612,304	\$ 1,947,691
FB	\$ 12.19	\$ 11.11	1139392	\$ 13,885,035	\$ 12,662,615
FC	\$ 10.20	\$ 9.64	1677460	\$ 17,113,498	\$ 16,177,294
FD	\$ 8.23	\$ 8.24	936543	\$ 7,703,598	\$ 7,716,231
FE	\$ 6.22	\$ 8.01	813651	\$ 5,064,545	\$ 6,513,468
FF	\$ 5.18	\$ 6.65	564445	\$ 2,926,596	\$ 3,753,487
FG	\$ 3.22	\$ 6.17	198507	\$ 638,837	\$ 1,224,640
FX	\$ 1.82	\$ 0.15	30484	\$ 55,587	\$ 4,573
			<b>TOTAL:</b>	<b>\$ 50,000,000</b>	<b>\$ 50,000,000</b>

**Tax impacts using volumes predicted by a growth and yield model.** The shift of the tax burden from lower to higher classes shown in Table 5-4 may be exaggerated, because the forest land market tends to under-estimate the value of the highest site quality land and over-estimate the value of the lowest site quality land. Newport suggested this might be the case when comparing estimated bare land market values to productivity values calculated for each DOR site class in Western Oregon. Newport suggests that, “the market for forestland does not seem to make clear distinctions as to the site quality of the land” (Newport, 1993).

Attempting to explain market value by examining timber production alone ignores the portion of market value that may be attributable to non-timber benefits. This may explain some of the shifting in tax burden shown in Table 5-4. In order to estimate yield taxes for this study, harvest values were solved for to generate the after-tax bare land market value using equation (4), given assumptions about taxes, rotation length, interest rate, and establishment costs (see Appendix C). These solved harvest values may not be the same as those that would be predicted using growth and yield model projections.

Table 5-5 illustrates this problem by comparing the market-estimated harvest values determined using equation (4) with yields estimated by using a growth and yield simulator. Column 3 shows the harvest value solved for in equation (4) that generates the market value of bare land for each site class, and column 5 gives the predicted yield determined by *Stand Projection System 2.3 (SPS)*, a Douglas-fir growth and yield model (Arney, 1989). Assuming a stumpage price of \$300 per thousand boardfeet (MBF), the SPS-predicted yield and the market-implied harvest volume can be compared. Column 4 of Table 5-5 displays the market-implied yield per acre at rotation age and is equal to the solved harvest value (column 3) divided by the assumed stumpage price of \$300 per MBF. Table 5-5 shows that the market-implied yields and harvest values for site classes FA and FB are lower than those predicted by the SPS growth and yield model. The converse is true for site classes FC through FG. One reason for this could be that a higher percentage

of the market value for the lowest site value classes could potentially be attributed to non-market values such as recreation potential.

**TABLE 5-5. Market-implied harvest value and harvest value predicted by the growth and yield model SPS for each DOR site class in Western Oregon.**

<i>DOR Site Class</i>	<i>Optimal Rotation Age (years)*</i>	<i>Solved Harvest Value (\$/acre)</i>	<i>Market-implied Yield (MBF/acre)</i>	<i>SPS Predicted Yield (MBF/acre)</i>	<i>SPS-predicted Harvest Value (\$/acre)</i>
FA	35	\$6,823	22.7	24.9	\$ 7,470
FB	40	\$8,367	27.9	29.4	\$ 8,820
FC	40	\$7,286	24.3	21.4	\$ 6,420
FD	40	\$6,258	20.9	18.3	\$ 5,490
FE	45	\$6,963	23.2	17.9	\$ 5,370
FF	45	\$5,783	19.3	10.2	\$ 3,060
FG	50	\$6,087	20.3	10.5	\$ 3,150
FX	0	0	0	0	\$ -

\*See Table 4-4 and Appendix B.

By substituting the SPS-predicted harvest values for the harvest values used in Table 5-4 and solving for a yield tax rate that equalizes the total annual revenue, we can re-examine the shifting of tax burden between the site classes. Table 5-6 compares the average tax burden per acre per year based on an equal-revenue-raising 5.48% site value tax to the burden imposed by the yield and land tax. Using SPS-predicted harvest values, a 5.54% yield tax, holding the 1991 land tax portion constant, would generate the same amount of revenue as a 5.48% site value tax, assuming that each site class is fully regulated. Contrary to Table 5-4, there would be no pattern to the shifting of the average tax burden per acre per year. Under this scenario site classes FA, FC, FD, FF, and FX would see an increase in average tax per acre per year while taxes for classes FB, FE, and FG would decrease. It should be noted that in Table 5-6 that the yield tax revenues are based on predicted optimal yields and the assumption that all land is dedicated to timber production.

**TABLE 5-6. Average tax per acre per year under site value tax and a yield and land tax each raising \$50 million per year in Western Oregon, using SPS-predicted harvest values (given that each site class is a fully regulated forest).**

<i>DOR Site Class</i>	<i>Site Value Tax (\$/acre/year)</i>	<i>Yield &amp; Land Tax (\$/acre/year)</i>	<i>Acreage</i>	<i>Revenue: 5.48% Site Value Tax</i>	<i>Revenue: Yield &amp; Land Tax</i>
FA	\$ 14.17	\$ 12.87	184291	\$ 2,612,304	\$ 2,372,624
FB	\$ 12.19	\$ 13.12	1139392	\$ 13,885,035	\$ 14,944,384
FC	\$ 10.20	\$ 9.64	1677460	\$ 17,113,498	\$ 16,174,060
FD	\$ 8.23	\$ 8.20	936543	\$ 7,703,598	\$ 7,683,307
FE	\$ 6.22	\$ 7.06	813651	\$ 5,064,545	\$ 5,745,422
FF	\$ 5.18	\$ 4.14	564445	\$ 2,926,596	\$ 2,338,114
FG	\$ 3.22	\$ 3.72	198507	\$ 638,837	\$ 737,516
FX	\$ 1.82	\$ 0.15	30484	\$ 55,587	\$ 4,573
			<b>TOTAL:</b>	<b>\$ 50,000,000</b>	<b>\$ 50,000,000</b>

## Implications of Reduced Yield Tax Rates

Because Oregon is currently reducing yield tax rates in order to provide property tax relief for forest landowners, we may also want to consider the equity of a forest site value tax that would raise annual revenue equivalent to a reduced yield tax rate of 3.2%. Table 5-7 compares the average property tax per acre for a reduced revenue goal on fully regulated forests for a 3.18% site value tax and a 3.2% yield and land tax. Both taxes are substantially lower and would raise an annual revenue of approximately \$34 million in Western Oregon. Similar to Table 5-4, compared to the yield tax, the average annual site value tax per acre would be higher in site classes, FA through FC, and lower in the lowest site classes.

**TABLE 5-7. Average tax per acre per year in Western Oregon with a 3.18% site value tax and an equal annual revenue raising 3.2% yield plus land tax (given each site class is a fully regulated forest).**

<i>DOR Site Class</i>	<i>Site Value Tax (\$/acre/year)</i>	<i>Yield &amp; Land Tax (\$/acre/year)</i>	<i>Acreage</i>	<i>Revenue: 3.18% Site Value Tax</i>	<i>Revenue: Yield &amp; Land Tax</i>
FA	\$ 9.65	\$ 7.29	184291	\$ 1,778,032	\$ 1,343,144
FB	\$ 8.29	\$ 7.59	1139392	\$ 9,450,675	\$ 8,652,087
FC	\$ 6.94	\$ 6.58	1677460	\$ 11,648,087	\$ 11,035,674
FD	\$ 5.60	\$ 5.61	936543	\$ 5,243,357	\$ 5,250,635
FE	\$ 4.24	\$ 5.40	813651	\$ 3,447,119	\$ 4,394,909
FF	\$ 3.53	\$ 4.49	564445	\$ 1,991,951	\$ 2,532,865
FG	\$ 2.19	\$ 4.12	198507	\$ 434,816	\$ 817,984
FX	\$ 1.24	\$ 0.15	30484	\$ 37,835	\$ 4,573
			<b>TOTAL:</b>	<b>\$ 34,031,871</b>	<b>\$ 34,031,871</b>

## Timing of the Tax Incidence

The previous two sections examined the equity of a proposed shift from a yield/land tax to a forest site value tax in Western Oregon for landowners of both bare land and fully regulated forests. When shifting to a site value tax, forest property owners with bare forestland will be worse off. Owners of regulated forests or multi age-classes will experience shifting of tax burden that depends on the characteristics of their property. Those who become best off with a switch to a forest site value tax from a yield tax would be the owners of timber ready for harvest.<sup>11</sup> Logically one could assume that owners of bare land would oppose shifting forest property taxes to the land, while owners of mature timber would welcome it. Thus, the simplest way to evaluate the timing of the tax incidence is to determine the present value of all expected future taxes under both systems for three hypothetical landowners: the owner of bare land, the owner of a regulated forest, and the owner of mature timber just before harvest.

<sup>11</sup> This applies in the case where the owner of mature timber intends to harvest it. Owners that do not intend to harvest timber may be better off under a yield tax.

**TABLE 5-8. Present value of future site value tax and yield plus land tax for owners of bare, regulated, and mature forestland, Western Oregon\*.**

<i>DOR Site Class</i>	<i>PV of Future Taxes Under a Site Value Tax: ALL OWNERS (\$/acre)</i>	<i>PV of Future Taxes Under a Yield &amp; Land Tax: BARE LAND (\$/acre)</i>	<i>PV of Future Taxes Under a Yield &amp; Land Tax: REGULATED (average \$/acre)</i>	<i>PV of Future Taxes Under a Yield &amp; Land Tax: MATURE (\$/acre)</i>
FA	\$ 236	\$ 67	\$ 176	\$ 400
FB	\$ 203	\$ 59	\$ 185	\$ 468
FC	\$ 170	\$ 51	\$ 161	\$ 407
FD	\$ 137	\$ 43	\$ 137	\$ 348
FE	\$ 104	\$ 34	\$ 133	\$ 374
FF	\$ 86	\$ 28	\$ 111	\$ 311
FG	\$ 54	\$ 21	\$ 103	\$ 318
FX	\$ 30	\$ 3	\$ 3	\$ 3

\*6% real interest rate; based on solved harvest values from Table 5-5.

Table 5-8 displays the calculations of present value per acre for both a forest site value tax and a yield plus land tax each raising \$50 million per year in Western Oregon. Under a site value tax, all owners would face the same present value of future property taxes without regard to the stocking level of their forestland. After switching from the Western Oregon yield/land tax to an equivalent-revenue-raising site value tax, owners of bare land would see the present value of future property taxes increase, while owners of mature forests would see the present value of future property taxes decrease. Owners of lower site class regulated forests, FE through FG, would prefer the site value tax, while owners of higher site class regulated forests, FA through FC, would prefer remaining under the yield tax. Owners of non-productive forestland, FX, would prefer the yield based tax regardless of stocking.

### ***Equity of “Adjusted” Site Value Taxes***

#### **Taxing Bare Land Value Plus Establishment Cost**

One alternative to a pure site value tax would be a tax on the bare land value plus establishment costs. Table 5-9 compares the 5.48% site value tax raising \$50 million per year with an equivalent-revenue-raising 2.77% tax on bare land value plus establishment costs from Table 4-4.<sup>12</sup> Using this approach to tax the land would result in unequal site burdens among the 8 DOR site classes in Western Oregon. A higher portion of the tax would be shifted to the lower site classes due to a higher cost to land value ratio. Such a tax could discourage reforestation and foster inefficiency with regard to managing land for its highest and best use.

<sup>12</sup> The tax rate was calculated in a spreadsheet model to generate the same annual revenue as a 5.48% pure site value tax using establishment costs outlined in Table 4-4 (See equation (8) in Chapter 6 for example of a tax on bare land value plus establishment cost).

**TABLE 5-9. Long-run effect on bare forestland market value and site burden under a 5.48% site value tax and an equivalent-revenue-raising 2.77% tax on bare land market value plus establishment cost in Western Oregon.**

<i>DOR Site Class</i>	<i>Establishment Cost (\$/acre)</i>	<i>After-tax Bare Land Market Value: 5.48% Site Value Tax (\$/acre)</i>	<i>Site Burden of col. 3 Tax<sup>#</sup> (percent)</i>	<i>After-tax Bare Land Market Value: 2.77% Tax on Land + Est. Cost (\$/acre)</i>	<i>Site Burden of col. 5 Tax (percent)</i>
FA	\$ 195.00	\$ 258	35.4%	\$ 271	32.3%
FB	\$ 185.00	\$ 222	35.4%	\$ 229	33.3%
FC	\$ 172.00	\$ 186	35.4%	\$ 188	34.6%
FD	\$ 162.00	\$ 150	35.4%	\$ 147	36.8%
FE	\$ 145.00	\$ 113	35.4%	\$ 106	39.6%
FF	\$ 120.00	\$ 95	35.4%	\$ 89	39.5%
FG	\$ 115.00	\$ 59	35.4%	\$ 46	49.1%
FX	\$ -	\$ 33	35.4%	\$ 40	21.7%

\* from Table 4-4; # from Table 4-6.

### **Exempting the Value of the Lowest Site Class**

Another adjustment to the site value tax that may be suggested would be to subtract the value of the lowest, “non-productive” site class from the taxable bare land market value of all the site classes. Such an adjustment could be justified based on a concern that some marginal property in the lowest site class may be driven out of forestland use or abandoned if the present value of the tax were to exceed its land value.<sup>13</sup> Some argument could be made that because the lowest site class is “non-productive”, it represents a base-level value of forestland for its non-timber benefits. Local governments may choose to make this exemption when concerned about the loss of forestland.

In Western Oregon this would mean subtracting the value of the FX site class from the values of all forest site classes when assessing bare forestland market values. Consequently, the FX site class would have an assessed value of zero and thus pay no property tax. The total assessed bare land value for the region would decrease and the site value tax rate would have to be increased in order maintain the prior level of revenue. Theoretically, such an exemption would render the site value tax non-neutral because it would distort the market allocation of land. However, the argument could be made that such an exemption would be necessary to correct possible non-neutralities associated with the administration of an applied forest site value tax. This argument is discussed in more detail in the following section.

Table 5-10 shows the effect on bare forestland market values when exempting the value of the lowest site value class in Western Oregon. In order to raise the same amount of annual revenue, the site value tax rate would have to be increased from 5.48% to 7.99%. Compared to the 35.4% site burden of a 5.48% site value tax, site burden would increase on the higher valued site classes and decrease on the lower valued site classes.

<sup>13</sup> For an example of how this can occur under an applied site value tax see “Administration” in Chapter 6.

This occurs because the fixed value exemption becomes a higher percent of land value as land value declines. Consequently, the FX site class would have a site burden of zero and pay no tax.

**TABLE 5-10. Effect on land value and site burden when exempting the value of the lowest site value class from the taxable value of all site classes, Western Oregon.**

<i>DOR Site Class</i>	<i>Bare Land Market Value Under a 5.48% Site Value Tax and No Exemption (\$/acre)</i>	<i>Bare Land Market Value Under a 7.99% Site Value Tax With Exemption (\$/acre)</i>	<i>Site Burden With Exemption (percent)</i>
FA	\$ 258.46	\$ 245.37	38.7%
FB	\$ 222.20	\$ 214.16	37.8%
FC	\$ 186.02	\$ 183.01	36.5%
FD	\$ 149.98	\$ 151.99	34.6%
FE	\$ 113.49	\$ 120.58	31.4%
FF	\$ 94.54	\$ 104.26	28.8%
FG	\$ 58.68	\$ 73.39	19.3%
FX	\$ 33.25	\$ 51.50	0.0%

## Chapter 6: Efficiency of a Forest Site Value Tax

Theoretically, the site value tax is neutral both with respect to land use and management decisions. However, in its actual application, a site value tax may not necessarily be neutral with respect to either decision. The question then becomes whether or not the site value tax is efficient relative to the status quo or other possible tax alternatives. The following sections will examine inefficiencies that may result from the actual application of a site value tax.

### *Improvements and Non-neutrality*

Theoretically a site value tax is applied only to the value of bare land, thus exempting all improvements. However, in reality, an applied site value tax would not always necessarily make a clear distinction between the value of land and the value of improvements. Sales of bare land free of any improvements are rare. Market data used to estimate the value of bare land will often include the value of some improvements.

Theoretically, a site value tax will reduce land value according to equation (7), assuming full capitalization of the tax applied annually as  $tL_a$ :

$$L_a = \left[ \frac{N}{(1+i)^R - 1} - C \right] \left[ \frac{i}{i+t} \right] \quad (7)$$

Where,

$L_a$  = After-tax land value (\$/acre)

$N$  = Net income every  $R$  years (\$/acre)

$C$  = Initial establishment/improvement cost (\$/acre)

$R$  = rotation length (years)

$i$  = real market rate of interest (percent/100)

$t$  = the annual tax rate applied to assessed value (percent/100)

The first term of equation (7) represents the before-tax bare land value, and the second term is equal to 1 minus the site burden (for derivation see equation 2). However, in its actual application, a site value tax may end up taxing the value of some improvements. Equation (8) shows the after-tax land value for a tax on the bare land value plus establishment/improvement costs, such that the tax equals  $t(L_a + C)$ :

$$L_a = \left[ \frac{N}{(1+i)^R - 1} \right] \left[ \frac{i}{i+t} \right] - C \quad (8)$$

For annual yield enterprises, where the rotation,  $R$ , equals one, the equation reduces to the after-tax land value under an unmodified ad valorem property tax:

$$L_a = \left[ \frac{N}{i+t} \right] - C \quad (9)$$

One problem in the actual application of a site value tax is that the full value of establishment,  $C$ , will not necessarily be deducted from the assessed property value before calculation of the tax. Using market data to accurately determine the value of the bare land is often impossible because sales of undisturbed bare land rarely occur.

When an establishment cost changes the bare land value, some or all of the improvement will be taxed. Thus, similar in effect to an income tax, a site value tax can discourage certain improvements. This inefficiency occurs when an improvement increases before-tax bare land value such that the increase in value is exceeded by the present value of increased site value taxes. The problem may occur when an improvement moves the bare land assessment to a higher site value class.

As an example of the foregoing inefficiency, consider the reclamation of an abandoned strip mine. Assume after the minimal reclamation required by law, that if left to natural regeneration, the strip mine could produce a revenue of \$250 every 75 years. Using a 6% real market interest rate, the before-tax net present value of this abandoned strip mine would be \$3.20 per acre:

$$L_b = \frac{\$250}{(1.06)^{75} - 1} = \$3.20 / \text{acre}$$

However, at a cost of \$200 per acre the land could be reclaimed, site prepared, and reforested to essentially convert the land into medium site quality forest now yielding \$1500 every 35 years. The before-tax net present value resulting from the reclamation would be:

$$L_b = \frac{\$1500}{(1.06)^{35} - 1} - \$200 = \$24.35$$

Thus, by converting the land to its highest and best use the landowner could improve the pre-tax net present value of the land by \$21.15 per acre ( \$24.35 - \$3.20). However, if the before-tax land value of medium site quality forest is \$224.35 per acre, and a 2% site value tax were in place, the assessor would now classify the value of the bare land as medium site quality forestland which has a after-tax bare land market value of \$168 per acre (using equation (2)):

$$L_a = L_b \left[ \frac{i}{i+t} \right] = \$224 \left[ \frac{.06}{.08} \right] = \$168 / \text{acre}$$

Thus the present value of expected future taxes would be \$56 per acre, which would exceed the landowners pre-tax gain in net present value. In this instance the site value tax would discourage the improvement of the land.

Another similar example would be draining a wet forest site to improve the site productivity. Although the drainage would be an improvement, the assessor would likely value the land as a higher forest site class, and as a result, the improvement would be taxed and potentially discouraged. The site value tax could discourage improvements whenever the value of an improvement increases the value of the bare land. Other examples of improvements that could be discouraged by a site value tax include building roads or bridges on property, erosion control, fencing, irrigation, and even consolidation through the purchase of adjacent properties. If the assessor does not separate the value of the improvement from the value of the bare land, the improvement may potentially be discouraged.

### **Administration**

An important aspect to consider when examining the efficiency and equity of a forest site value tax is how the tax will be administered. Local governments must

determine the optimal number of site value classes to recognize, in light of increasing administrative costs. Obviously, property does not fall exactly into any number of site value classes. Theoretically, true land values in a region will generally reflect a continuum of values within a given range, potentially from zero to some higher value. By establishing a finite number of site value tax classes, each site value class will incorporate a range of land values that will be taxed at the average value for the site value class.

As the number of recognized site value classes increases, the disparity in site burden across forestland ownerships will decrease. The disparity caused by imperfect assessment may have the greatest impact at the marginal (lowest valued) site class. Thus, the potential exists for some properties in the lowest site value tax class to be shifted out of production and abandoned if the assessed value exceeds the actual land value.

**TABLE 6-1. Effects of Site Value Tax With 10 Site Classes\*.**

<i>Hypothetical Landowner</i>	<i>Theoretical Before-tax Present Value of Land (\$/acre)</i>	<i>Before-tax Assessed Value of Land (\$/acre)</i>	<i>After-tax Assessed Value (\$/acre) [eq.(2)]</i>	<i>Theoretical After-tax Present Value of Land (\$/acre)</i>	<i>Site Burden [eq.(1)]</i>
1	\$ 25	\$ 25	\$ 16.67	\$ 16.67	33%
2	\$ 50	\$ 50	\$ 33.33	\$ 33.33	33%
3	\$ 75	\$ 75	\$ 50.00	\$ 50.00	33%
4	\$ 100	\$ 100	\$ 66.67	\$ 66.67	33%
5	\$ 125	\$ 125	\$ 83.33	\$ 83.33	33%
6	\$ 150	\$ 150	\$ 100.00	\$ 100.00	33%
7	\$ 175	\$ 175	\$ 116.67	\$ 116.67	33%
8	\$ 200	\$ 200	\$ 133.33	\$ 133.33	33%
9	\$ 225	\$ 225	\$ 150.00	\$ 150.00	33%
10	\$ 250	\$ 250	\$ 166.67	\$ 166.67	33%

\* Table based on a 2.5% annual tax, and a 5% annual discount rate.

To illustrate this concept, Tables 6-1, 6-2, and 6-3 show how the method of administering a site value tax can affect its degree of neutrality for a hypothetical group of landowners. Table 6-1 depicts an example of perfect assessment, where landowners' theoretical before-tax present values of land equal the before-tax assessed value assigned to their site classes. In this example there are 10 designated site classes, and each landowner experiences a 33% reduction in the theoretical bid price for land (see equation (3)). Assuming full tax capitalization, this example is based on a 2.5% site value tax rate and a 5% real rate of interest. Table 6-2 illustrates the case where only four site value classes are utilized for the same group of 10 landowners. Note that now each landowner does not face an equal site burden depending upon the degree to which each property was over or under assessed. Table 6-3 shows the more extreme case where only two administrative site classes exist. Here, the first landowner receives a site burden of 100%, driving the value of the land to zero.

**TABLE 6-2. Effects of Site Value Tax With 4 Site Classes\*.**

<i>Hypothetical Landowner</i>	<i>Theoretical Before-tax Present Value of Land (\$/acre)</i>	<i>Before-tax Assessed Value of Land (\$/acre)</i>	<i>After-tax Assessed Value (\$/acre) [eq.(2)]</i>	<i>Theoretical After-tax Present Value of Land (\$/acre)</i>	<i>Site Burden [eq.(1)]</i>
1	\$ 25	\$ 50	\$ 33.33	\$ 8.33	67%
2	\$ 50	\$ 50	\$ 33.33	\$ 33.33	33%
3	\$ 75	\$ 50	\$ 33.33	\$ 58.33	22%
4	\$ 100	\$ 125	\$ 83.33	\$ 58.33	42%
5	\$ 125	\$ 125	\$ 83.33	\$ 83.33	33%
6	\$ 150	\$ 125	\$ 83.33	\$ 108.33	28%
7	\$ 175	\$ 200	\$ 133.33	\$ 108.33	38%
8	\$ 200	\$ 200	\$ 133.33	\$ 133.33	33%
9	\$ 225	\$ 200	\$ 133.33	\$ 158.33	30%
10	\$ 250	\$ 275	\$ 183.33	\$ 158.33	37%

\* Table based on a 2.5% annual tax, and a 5% annual discount rate.

Returning to the example of Western Oregon, we could examine what the effect would be if the Oregon Department of Revenue were to simplify their forestland site

**TABLE 6-3. Effects of Site Value Tax With 2 Site Classes\*.**

<i>Hypothetical Landowner</i>	<i>Theoretical Before-tax Present Value of Land (\$/acre)</i>	<i>Before-tax Assessed Value of Land (\$/acre)</i>	<i>After-tax Assessed Value (\$/acre) [eq.(2)]</i>	<i>Theoretical After-tax Present Value of Land (\$/acre)</i>	<i>Site Burden [eq.(1)]</i>
1	\$ 25	\$ 75	\$ 50.00	\$ -	100%
2	\$ 50	\$ 75	\$ 50.00	\$ 25.00	50%
3	\$ 75	\$ 75	\$ 50.00	\$ 50.00	33%
4	\$ 100	\$ 75	\$ 50.00	\$ 75.00	25%
5	\$ 125	\$ 75	\$ 50.00	\$ 100.00	20%
6	\$ 150	\$ 200	\$ 133.33	\$ 83.33	44%
7	\$ 175	\$ 200	\$ 133.33	\$ 108.33	38%
8	\$ 200	\$ 200	\$ 133.33	\$ 133.33	33%
9	\$ 225	\$ 200	\$ 133.33	\$ 158.33	30%
10	\$ 250	\$ 200	\$ 133.33	\$ 183.33	27%

\* Table based on a 2.5% annual tax, and a 5% annual discount rate.

classification system in order to lower the administrative cost of applying a site value tax. In Table 6-4, the 8 DOR site classes in Western Oregon are combined to form 3 site value classes, and then site burden is simulated based on the 5.48% site value tax rate solved for in Chapter 4. Site Classes FA and FB are combined into the *High* site value class, FC through FE into the *medium* site value class, and FF through FX into the *low* site value class. The before-tax bare land value assigned to each of the three site classes is the acreage-weighted average of the before-tax bare land values solved for in Chapter 4. As a result, taxing only three site value classes would raise the same amount (\$50 million) of long-run annual revenue as the 5.48% site value tax calculated in Table 4-7. When the tax was applied to 8 separate site value classes in Table 4-7, each site class had a site burden of 35%. However, in Table 6-4, site burden varies considerably, especially among the

**TABLE 6-4. Simulated site burden on the 8 DOR site classes in Western Oregon when 5.48% site value tax is applied to only 3 site value classes (6% real interest).**

<b>Original DOR Site Class</b>	<b>Before-tax Bare Land Market Value (\$/acre)</b>	<b>New Site Value Class: Weighted Average Before-tax Bare Land Market Value (\$/acre)</b>	<b>Long-run After-tax Assessed Bare Land Market Value (\$/acre)</b>	<b>Simulated Long-run After-tax Bare Land Market Value (\$/acre)</b>	<b>Actual Site Burden (percent) [eq.(1)]</b>
FA	\$ 400	High	\$ 352	\$ 276	31%
FB	\$ 344	High	\$ 352	\$ 219	36%
FC	\$ 288	Medium	\$ 246	\$ 201	30%
FD	\$ 232	Medium	\$ 246	\$ 145	38%
FE	\$ 176	Medium	\$ 246	\$ 89	50%
FF	\$ 146	Low	\$ 129	\$ 101	31%
FG	\$ 91	Low	\$ 129	\$ 45	50%
FX	\$ 52	Low	\$ 129	\$ 6	89%

lower site value classes. Table 6-4 shows that the site burden for the lowest site value class, FX, would be 89 % under this type of site value tax administration. It is also interesting to note that under this scenario, site class FF would have a higher after-tax market value than site class FE despite the fact that site class FE has a higher site productivity.

In summary, the efficiency of a forest site value tax depends on how the tax will be administered. It would be unreasonable to assume that any local government could ever achieve perfect assessment, and even if feasible, the cost of administering such a tax would likely be prohibitive. This is especially true for the forest sector where properties tend to be remote, highly variable, and often of low value relative to residential and commercial real estate. However, in areas where forestland dominates the property tax base, accuracy is essential for both local government revenue and the equity of private landowners.

The cost of administering a forest site value tax will vary from region to region. One of the largest costs is classifying forestland into site value classes, and determining highest and best use for each property. Although a forest site value tax would not require assessors to inventory growing stock, periodic reassessment of market value would still be necessary. Some regions, for example Western Oregon, already have a well established uniform system of forestland classification in place which would help to curb the initial cost of administering a forest site value tax. Other states that have recently adopted productivity taxation, for example Idaho, have reported initial cost savings by utilizing soil productivity maps for forest site classification.

### ***Encouraging Efficient Land Use***

One reason why the site value tax is argued to be efficient is that it may encourage active land use. Because the tax would be levied on bare land market value and assuming that the tax is capitalized into the bid price for the land, a site value tax may shift some land from individuals with low personal discount rates to individuals with higher discount rates (Tideman 1995). This may help to alleviate some market imperfections because some land may be shifted away from idle use. Recall that from equation (3) that the site burden of a site value tax is equal to  $t/(i + t)$ , where  $t$  equals the site value tax rate and  $i$

equals the discount rate. As a result, individuals requiring a higher discount rate may expect a lower site burden than individuals a lower discount rate. Therefore, a site value tax may help to shift forestland into more economically efficient uses. However, this interpretation economic efficiency does not account for the environmental benefits that less active management may provide.

### ***A Site Value Tax for All Lands Versus Forestland Only***

In theory, to be truly efficient a site value tax must be applied to all forms of property, and not just to forestland as considered thus far in this paper. This would entail taxing forest, agricultural, residential, and commercial property at the same rate applied to bare land value alone. Many states currently exempt improvements from taxation on forests and most agricultural land but not on residential and commercial real estate (Malme 1993). Given government budget constraints, if all property were taxed equally on bare land value alone, forestry and agriculture would lose the preferential treatment they generally receive now. Some argue that open lands do deserve preferential treatment because they generally require fewer public services and utilities than do commercial and residential properties. Also, many argue that open lands deserve preferential treatment because they provide public non-market goods such as wildlife and aesthetics. Arguments against preferential treatment claim that uniformly taxing land value alone will encourage more centralized development and help to retard urban sprawl. This is because taxing land at highest and best use encourages more intensive development on high value sites. By shifting the tax burden to the bare land value alone, development will be encouraged where it may have been previously discouraged by taxes on improvement value.

## Chapter 7: Summary and Conclusions

This study's review of forest property taxation literature reveals that many questions remain unanswered about the optimal system of forest taxation. Traditional theory suggests that the optimal forest property tax should strive to be neutral, meaning that it does not distort the market allocation of resources with respect to the pre-tax condition. This has led to a great deal of interest in the site value tax, which is levied as a percent of land value alone (exempting improvements), because of its alleged non-distortive properties. The site value tax has been partially applied in some regions in an effort to revitalize urban communities. However, little research has focused on the implications of a site value tax specifically in the forest sector. This is surprising considering the many non-market benefits that forests provide society. A large number of analysts suggest that, in the presence of externalities, the pre-tax allocation of resources is not necessarily optimal. In an attempt to address these issues, this study examines implications of applying a forest site value tax.

For the two regions examined in this paper, Western Oregon and Alabama, it is apparent that a site value tax could generate annual revenues to adequately fund local governments at current levels. Based on 1991-1995 forest tax receipts and currently legislated property-tax relief, it was estimated that a forest site value tax would need to raise an annual revenue of about \$50 million in Western Oregon. Using 1991 bare forestland market values, a simulated 4.09% site value tax would achieve the \$50 million revenue goal in the short-run. However, given the assumption that the tax would be capitalized into lower bare land market values, an estimated 5.48% site value tax rate would be necessary in order to continue raising the \$50 million annual revenue goal in the long-run. Based on selected assumptions, a 5.48% Western Oregon site value tax would reduce theoretical before-tax bare forestland values by 35%, indicating a "site burden" of 35%. Current site burdens from the yield tax in Western Oregon generally range from 12% to 17%. Thus, shifting from the current system to a forest site value tax in regions similar to Western Oregon may result in a significant reduction in bare forestland market values. If levied only on forestland, such a tax would be biased against forest land use. Despite the fiscal feasibility of a forest site value tax in Oregon and similar regions, such a significant shift in tax burden from the timber to the land is not likely to be politically acceptable.

Timber is exempt from property taxation in Alabama. Consequently, unlike Western Oregon, the forest property tax system in Alabama currently resembles a forest site value tax. The only differences between the current forest tax system in Alabama and a true forest site value tax are that land value assessment is relatively unsophisticated and landowners are allowed to enroll in a current use assessment program. However, the majority of landowners elect to be assessed at fair market value, which on average is a significantly lower than current use assessment value. Although each county in Alabama applies a different property tax rate, most forestland bears a low property tax burden relative to Western Oregon. Based on our simulation, the average site burden on forestland in Alabama is slightly over 3%.

In theory, given perfect land markets, an efficiently administered site value tax will not distort the market allocation of resources. In its actual application a forest site value tax may discourage certain improvements. This can occur whenever the value of improvements, such as drainage, roads, and other site ameliorations, increase the assessed bare land market value.

Also, a forest site value tax could potentially drive marginal land out of production or encourage sub-optimal management if too few site value classes are administratively assessed. Improving assessment accuracy would help to limit possible distortions but would have to be balanced against increased administrative cost.

If a site value tax were applied to forestland alone, and not to other lands, it would not prevent tax-induced shifting of land between forestry and other competing land uses. If a site value tax were applied to all property, forestland would likely lose the preferential property tax treatment that it already generally receives.

Although a perfectly administered site value tax may prove more neutral than other taxes by not distorting the market allocation of resources, it may not be the most efficient tax. Due to the presence of existing distortions and possible externalities in the economy, attempting to correct only one sector will merely provide a second best solution. Consequently, a site value tax will not necessarily be perceived as preferable to other forest tax alternatives.

## Literature Cited

- Amacher, G.S. 1994. Optimal provision of public and private goods: Designing forest taxes and public harvests. In: Newman, D.H. and Aronow, M.E., eds. Forest economics on the edge: Proceedings of the 24th annual Southern Forest Economics Workshop, Savannah, GA, March 27-29, 1994. University of Georgia, Daniel B. Warnell School of Forest Resources. p.88.
- Amacher, G.S., and D. Brazee. 1996. Designing forest taxes with varying government preferences and budget targets. *Journal of Environmental Economics and Management*.(In Press).
- Amacher, G., D. Brazee, and T. Thompson. 1991. The effects of forest productivity taxes in optimal rotation age and silvicultural effort. *Forest Science*. 37(4).
- Arney, J. D. 1989. *SPS Guide: Stand Projection System*. Vers. 2.3.
- Bare, B.B., 1990. An analysis of forest property tax burdens under a land and reforestation tax system: a western Washington case study. *Canadian Journal of Forest Research*. 20:554-565.
- Bare, B. B., 1978. Forest-land valuation in Washington State: controversy over methodology. *Assessors Journal*. 13(2):81-99.
- Bare, B.B. and C.W. McKetta. 1977. Forest land valuation in Washington State: Comparison of abstraction and regression. *The Real Estate Appraiser* 43(1):25-31.
- Bentick, B. L., 1980(a). Property and income taxation in rural industries with different rotation periods. *National Tax Journal*. 33(2):219-225.
- Bentick, B. L. 1980(b). Property taxation and the viability of rural enterprise subject to urban pressure. *Land Economics*. 56(4):451-456.
- Bentick, B. L., 1979. The impact of taxation and valuation practices on the timing and efficiency of land use. *The Journal of Political Economy*. 87(4):859-868.
- Borie, L. 1987. "Use value" assessment: Tax break or management incentive? *American Forests*. 93(5/6):46-49, 74-77.
- Boyd, R. 1986. Forest taxation: Current issues and future research. Research Note SE-33. Southeastern Forest Experiment Station. USDA Forest Service. Asheville, NC.
- Blackman, T. 1985. Timberland value depends on tax reform. *Forest Industries* 112(11):13.

- Bourassa, S. C. 1987. Land Value Taxation and New Housing Development in Pittsburgh. *Growth and Change* 18(4):44-56. Fall 1987.
- Cartwright, P. W. and B. Dowdle. 1979. An economics analysis of forest taxation in Washington State. College of Forest Resources. University of Washington. Seattle, WA.
- Chang, S.J. 1983. "Rotation age, management intensity, and the economic factors of timber production: Do changes in stumpage price, interest rate, regeneration cost, and forest taxation matter?". *Forest Science*. 29(2):257-277.
- Chang, S.J. 1983. Reforestation by non-industrial private landowners: Does the capital gains tax matter? In: Royer, J.P. and C.D. Risbrudt, eds. Non-industrial Private Forests. Symp. Proc. pp. 142-145.
- Chang, S. J. 1982. An economic analysis of forest taxation's impact on optimal rotation age. *Land Economics* 58:310-324.
- Clements S. E., W. D. Klemperer, H. L. Haney, Jr. and W. C. Siegel. 1986. Current status of timber yield and severance taxes in the United States. *Forest Products Journal*. 36(6):31-35.
- Condrell, W.K. 1983. Constraints and risks: Timber tax policies. In: McCarthy, J.A., editor. Forest land Investment. pp. 95-97.
- Conklin, J. B. 1988. Washington's experience with the yield tax. In: Hamel, M.P., ed. Forest taxation: Adapting in an era of change. Madison, WI, Forest Products Research Society. pp.32-34.
- Conklin, J. B. 1980. Equity and efficiency in forest tax administration. *In: State Taxation of Forest and Land Resources: a symposium, Dec. 12-14, 1979, Cambridge, MA. Edited: W. Knedlik. Lincoln Institute of Land Policy, Cambridge, MA. pp. 17-27.*
- Dennis, D. F., and P. E. Sendak. 1992. Analyzing the effectiveness of Vermont's modified assessment program for forest land. In: Subject Group S6.13-00. Zurich, ETH Zurich. Forstwissenschaftliche Beitrage no. 11. pp. 55-61.
- Dennis, D. F., and P. E. Sendak. 1991. An alternate property tax program requiring a forest management plan and scheduled harvesting. In: 8th Central Hardwood Forest Conference: Proceedings of a meeting, University Park, PA, Mar.3-6, 1991. U.S. Forest Service, General Technical Report NE-148:15-22.

- Doherty, B. A. 1994. An analysis of alternative procedures utilized for determining forestry use value property tax assessments. In: Newman, D.H. and Aronow, M.E., eds. *Forest economics on the edge: Proceedings of the 24th annual Southern Forest Economics Workshop*, Savannah, GA, March 27-29, 1994. University of Georgia, Daniel B. Warnell School of Forest Resources. p.210.
- Douglas, R. W. 1980. Site value taxation and the timing of land development. *American Journal of Economics and Sociology*. 39(3):289-294.
- Dowdle, B. 1980. Some problems in the theory of forest property taxation. In: *State Taxation of Forest and Land Resources: a symposium*, Dec. 12-14, 1979, Cambridge, MA. Edited: W. Knedlik. Lincoln Institute of Land Policy, Cambridge, MA. pp. 95-111.
- Edwards, M. 1984. Site value taxation in Australia: where land is taxed more and improvements less, average housing values and stocks are higher. *American Journal of Economics and Sociology*. 43(4):481-495.
- Englin, J., and M. Klan. 1990. Optimal Taxation: Timber and Externalities. *Journal of Environmental Economics and Management*. 18:263-275.
- Fairchild, F. R. 1908. The taxation of timberlands in the United States. In: *Proceedings of the second conference of National Tax Association*. National Tax Association. Washington, D.C.
- Fairchild, F. R. 1935. *Forest taxation in the United States*. Misc. Publication 218. U. S. Department of Agriculture. Washington, DC.
- Flick, W. A., S. W. Krietemeyer, and C. A. Hickman. 1989. Current-use assessment in Alabama. Alabama Agricultural Experiment Station, Bulletin 600. 31 pp.
- Franklin, E. C. 1982. "Present use" valuation of forest land in North Carolina for ad valorem taxation: Current implementation and future needs. N.C. State Univ., Small Woodlot Forestry R & D Program, Res. Notes Ser. no.4. 7pp.
- Gaffney, M. 1978. An Overview of Forest Taxation. In: *Proceedings of Forest Taxation Symposium*. Virginia Polytechnic Institute and State University. pp. 4-16.
- Gaffney, M. 1975. Taxes on yield, property income, and site: Effects on forest revenues and management. unpublished manuscript.
- Gaffney, M. 1970. Adequacy of land as a tax base. In: *The Assessment of Land Value*. D. M. Holland, Ed. The University of Wisconsin Press. Madison. pp. 157-212.

- Gamponia, V., and R. Mendelsohn. 1987. The economic efficiency of forest taxes. *Forest Science*. 33(2):367-378.
- George, H. 1879. *Progress and poverty*. Robert Schalkenback Foundation (1954). New York, NY.
- Granvall, R. 1992. *Transactions-Based Forest Land Value Study*: a report prepared for the Oregon Forest Industries Council. Cascade Appraisal Services, Inc. Wilsonville, Oregon.
- Greason, M. C. 1988. New York's experience with the optional yield tax approach. In: Hamel, M.P., ed. *Forest taxation: Adapting in an era of change*. Madison, WI, Forest Products Research Society. pp.52-53.
- Haines, T.K. 1995. Current status and trends in timber severance tax legislation in the South. U.S. Forest Service, Research Note SO-377. 4 pp.
- Hellerstein, W. 1986. State and local taxation of natural resources in the federal system; legal, economic, and political perspectives. N.P., American Bar Association, Section of Taxation. 406p.
- Heilbrun, J. 1966. *Real Estate Taxes and Urban Housing*. New York: Columbia University Press.
- Hickman, C. A. 1989. Inconsistent forest property tax policies within selected southern states. U.S. Forest Service, Research Paper SO-253. 7 pp.
- Hickman, C. A. 1983. Use value assessment of forest lands in the United States. *International Real Estate Journal* 1(4):62-70.
- Hickman, C. A. 1982. Property-tax impacts of current-use assessment of forest and other rural land in Tennessee. U.S. Forest Service. Research Paper SO-180. 17pp.
- Hickman, C. A., A. E. Huebner, and H. F. Kaiser. 1986. Tax equivalency proposal for National Forests in the United States. In: Schmithusen, F. ed. *Forestry Legislation*. pp.62-70.
- Hickman, C. A., A. E. Huebner, and H. F. Kaiser. 1985. USDA's tax equivalency initiative: A preliminary assessment of its potential fiscal impacts. In: Cabbage, F.W. and Robinson, V.L., eds. *Joint proceedings of 1985 Southern Forest Economics Workshop and 1984 Southern Economic Association Convention*. pp. 71-81.

- Hickman, C. A., A. E. Huebner, and H. F. Kaiser. 1985. A tax equivalency study on national forest system lands in the United States. U.S. Forest Service FS-396. 50 pp.
- Jackson, D. 1980. The microeconomics of the timber industry. Westview Press, Boulder, CO. 136pp.
- Kilgore, M. A., P. V. Ellefson, and R. A. Skok. 1984. Minnesota's 1982-83 forest property tax structure: A review and evaluation. Minnesota Forestry Research Notes no. 287. 4pp.
- Klemperer, W. D. 1989. Taxation of forest products and forest resources. In: Ellefson, P.V., ed. Forest resource economics and policy research: Strategic directions for the future. Boulder, Westview Press. pp.276-287.
- Klemperer, W. D. 1988. An income tax wedge between buyers' and sellers' values of forests. Research Triangle Park, N.C., Southeastern Center for Forest Economics Research, SCFER Working Paper no. 54. 29 pp.
- Klemperer, W. D. 1988. Revising forest property taxes -- Recent trends and policy questions. In: Hamel, M.P., ed. Forest taxation: Adapting in an era of change. Madison, WI, Forest Products Research Society. pp. 9-14.
- Klemperer, W. D. 1987. The economic efficiency of forest taxes: A comment. *Forest Science* 33:379-380.
- Klemperer, W. D. 1983. Ambiguities and pitfalls in forest productivity taxation. *Journal of Forestry*. 81(1):16-19.
- Klemperer, W. D. 1982. An analysis of selected property tax exemptions for timber. *Land Economics*. 58(3):293-309.
- Klemperer, W. D. 1981. Segregating land values from sales of forested properties under even-aged management. *Forest Science*. 27(2):305-315.
- Klemperer, W. D. 1980. *Equity Considerations in Designing Substitutes for Unmodified Forest Property Taxes*. Proceedings of Symposium on State Taxation of Forest and Land Resources. Lincoln Institute of Land Policy. Cambridge, MA. pp. 41-54.
- Klemperer, W. D. 1979. Segregating land and timber values from sales of uneven-aged forests. *The Appraisal Journal*. 47(1):16-25.
- Klemperer, W. D. 1978. An analysis of forest tax equity guides. *Forest Science*. 24(3):318-326.

- Klemperer, W. D. 1977. Unmodified property tax -- is it fair? *Journal of Forestry*. 75(10):650-652.
- Klemperer, W. D. 1976. Impacts of tax alternatives on forest values and investment. *Land Economics*. 52(2):135-157.
- Klemperer, W. D. 1975. *Evaluating Forest Tax Alternatives Oregon*. Prepared for Oregon Legislative Interim Committee on Revenue. Salem, OR. 119 pp.
- Klemperer, W. D. 1974. Forests and the property tax. *National Tax Journal*. 27(4):645-651.
- Klemperer, W. D. and S. E. Clements. 1988. Smoothing revenue distributions from a forest yield tax. *Journal of State Taxation* 6:359-365.
- Kochanowski, P. S. 1991. Site value taxation in a declining city. *American Journal of Economics and Sociology*. 50(1):45-58.
- Kovenock, D. 1986. Property and income taxation in an economy with an austrian sector. *Land Economics*. 62(2):202-209.
- Kronrad, G.D. 1984. The effects of a special forest tax law on local government revenue: Case studies from Massachusetts. N.C. State University Small Woodlot Forestry R & D Program, Research Notes Series no.41. 12pp.
- Lindholm, R. W. 1973. Taxation of timber resources to maximize equity and wood fiber production: An Oregon case study. Publication No. 5. Bureau of Business and Economic Research. University of Oregon. Eugene, OR.
- Lipsey R. and K. Lancaster. 1957. The general theory of the second best. *Review of Economic Studies*. 24:11-32.
- Malme, J. 1993. *Preferential Property Tax Treatment of Land*. Lincoln Institute of Land Policy working paper. Cambridge, MA.
- Max, W. 1983. Landowner response to alternative tax policies in Santa Cruz County, California. In: Royer, J.P. and C.D. Risbrudt, eds., *Non-industrial Private Forests*. Symp. Proc., pp.134-141.
- Mendelsohn, R. 1993. Nonlinear forest taxes. *Journal of Environmental Economics and Management* 24(3):296-299.
- Merz, T. E. 1987. The impact of site value taxation on the optimal time to cut timber when borrowing and lending rates diverge. *Forest Science*. 33(3):763-766.

- Netzer, R. 1984. On modernizing local public finance: why aren't property taxes in urban areas being reformed into land value taxes. *American Journal of Economics and Sociology*. 43(4):497-501.
- Neutze, M. 1969. Property Taxation and Multiple-Family Housing. In *Land and Building Taxes--Their Effect on Economic Development*. ed. A. P. Becker. Madison: The University of Wisconsin Press.
- Newport, C. A. 1993. *Analysis of after-tax values of and the related severance tax rate equivalent to a 1.5% ad valorem tax on the land*. Prepared for the Oregon Forest Industries Council. Salem, OR.
- Oregon, 1995. 1995 Oregon Timber Tax Profile. pub. 150-441-497. Oregon Department of Revenue. Salem, OR. 22 pp.
- Oregon Forest Industries Council. 1993. Forest Taxation Proposal (HB 2438) and Research Reports. Salem, Oregon.
- Pasour, E. C., Jr. and D. L. Holley. 1976. An economic analysis of the case against ad valorem property taxation in forestry. *National Taxation Journal* 29:155-164.
- Pasour, E. C., Jr. 1973. Real property taxes and farm real estate values in North Carolina. Economic Research Report No. 25. North Carolina State University. Raleigh, NC.
- Pollock, R., and D. Shoup. 1977. The effect of shifting the property tax base from improvement values to land value: An empirical estimate. *Land Economics*. 53:67-77.
- Reece, B. F., 1993. The Abolition of the Land Tax in New Zealand: Searching for causes and Policy Lessons. *Australian Tax Forum*: 10(2):223-244. 1993.
- Rickard, W. 1976. A consideration of forest land valuation alternatives. Report to the Washington Forest Protection Association. Tacoma, WA.
- Rideout, D. 1982. Micro-economic properties of four local forest tax methods. Ph D dissertation, University of Washington. Seattle, WA. 110pp.
- Rideout, D. and J. G. Hof. 1986. A reevaluation of the site burden concept when forest land value is maximized. *Forest Science* 32(2):511-516.
- Rodgers, G. W. 1984. Wisconsin's forest tax laws can benefit the forest owner. In: Proceedings Woodland Owners and Users Conference, St. Paul, 1984. University of Minnesota, Office of Special Programs. pp.100-102.

- Sendak, P. E. and D. F. Dennis. 1989. Vermont's use value appraisal property tax program: A forest inventory and analysis. U.S. Forest Service, Research Paper NE-627. 68 pp.
- Siegel, W.C. and H.L. Haney, Jr. 1983. State income tax implications for the nonindustrial private forest landowner. In: Royer, J. P. and C.D. Risbrudt, eds. Nonindustrial Private Forests. Symp. Proc. pp. 113-122.
- Small, D. V. 1984. The incidence of forest taxes. Ph.D. thesis, Cornell University; Ann Arbor, MI, University Microfilms International. 187pp.
- Stewart, K. C., Jr. 1988. Productivity taxation - the West Virginia method. In: Hamel, M.P., ed. Forest taxation: Adapting in an era of change. Madison, WI. Forest Products Research Society. pp.27-31.
- Stewart, K. C., Jr. 1983. West Virginia taxation. In: Dempsy, G.P. and K.S. Price, eds. Governor's Conference on West Virginia's Forest Industry, pp. 185-192.
- Stier, J. C. 1988. Wisconsin's experience with the optional yield tax. In: Hamel, M.P., ed. Forest taxation: Adapting in an era of change. Madison, WI, Forest Products Research Society. pp.47-51.
- Stier, J. C. 1986. Forest taxation: A bibliography of literature for the period 1980-1985. University of Wisconsin-Madison, Department of Forestry, Staff Paper Series no. 25. 15 pp.
- Stier, J. C. and S. J. Chang. 1983. Land use implications of the ad valorem property tax: The role of tax incidence. *Forest Science* 26(Dec.):702-712.
- Teegarden, D. E. and P. E. Crebbin. 1988. Experience with the timber yield tax in California. In: Hamel, M.P., ed. Forest taxation: Adapting in an era of change. Madison, WI. Forest Products Research Society. pp.35-40.
- Tideman, N. 1995. *The Economics of Efficient Taxes on Land*. Land policy working paper. Lincoln Institute of Land Policy. Cambridge, MA.
- Trestrail, R. W. 1969. Forests and the property tax: Unsound accepted theory. *National Tax Journal* 22:347-356.
- Turnbull, G. K. and R. Boyd. 1985. Dynamic adjustment to land taxation policy: Neutrality and welfare implications. Southeastern Center for Forest Economics Research, SCFER Working Paper No. 11. 18 pp.

- Turner, R., C. M. Newton, and D. F. Dennis. 1991. Economic relationships between parcel characteristics and price in the market for Vermont forest land. *Forest Science*. 37(4):1150-1162.
- USDA. 1993. *Forest Resources of the United States, 1992*. Gen. Tech Report RM-234. Rocky Mt. Forest and Range Experiment Station. Ft. Collins, CO. 132pp.
- USDA. 1990. *Resource Bull. SO-158*. New Orleans, LA. USDA Forest Service, Southeastern Experiment Station. 67 pp.
- Utz, K. A. 1985. Taxes affecting forestry investments. In: Symposium on Southeastern Hardwoods, 3rd, 1985. Proceedings. U.S. Forest Service, Southern Region. pp.23- 27.
- Williams, E. T. 1974. Site value taxation -- how does it relate to forest land? *National Tax Journal*. 27(1):29-44.
- Williams, E. T. and H. O. Canham. 1972. The productivity concept in forest taxation. *Forest Science*. 18:3-20.

## Glossary

**ad valorem tax** An annual **property tax** levied as a percent of asset value.

**afforestation** The process of establishing trees on a site via planting or seeding.  
*Reforestation* refers to this process when the site was formerly forested.

**assessed value** The assigned value to which the **property tax** is applied.

**bid price for land** The maximum amount that an individual would be willing to pay for bare land; calculated by discounting all future expected costs and revenues using some minimum acceptable rate of return on investment.

**current use assessment** An annual **property tax** levied as a percent of asset value based upon the property's current use, rather than highest and best use. In forestry, sometimes called a **productivity tax**.

**distortional** Term used to describe a tax which is not **neutral**.

**establishment cost** In forestry, the cost of initiating a stand at **rotation**-start, generally including, but not limited to, clearing, site preparation, and **regeneration**.

**excess burden** Loss borne to society due to a tax or policy induced change in market behavior. Sometimes referred to as dead-weight-loss

**externality** Term generally used to describe results when the economic decision of one individual(s) has a positive or negative effect on another individual(s).

**highest and best use** For any property, the use that would maximize **net present value**.

**market allocation of resources** A term used to describe the manner in which land, capital, and labor would be utilized in a market.

**Mbf** Unit of timber volume equal to one thousand board feet.

**mean annual increment (MAI)** Average annual volume growth per unit area. Usually expressed as cubic feet, cords, or **Mbf** per acre per year.

**net present value (NPV)** The discounted value of future revenues minus the discounted value of future costs.

**neutral** Refers to a tax which does not alter the **market allocation of resources** with respect to the pre-tax condition.

**productivity tax** A tax levied annually as a percent of a formula-derived value reflecting the productive potential of the land, regardless of timber stocking.

**property tax** An annual tax levied as a percent of property value; generally on the state or local level in order fund public services--- traditionally the **ad valorem tax**.

**property tax alternative** A tax levied to in order to fund state or local services applied in lieu of an **ad valorem tax**. Examples include the **productivity tax**, **site value tax**, and **yield tax**.

**real interest rate** The interest rate excluding inflation. Equal to  $(1+i)/(1+f)$  where  $i$ = nominal rate/100, and  $f$  = inflation rate/100.

**regeneration** The process of reestablishing trees on a site by planting, seeding, or natural means.

**regulated forest** An even-aged forest consisting of equal acreage in each age-class such that equal harvests could occur into perpetuity. Using one year intervals the number of acres harvested each year would be equal to the total acreage divided by the **rotation** length.

**rotation** The interval, in years, between regeneration (or afforestation) of an even-aged forest stand and the stand's eventual harvest. Optimal rotation refers to the rotation that maximizes **net present value** (on a perpetual time horizon).

**severance tax** A forest tax assessed as a set amount per unit volume harvested. Severance taxes are usually applied specifically to fund local programs like forest research, protection, and assistance.

**site burden** The percent tax-induced reduction in the **bid price** for bare land.

**site index** Indication of site quality; expressed numerically as the average height of dominant and codominant trees at a given age.

**site value tax** A **property tax** levied on the bare land market value, excluding the value of improvements.

**stocking** A general term describing the number of trees or volume of timber per unit area.

**stumpage price** The amount paid for standing timber that is to be harvested immediately.

**tax capitalization** Refers to the shifting of taxes into lower property values.

**tax shifting** The effect of taxes on prices. Tax shifting may appear as higher output prices, lower land values, lower rates of return, or in combination.

**urban sprawl** A term utilized to describe a scattered pattern of development away from urban centers, also referred to as “leap-frogging”.

**yield tax** A forest tax levied as a percentage of harvested stumpage value.

## Appendix A: W. Oregon Land Value Data

Data indicating estimated bare forestland market values was taken from a report entitled, "Transactions-Based Forest Land Value Study", compiled by Cascade Appraisal Services, Inc. in Wilsonville, Oregon. The report was prepared for the Oregon Forest Industries Council. Utilizing the 8 Oregon Department of Revenue land classes, regression analysis was used to estimate bare land market value from a data set including 174 sales of forested properties. The sales data was received from approximately 35 corporations, individuals, and government agencies. Sale transactions encompassed the period of 1989 to early 1992, and the date of valuation for this report was July 1, 1991. 28 sales were considered bare land, 24 land including regeneration, and 122 were sales including some merchantable timber. Sales of land without forestry as highest and best use, unique requirements, or negotiated trade were rejected. The report also included a separate section estimating bare forestland market values in Eastern Oregon.

**TABLE A-1. Results of Transactions-Based Study for Western Oregon.**

<i>DOR Site Class</i>	<i>Bare Land Market Value (\$/acre)</i>
FA	\$ 350.00
FB	\$ 300.00
FC	\$ 250.00
FD	\$ 200.00
FE	\$ 150.00
FF	\$ 125.00
FG	\$ 75.00
FX	\$ 50.00

## Appendix B: Estimate of Optimal Rotation Age in W. Oregon

In order to be able to estimate before-property-tax land values for the 8 DOR site classes it was necessary to make assumptions about rotation length and establishment costs for each site class. Using equation (4) from Chapter 4, we estimated the before-property-tax land value by solving for the harvest value that caused the land value to equal the after-tax bare land market value for each site, given all other parameters. Once the harvest value was determined the before-tax value could be generated by setting property tax rates to zero (see App. C for example calculation). To estimate optimal rotation length for each site class for this procedure we used predicted growth and yield data from Stand Projection System (SPS) version 2.3 (Arney, 1989). Using five year intervals we generated a table of yield predictions for even-aged Douglas-fir plantations initially stocked at 300 trees per acre. No assumptions were made regarding costs, stumpage prices, or thinning. Optimal rotation was determined simply by discounting a net yield perpetually against an assumed 6% real rate of interest. Table B-1 shows the relevant range of predictions for each site class (site index beneath) with the optimal yield (MBF/acre) indicating rotation age in bold:

**TABLE B-1. Calculation of optimal rotation per site class, Western Oregon.**

<i>Rotation Age</i>	<i>FA (SI 140)</i>	<i>FB (SI 131)</i>	<i>FC (SI 120)</i>	<i>FD (SI 112)</i>	<i>FE (SI 102)</i>	<i>FF (SI 86)</i>	<i>FG (SI 80)</i>
<b>35</b>	<b>24.9</b>	21.1	15.4	12.1	9.2	4.1	2.3
<b>40</b>	32.4	<b>29.4</b>	<b>21.4</b>	<b>18.3</b>	12.7	7.0	5.7
<b>45</b>	40.7	37.8	28.6	23.8	<b>17.9</b>	<b>10.2</b>	8.6
<b>50</b>	51.1	46.8	34.9	30.4	22.8	13.5	<b>10.5</b>

## Appendix C: Sample Calculation/Equation (4)

The following illustrates a sample of how equation (4) was used to estimate before-property-tax bare land value from after-tax bare land value for Western Oregon. This example includes the calculation for site value class FA. Equation (4):

$$LV = \frac{H - Hy - H(1-d)(1-y) - Ed}{(1+i)^R - 1} - E - \frac{ld}{i} \quad (4)$$

Applied to site value class FA, which has an after-tax bare land market value of \$350:

$$\$350 = \frac{H - H(.065) - H(1-.6006)(1-.065) - (195)(.6006)}{(1+.06)^{35} - 1} - 195 - \frac{(1.05)(.6006)}{(.06)}$$

Solving for the harvest value,  $H = \$6822.60$ , and setting all local tax rates equal to zero, equation (4) yields a before-property-tax (but after income tax) land value of \$400.35.

## Appendix D: Land Value Data for Alabama

Data on bare land market values for Alabama was provided by Steve Burak of Sizemore and Sizemore, Inc., a forest appraisal and management firm in Tallassee, Alabama. An estimate of land value for four site classes was provided from a company data base which contained over 600 sales meeting the following criteria: sale size greater than 80 acres primary use timber production. All sales used took place between January 1, 1990 and February 11, 1997. Also a second summary included land value averages from 218 sales where timber production was listed as a secondary use. Table D-1 below summarizes the data provided. The second column shows the value with timber as primary, and the third column where it was secondary.

**TABLE D-1. Bare Land Market Value Estimates, Alabama.**

<i>Cover-type Site Class</i>	<i>Estimated Bare Land Market Value- Timber Primary Use (\$/acre)</i>	<i>Estimated Bare Land Market Value- Timber Secondary Use (\$/acre)</i>
Pine	\$ 308	\$ 303
Pine/Hardwood	\$292	\$ 271
Hardwood	\$ 146	\$ 171
Bottomland Hardwood	\$ 160	\$ 164

## VITA

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The author, son of Beverly and Eric Costello, was born February 3, 1973 in Fort Thomas, Kentucky. Raised in Highland Heights, Kentucky until the age of eighteen, a Governors Scholar and National Merit Finalist, he graduated from Bishop Brossart Highschool in May 1991. In August 1991 he attended the University of Kentucky in Lexington. While pursuing a degree in forestry, he served as a student council representative to the College of Agriculture, and as president of both the Society of American Foresters and The Wildlife Society student chapters. He graduated with honors in May of 1995, receiving his Bachelor's of Science Degree in Forest Management.

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