

LESSONS FROM BRITISH COLUMBIA:

PUBLIC FOREST MANAGEMENT

PUBLIC LANDS



BY ALISON BERRY

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TO THE READER

This essay is published by PERC, the Property and Environment Research Center, a nonprofit institute dedicated to improving environmental quality through property rights and markets. Given PERC's emphasis on the role of the private sector, readers may wonder why this paper focuses on the forestry practices in British Columbia, Canada, where 96 percent of the forested land is owned by the provincial government.

The reason is that the provincial government transfers management responsibilities for this land to the private sector through long-term agreements, and some of these agreements, known as tenures, offer valuable lessons for the United States. This essay reveals that the tenures that are most like private property rights provide incentives for reforestation, investment in silviculture, and environmental protection. The paper also includes case studies illustrating specifically how some British Columbia tenures operate.

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INTRODUCTION

The Canadian province of British Columbia manages about the same amount of forestland as the entire U.S. Forest Service—152 million acres compared with 149 million acres. Yet with only one-tenth of the number of employees as the Forest Service, it obtains more than twice the timber revenues (USDA Forest Service 2005; British Columbia Ministry of Forests and Range 2005; British Columbia Ministry of Finance 2004/05b).¹

One reason for this difference is that in British Columbia private companies are often responsible for much of the management associated with timber production from public lands. This is possible through timber tenures—licenses, permits, or agreements between the government and the private sector.

In contrast, in the United States federal agencies bear full responsibility for all land management on public forests.² These federal agencies are encumbered by a tangled web of land management policy, resulting in gridlock and unnecessary expense. Despite the potential for profit, the timber program on U.S. national forests costs taxpayers hundreds of millions of dollars annually (Fretwell 1998, 7).

British Columbia's timber tenures offer lessons for U.S. public land management. Although it is not perfect, the tenure system provides incentives for long-term stewardship and creates opportunities for collaborative management. As this essay will show, the greater security provided by some tenures—in terms of duration, rights allocated, and renewability—leads to more efficient reforestation and more investment in silviculture as well as stronger compliance with environmental guidelines.

Public Forest Management in the United States

There are 747 million acres of forestland in the United States, of which 59 percent are privately owned, 8 percent belong to individual states, and 33 percent are federal (USDA Forest Service 2003). The current policy for timber sales on U.S. federal lands is generally the same nationwide; the logging is contracted out, while the land remains under federal control. Government agencies are responsible for all timber sale preparation and post-harvest reforestation and restoration. The right to cut and sell the timber goes to the highest bidder, and logging must occur within three years of the sale of the contract.

Under this system, the harvester has no responsibility for land management, and no incentive to invest in responsible stewardship. At the same time, federal agencies have an incentive to promote timber sales. Most revenues from timber sales are sent to the general treasury, but some funds are retained by the agencies for restoration and reforestation. This combination can result in an overall degradation of environmental quality because federal managers promote timber sales and contractors have no long-term interest in the land.

Additionally, this “one-size-fits-all” timber sale policy does not create opportunities for different approaches to timber management. Only the federal agencies and the bidders that win contracts are active in forest management on U.S. federal lands. The general public can comment on forest plans and environmental impact statements, but there is no opportunity for the private sector to be active in forest management on the ground or to take responsibility for

forest maintenance on federally owned forestlands.

U.S. federal agencies have experimented with a few alternative methods of timber management. In 1944, the Sustained Yield Management Act authorized long-term agreements with designated local mills for timber harvesting on specified units of federal land. The goal of these “sustained yield units” was community stability in timber-dependent towns. But they met with limited success. Only six units were created, two of which have since been dissolved. Neighboring communities and excluded mills fiercely opposed the units, claiming that they granted monopolies to the selected mills (Clary 1986, 126–7, 145–6; Fedkiw 1998, 45). All of the units experienced reductions in timber harvests from federal lands in the 1980s.

Another alternative to federal timber sales is stewardship contracting, which began in 1999. Stewardship contracts allow forest managers some flexibility to develop multi-year contracts. Also, managers can retain all revenues for forest management, or for other stewardship contracts. This contrasts with standard timber sales, which are short-term and from which most revenues must be sent to the general treasury. Many observers feel that stewardship contracting is a step in the right direction (American Forests 2005), but some environmental groups feel that it gives forest managers too much power, and that it merely makes it easier to harvest federal timber (Sierra Club 2002).

Stewardship contracting and sustained yield units represent a small portion of the timber management program on federal lands. In 2004, stewardship contracts accounted for only 1.5 percent of timber harvested from Forest Service lands (USDA Forest Service 2004a, 2004b). Sustained yield units accounted for less than two percent of the federal timber land base in 1998 (Fedkiw 1998, 45).

More flexibility needs to be incorporated into the U.S. timber sale program so that it can adapt to changing demands on public forests. Examples from British Columbia show that the timber tenure system makes possible a variety of approaches to public forest management. It would not be advisable for the federal United States to copy British Columbia’s system exactly, but the United States could use the timber tenure system as a model for creating a more adaptable timber program.

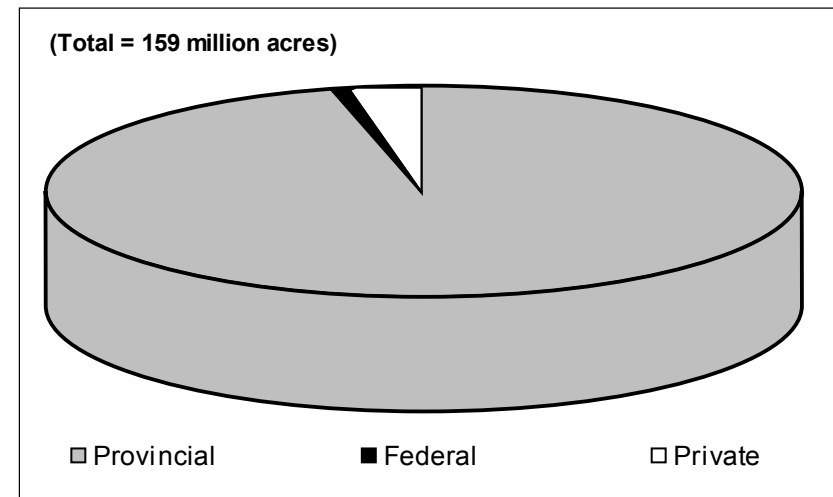
British Columbia’s Timber Tenure System

In order to assess which parts of British Columbia’s system could be applied to U.S. public forests, it is important to understand the differences among British Columbia’s timber tenures. The following sections give background on British Columbia and discuss unique characteristics of some important and innovative timber tenures.

Covering nearly 160 million acres, British Columbia’s forests are not only vast, but they are also mostly publicly owned (see Figure 1: Forest Ownership in British Columbia). Ninety-six percent of British Columbian forests are owned by the provincial government (Natural Resources Canada 2005).

To manage this resource, British Columbia has created a suite of timber tenures that is continually evolving in response to new pressures and innovations.³ These tenures give the forest industry access to provincially owned timber

**FIGURE 1:
FOREST OWNERSHIP IN BRITISH COLUMBIA**



Source: Natural Resources Canada (2005).

in exchange for forest management, annual rent, and stumpage fees.⁴

The timber tenure system has advantages for both the provincial governments and the forest industry. The provinces, which retain ownership of public—or Crown—lands, generate revenues from timber tenures to finance other provincial operations. The forest industry gains access to timber on Crown lands, often for long periods of time, but it does not have to pay the costs of ownership or associated taxes as it would if it actually owned the land.

Each Canadian province has its own timber tenure system, and British Columbia's is the most complex, with more than eight different tenure arrangements, varying in duration, renewability, and rights allocated (Haley and Luckert 1990). Since the earliest tenures of the late 1800s, periodic reforms have resulted in a proliferation of tenure arrangements. The tenure system continues to adapt; recent changes have emphasized market-based pricing and community forestry.

The British Columbia Ministry of Forests and Range administers timber tenures on Crown lands and determines annual allowable harvest levels. It has a staff of 3,000 and annual expenses of \$608 million (fiscal year 2004/05, British Columbia Ministry of Finance 2004/05a). Given the large acreage it administers, this amounts to 51,000 acres per employee and expenses of only \$4 per acre annually. Staffing and expenses can be kept low because holders of forest tenures are responsible for many aspects of forest management including planning, road building, timber harvesting, and reforestation.

Provincial Tenures

Within the range of tenures, the incentives for responsible stewardship vary. Economic theory suggests that timber tenures that incorporate stronger property rights will encourage more responsible forest management (see, for example, Demsetz 1967). Tenures that are long-term, renewable, and area-based carry incentives for stewardship because the tenure holder is likely to harvest repeatedly from the same site. Area-based tenures allocate harvesting rights to a specific location, and the tenure holder bears responsibility for ongoing management activities, such as forest inventory and maintenance.

In contrast, short-term, non-renewable, and volume-based licenses seem to carry fewer incentives for stewardship. Volume-based tenures grant the holder the right to harvest a specified amount of timber, but do not restrict the location of harvest within a broad area. The tenure holder may never return to harvest from the same area twice and is not responsible for ongoing forest management beyond timber harvest and reforestation.

Timber tenures vary with respect to duration and renewability. They may last for less than one year or up to 25 years. Some tenures are not renewable; others may be renewed at their endpoint, or prior to their endpoint—the latter are dubbed “evergreen.” To be eligible for renewal, tenure holders must meet requirements of the tenure as well as provincial environmental and silvicultural regulations. Longer-term and renewable tenures encourage holders to consider the long-run implications of any management activities and therefore tend to carry stronger incentives for stewardship.

This paper will compare the incentives provided by selected tenures, relying in part on a series of empirical studies that looked at the impact of different tenures on reforestation, investment in silviculture, and compliance with environmental regulations. (See Table 1 for a side-by-side comparison of selected British Columbia timber tenures.) From Tree Farm Licenses to forest licenses, the tenures are listed from the most secure to the least secure, based on duration, renewability, and whether they are area- or volume-based. (See also Figure 2). A final category (IFPAs) combines tenures.

Tree Farm Licenses

Tree Farm Licenses (TFLs) are area-based tenures that last for 25 years and are renewable on an evergreen basis. These characteristics give companies relatively secure, long-term access to Crown timber. The province developed TFLs in the 1940s in order to encourage capital investment in mills by industrial forestry companies. In return for access to Crown timber through a TFL, companies originally were required to include their own adjacent private lands in the tenure area, and to manage their private lands to the standards of the tenure set by the province (Clogg 1999). TFLs are generally located on the most productive and

accessible areas of Crown forests.⁵ By volume of timber harvested, TFLs are the second most common tenure in British Columbia, accounting for 18 percent of the timber harvest (British Columbia Ministry of Forests 2005).

Timber Licenses

Timber Licenses, which date back to 1888, are area-based but not renewable (Clogg 1999). They were designed to encourage early settlers to clear forests, and they expire when the timber is harvested. New Timber Licenses are no longer is-

sued, but some are still in effect. Timber Licenses account for about 6 percent of the annual provincial harvest (Burda et al. 1997, 16).

British Columbia Timber Sales

British Columbia Timber Sales (BCTS) is an independent organization within the British Columbia Ministry of Forests and Range that sells Crown timber through auctions. As with timber sales in the United States, the timber is sold to the highest bidder, and BCTS, like U.S. agencies, is responsible for

**TABLE 1:
SELECTED BRITISH COLUMBIA TIMBER TENURES**

	<u>TREE FARM LICENSE</u>	<u>TIMBER LICENSE</u>	<u>BC TIMBER SALES</u>	<u>FOREST LICENSE-REPLACEABLE</u>	<u>FOREST LICENSE-NON-REPLACEABLE</u>	<u>IFPA</u>
<u>NATURE OF TENURE</u>	Area-based	Area-based	Area-based	Volume-based	Volume-based	Area-based
<u>DURATION</u>	25 yrs	Variable—until timber is harvested	Up to 15 yrs	Up to 20 yrs	Up to 20 yrs	Up to 15 yrs
<u>IS IT RENEWABLE?</u>	Yes	No	No	Yes	No	No
<u>ANNUAL TIMBER HARVEST</u>	18%	6%	12%	37%	16%	n/a

Note: Innovative Forest Practices Agreements (IFPAs) are made up of a group of other tenures, often forest licenses. Sources: Burda et al. (1997, 16); British Columbia Ministry of Forests and Range (2006); Cortex Consultants (2001); British Columbia Ministry of Forests (2005).

pre-harvest preparation and post-harvest restoration. These tenures are area-based, but they are short-term and not renewable, and they account for 12 percent of annual harvest (British Columbia Ministry of Forests 2005). The Ministry of Forests created BCTS in 2003 to establish a basis for market pricing in the tenure system, partly in response to the softwood lumber disputes with the United States.

Forest Licenses

The most common tenure in British Columbia is the volume-based Replaceable Forest License (British Columbia Ministry of Forests 2005). Replaceable Forest Licenses last up to 20 years and are renewable on an evergreen basis between year 5 and 10 for a new 15-year agreement.⁶ British Columbia also offers Non-replaceable Forest Licenses, which are volume-based but not renewable. Taken together these forests licenses represent about 53 percent of British Columbia's annual timber harvest by volume (British Columbia Ministry of Forests 2005).

Innovative Forest Practices Agreements (IFPAs)

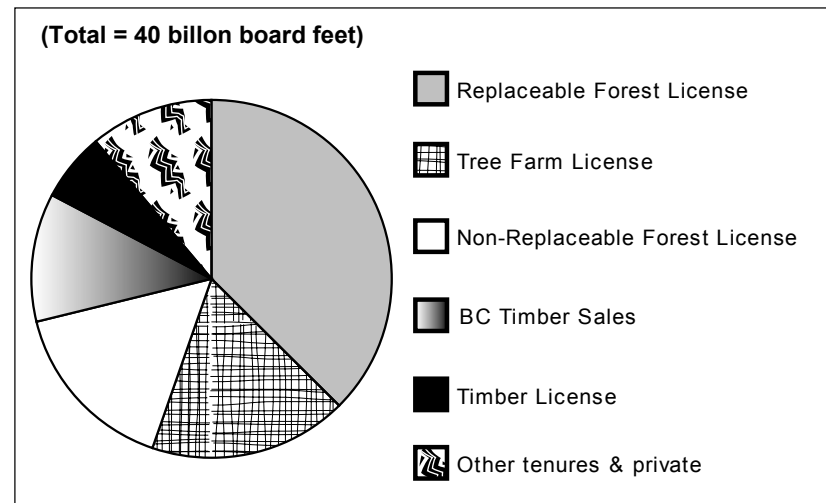
In 1996, the Ministry of Forests introduced Innovative Forest Practice Agreements (IFPAs) in order to encourage creativity in forest management. IFPAs are not truly a tenure, but rather a method of collaboration for volume-based tenure holders working in the same area. These agreements, primarily aimed at holders of forest licenses, allow tenure holders to jointly implement new forest management practices in a region. If innovative forest management practices result in increased site productivity—in this case, greater capability to produce wood quickly—members of an IFPA can be rewarded with increases in allowable annual harvest levels. IFPAs last for up to 15 years, and essentially create area-based tenures out of a group of volume-based tenures. IFPAs are not renewable.

Other Tenures and Private Lands

About 8 percent of British Columbia's timber harvest comes from private lands outside the tenure system (British Columbia Ministry of Forests 2003/04). A handful of other tenures account for the remainder—less than 5 percent—of the annual provincial harvest (British Columbia Ministry of Forests 2005).

The variety within British Columbia's tenure system provides opportunities to experiment with many different approaches for timber management on public lands. A series of studies, discussed below, shows that within the British Columbia tenure system, there are distinct differences that dramatically affect a number of forest management practices. ■

**FIGURE 2:
BRITISH COLUMBIA HARVEST VOLUME BY TENURE**



Sources: British Columbia Ministry of Forests (2005); British Columbia Ministry of Forests (2003/04); Burda et al. (1997, 16).

A CLEAR-CUT DIFFERENCE AMONG TIMBER TENURES

All forestland managed through British Columbia timber tenures must meet the same environmental and managerial standards.⁷ But the stronger property rights associated with some tenures should provide greater incentives for stewardship (Hardin 1968). This theory was tested in studies by researchers Daowei Zhang and Peter Pearse, who were affiliated with the University of British Columbia at the time of their research.

In three separate studies, Zhang and Pearse examined the effect of tenure on reforestation practices, investment in silviculture, and compliance with environmental regulations (Zhang and Pearse 1997, Zhang and Pearse 1996, Zhang 1996). They hypothesized that greater security of tenure would lead to faster reforestation, greater investment in silviculture, and stronger compliance with environmental guidelines. The tenures in the studies were private lands in Tree Farm Licenses, Crown lands in Tree Farm Licenses, Timber Licenses, and Replaceable Forest Licenses. Together, these four tenures accounted for 85 percent of British Columbia's annual timber harvest in 1992. Each study is described below.

Reforestation

All tenure holders are obligated to reforest harvested areas, either through replanting or natural regeneration. If logged areas, or cutblocks, do not meet agreed-upon restocking requirements within a designated amount of time, they are declared “Not Satisfactorily Restocked” (NSR). More often, a portion of a cutblock may be declared NSR.

Zhang and Pearse (1997) investigated how tenures affected four aspects of

reforestation. They studied the occurrence of NSR areas, the percentage of such areas within cutblocks, the reforestation method—artificial or natural—and, in the case of artificial regeneration, the time after harvest until planting was completed. The researchers hypothesized that more secure tenures would be associated with fewer NSR areas, smaller NSR areas, and more and faster planting.

Zhang and Pearse judged the security of tenures based on whether they are area- or volume-based, the duration of the tenure, and renewability. The least secure tenure was the Replaceable Forest License, which is renewable but volume-based and short-term. Timber Licenses were second because they are area-based and vary in duration, but they are not renewable. Next were Crown lands in Tree Farm Licenses, which are area-based, long-term, and renewable. Private lands in Tree Farm Licenses represented the most secure tenure, with no limits on duration or renewability, and with more rights allocated than even area-based tenures on Crown lands.

In order to level the playing field for their comparisons, Zhang and Pearse accounted for physical and managerial variables in their analysis. For example, private lands and Tree Farm Licenses are generally located in the most productive sites.⁸ Therefore, Zhang and Pearse accounted for factors such as site class, biogeoclimatic zone, and the species composition of the new forest crop. Other variables were the size of the area harvested, date of logging, size of the firm, and investment in silviculture.

The results supported their hypothesis. Zhang and Pearse concluded that “more intensive resource management is fostered by more secure forms of tenure.” Specifically, the most secure form of tenure, private lands in Tree Farm Licenses, had results significantly different from other forms of tenure in every category.

Overall, the clearest and most statistically significant trend was found in the time it took to complete planting after logging. (See Figure 3.) Based on the regression results, cutblocks on private lands in Tree Farm Licenses were regenerated in an average of 29 months after logging. Crown lands in Tree Farm Licenses were regenerated in 30 months, Timber Licenses in 31 months, and Forest Licenses in 36 months. The statistical analysis provided strong evidence of a difference between forest licenses, which have the longest period prior to regeneration, and the three other more secure tenure arrangements.⁹

Harvested areas on private lands in Tree Farm Licenses were also the most likely to be planted at all. Eighty-nine percent of cutblocks on private lands in these tenures were planted instead of being left to regenerate naturally. Other

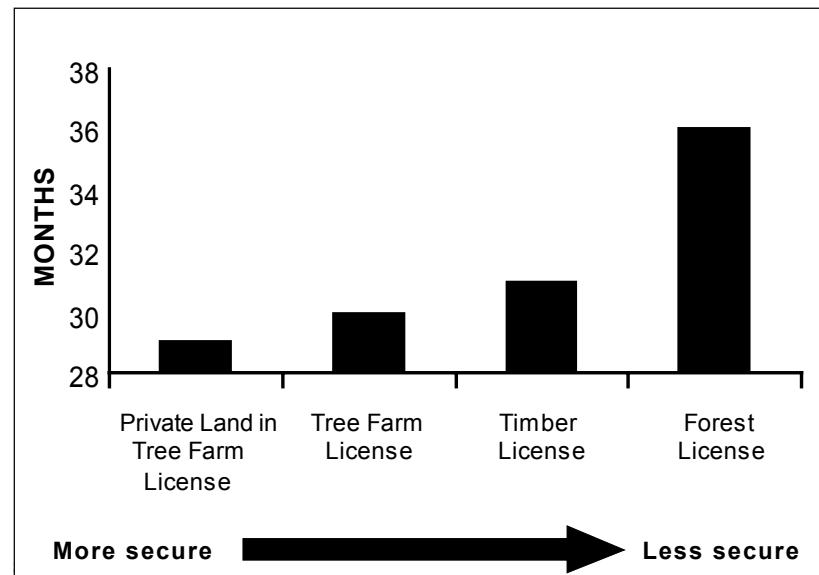
rates were 76 percent for Crown lands in TFLs, 72 percent for Timber Licenses, and 74 percent for Replaceable Forest Licenses. Again, the analysis provided moderate statistical evidence of a difference in planting rates between Replaceable Forest Licenses and private lands in TFLs when all other factors were held constant.¹⁰

With an average rate of 4 percent “not sufficiently restocked” (NSR), logged areas on private lands in TFLs were most likely to be adequately reforested. Other rates were 9 percent for Crown lands in TFLs, 9 percent for Timber Licenses, and 10 percent for Replaceable Forest Licenses. Statistical analysis provides only very weak evidence of a difference between private lands in TFLs and Replaceable Forest Licenses, however, when all other factors are held constant.¹¹ This suggests that there may be a difference between the two tenures, but further testing is necessary in order to generate conclusive evidence.

When logged areas were insufficiently restocked, those on private lands in Tree Farm Licenses had the smallest proportion of understocked areas. On average, the cutblocks on private lands in Tree Farm Licenses that were understocked had 25 percent of their area not sufficiently restocked, while understocked cutblocks on Crown land in TFLs averaged 54 percent NSR; Timber Licenses, 61 percent; and Replaceable Forest Licenses, 66 percent. The results of the regression analysis provided moderate evidence of a difference between percentages of insufficient restocking on Replaceable Forest Licenses vs. private lands in Tree Farm Licenses when all other factors were held constant.¹²

This study suggests that under similar conditions more secure tenures are associated with faster, more efficient regeneration practices. The results provided significant evidence of a difference between tenures, but in absolute terms the value of the differences was small. In other words, although the results showed that there is a difference between the tenures, because that difference was small it may be difficult to observe on the ground. For example, after a few years have passed, it may be difficult to see a difference between a cutblock that was replanted in 29 months after logging and one that was replanted in 36 months after logging. Nevertheless, the strong statistical difference between reforestation practices in different tenures indicates that management approaches vary depending on tenure characteristics such as duration, renewability, and whether tenures are area- or volume-based.

FIGURE 3:
MONTHS FOLLOWING LOGGING TO COMPLETE PLANTING



Source: Zhang and Pearse (1997).

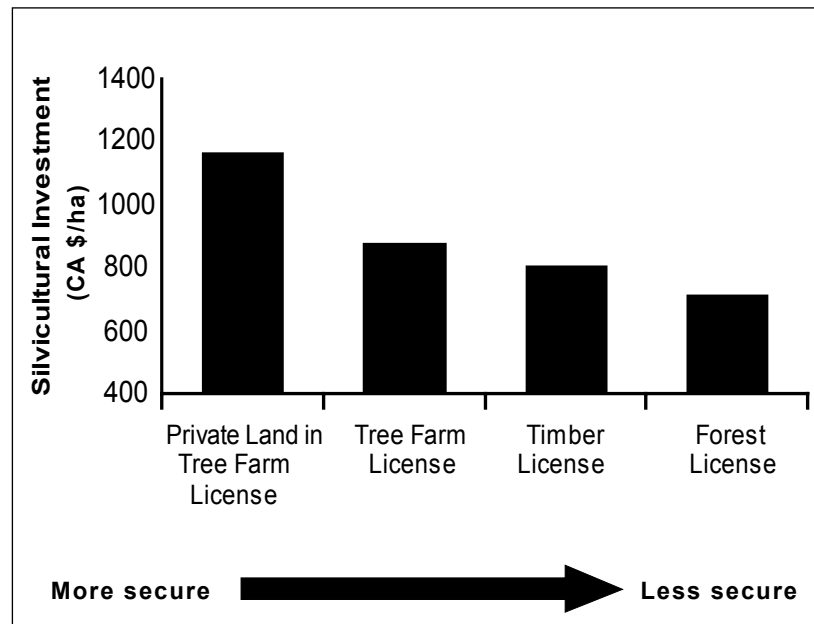
Silvicultural Investment

In a similar study, Zhang and Pearse (1996) investigated differences between tenures in financial investments for silvicultural activities including reforestation, surveys, site preparation, and stand maintenance.¹³ They hypothesized that more secure tenures would be associated with greater investments in silviculture. The logic was that investors are likely to spend more if they have greater expectations of capturing the benefits of their investments. Therefore, private owners and holders of long-term, renewable, area-based licenses are more likely

to invest in silviculture than those with less secure tenures. Again, Zhang and Pearse accounted for physical and managerial factors in the analysis.

Results provided evidence in support of the hypothesis, with the greatest investment in silviculture on private lands in Tree Farm Licenses. (See Figure 4.) The trend continued, with decreasing investments in Crown land in Tree Farm Licenses, Timber Licenses, and Replaceable Forest Licenses. Regression results provided strong evidence of a difference between the least secure tenures (Replaceable Forest Licenses) and both private and Crown lands in TFLs.¹⁴ There was moderate evidence of a difference between Replaceable Forest Licenses and Timber Licenses.¹⁵ These results indicate that under similar physical and managerial conditions, more secure tenures can encourage greater investments in silviculture. Zhang and Pearse conclude, “[F]orms of forest tenure that are longer term, more clearly defined, provide more of the economic benefits to their holders, and otherwise offer them more security are likely to stimulate more silvicultural investment.”

FIGURE 4:
SILVICULTURAL INVESTMENT AMONG FOREST TENURES



Note: Data are in (1996) Canadian dollars.
Source: Zhang and Pearse (1996).

Compliance with Environmental Guidelines

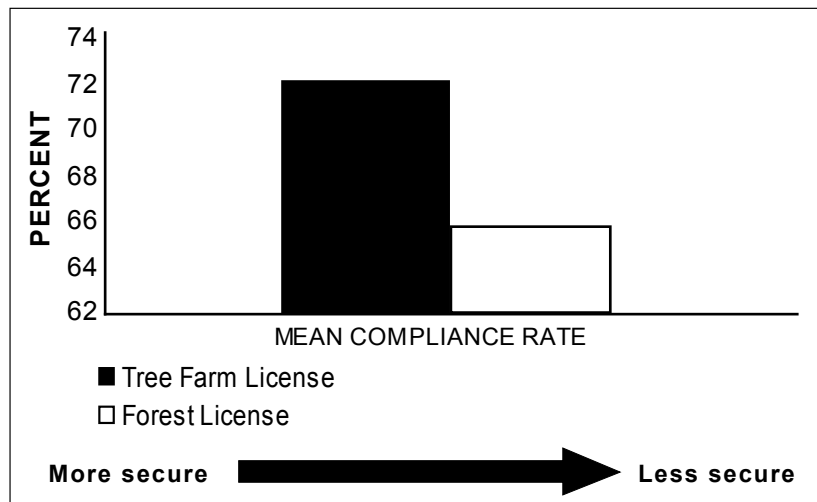
In order to study the relationship between tenures and environmental quality, Zhang (1996) compared the rates of compliance with British Columbia Coastal Fisheries and Forestry Guidelines on Crown lands in two tenures, Tree Farm Licenses (more secure) and Replaceable Forest Licenses (less secure). The guidelines, developed jointly by industry and government, aimed to protect water quality and fish habitat and to prevent soil erosion. They defined four classes of coastal streams based on gradients and the presence and types of fish populations. For each stream class, there were recommendations for methods of road construction, timber harvest, and silvicultural treatments. Compliance with the guidelines was voluntary (Moore and Bull 2003, 26).¹⁶

Zhang analyzed the rate of compliance with the guidelines and accounted for slope, size of the logged area, location, and size of firm. The regression results provided only very weak evidence of a higher level of compliance on Crown land in Tree Farm Licenses than in Replaceable Forest Licenses.¹⁷ These results suggest

that there is a difference between the two tenures, but that additional analysis is necessary to produce conclusive results.

Holding all other factors constant, the compliance rate under Tree Farm Licenses was about 5 percent higher than that under Forest Licenses. (See Figure 5.) Again, Zhang attributes these findings to the more secure property rights associated with Tree Farm Licenses. Holders of these types of tenures are more likely to return to the same site and therefore are less likely to cause environmental degradation on that site. Zhang notes, “[T]he results of this study suggest that providing a secure right to timber is complementary to providing a right to some important environmental resources, namely, soil stabilization, water quality, and fish habitat protection” (Zhang 1996).

**FIGURE 5:
COMPLIANCE WITH COASTAL FISHERIES GUIDELINES
IN TREE FARM LICENSES VS. FOREST LICENSES**



Source: Zhang (1996).

Although the results provide some evidence of a difference in the compliance rate between Tree Farm Licenses and Forest Licenses, there was a large amount of unexplained variation in the compliance rates. This suggests that other important factors were left out of the model. For instance, factors such as site quality and tree species, which were included in the other two analyses, were not included here. Inclusion of these and other potentially important variables could produce more robust results.

This study is of particular interest because of its implications for environmental stewardship. Reforestation practices and silvicultural investments, the subjects of the first two studies, are direct indicators of more efficient timber production, but compliance with voluntary environmental guidelines is a direct indicator of environmental stewardship. The final study suggests that more secure tenures are associated with greater environmental stewardship as well as more efficient timber production.

Significance of Research by Zhang & Pearse

These studies show that forest management practices differ under different tenures. More secure tenures encourage faster reforestation, greater investments in silviculture, and stronger compliance with voluntary environmental guidelines. All tenure holders are required to meet the same environmental and silvicultural standards, so the fact that some tenure holders go beyond these requirements reflects different incentive structures within the various tenures.

In the United States, the federal timber program could draw from the parts of British Columbia's system that best encourage responsible forest stewardship. As shown by Zhang and Pearse, long-term, renewable, area-based tenures have advantages for some aspects of public forest management. These might be the most promising for incorporation into U.S. federal land management. Additionally, this approach would lighten the burden on agency resources by shifting the responsibility for forest management to the private sector. ■

CASE STUDIES

The case studies that follow reinforce Zhang and Pearse's findings. In addition, they show that different tenure holders can work within the constraints of the tenures to achieve distinctive individual goals. Examples include an industrial forest company, a group of volume-based license holders that have joined together to promote innovative forest practices, a First Nations forest company, and a community-based forest.

Case 1: Major Industrial Forest Tenures *Making the Cut*

Canadian Forest Products (Canfor) is the largest industrial forest tenure holder in British Columbia.¹⁸ Like other industrial forestry companies, Canfor holds several different types of tenure including Replaceable and Non-replaceable Forest Licenses and Tree Farm Licenses (TFLs) on Crown land in British Columbia. The company's forest management practices are generally the same regardless of tenure type, but there are a few differences.

As noted earlier, area-based Tree Farm Licenses tend to be located on the best quality sites for forest management.¹⁹ The site in Figure 6 is Crown land in a Tree Farm License in northern interior British Columbia. This stand was harvested only four years prior to the photo, so the new saplings are not more than five years old. But already they are overtopping the competing vegetation. Since TFLs tend to be on high-quality sites, growth can be faster in these areas. Also, this stand was planted only four months after timber harvest, a much shorter period than the average. As suggested above, TFLs tend to be planted faster than other tenures.

Managers also acknowledge other advantages of secure tenures. Long-term,

FIGURE 6:
REGENERATION ON CANFOR'S TREE FARM LICENSE



The lodgepole pine and spruce seedlings were planted only four years prior to the photo. Also, the seedlings were planted only a few months after harvesting. On more secure tenures like this Tree Farm License, planting tends to occur sooner after harvest. Also, Tree Farm Licenses are generally on more productive sites than other tenures, so growth rates may be higher.

Photo courtesy of Derek Belsham.

renewable, area-based tenures increase the holder's ability to capitalize on investments. Therefore, more time and money are invested in more secure tenures. Often, efforts are first focused on Tree Farm Licenses, and any resources left over are then devoted to management on less-secure tenures. For example, in northern interior British Columbia, seeds that are weevil-resistant and have the highest growth potential are first devoted to TFLs before being used on other sites. Additionally, if federal or provincial funding becomes available for forest investment, it is spent on the TFL first.²⁰

Canfor is focusing on area-based licenses like TFLs for forest certification, a third-party verification that wood is produced and harvested under conditions that meet certain standards. There is a range of certifying organizations, each with unique requirements and characteristics. Generally, all certifiers require forests to meet their own defined criteria for sustainable management, which place varying emphasis on ecological, economic, and social aspects. Potential benefits of certification for Canfor include price premiums, improved management, and market advantage (Hayward and Vertinsky 1999).²¹

Canfor has received certification for its Tree Farm License in northern interior British Columbia from the Sustainable Forestry Initiative of the American Forest and Paper Association. Additionally, Canfor is seeking certification from the Canadian Standards Association for all of its woodland operations, starting with area-based tenures, such as TFLs, and then moving on to volume-based tenures (Canfor n.d.). Certification is more suited to area-based tenures because the holder has a longer-term and more continuous role in forest management.

Case 2: Innovative Forest Practices Agreements *Forest Licenses Turn a New Leaf*

Recognizing the advantages of area-based licenses, the Ministry of Forests in 1996 created Innovative Forest Practices Agreements (IFPAs). IFPAs in essence turn volume-based tenures into area-based tenures by allowing one or more holders of volume-based licenses to work together for long-term forest

**FIGURE 7:
PREDICTIVE ECOSYSTEM MAPPING IN ACTION**



Larry Henry, former NSIFS executive director (center), discusses the advantages of Predictive Ecosystem Mapping with government officials and society board members during a tour of the Merritt Timber Supply Area.

Photo courtesy of Julie Taylor Schooling.

management over a broad area of Crown land. These tenures create more secure arrangements out of less secure arrangements and stimulate more silvicultural investment.

The Merritt IFPA oversees forest management of 2.79 million acres (1.13 million hectares) of Crown land in the southern interior portion of British Columbia (Nicola-Similkameen Innovative Forestry Society n.d. a). Members of the IFPA include six forestry companies, two tribal organizations, and British

Columbia Timber Sales, all holders of tenures within the Merritt Timber Supply Area. Together, they form the Nicola-Similkameen Innovative Forestry Society (NSIFS). The society's stated mission is to use "innovative forest management practices that incorporate Aboriginal knowledge and values and public involvement in order to increase the productivity of a healthy and resilient working forest" (NSIFS n.d. b).

Because the IFPA arrangement creates an area-based tenure out of a group of tenures, there is greater incentive to manage for the long term than there would be without the IFPA arrangement. Since its creation in 1998, NSFIS has created a comprehensive plan for wildlife and fisheries, including mapping of deer winter ranges. With the Upper Similkameen Indian Band, the IFPA has created a predictive model for archeological sites. And it has completed a sustainable forest management strategy, that includes integration of First Nations, timber, and non-timber forest interests (NSIFS n.d. c).

One incentive for license holders to form IFPAs is that if management results in increased site productivity, the Ministry of Forests and Range can award IFPA holders with higher allowable harvest levels.²² The allowable harvest volume can also be increased if more accurate inventories indicate that timber growth is greater than previously estimated. Normally, volume-based license holders and British Columbia Timber Sales do not compile forest inventories or participate in forest management beyond harvesting and reforestation, but the IFPA allows them to take on these responsibilities. Merritt IFPA received an increased harvest level in January 2004.

The Nicola-Similkameen Innovative Forestry Society has improved on forest inventories through the use of Predictive Ecosystem Mapping (PEM), which assimilates ecological, biological, and geographical data in order to predict the type of ecosystem existing on a particular piece of land. This mapping technique has resulted in more accurate inventories on the Merritt IFPA. Predictive Ecosystem Mapping is economically feasible only because the costs are spread out among all the different members. (See Figure 7.)

Figure 8 shows how the society is using research to increase site productivity. By examining the root structure of larger trees in their area, the Ministry of Forests found that roots are shallow and have a wide spread, making it difficult

**FIGURE 8:
ROOTS RESEARCH**



In this dry-belt Douglas-fir area, researchers found that most roots from large trees are shallow but have a far reach. These conditions can make it difficult for smaller trees to get established due to competition for water. The Nicola-Similkameen Innovative Forestry Society is taking advantage of research like this to plan planting and maintenance activities that enhance forest growth.

Photo courtesy of Julie Taylor Schooling.

for small trees to grow. Therefore, NSFIS can adjust harvesting and planting methods so that the seedlings have a better chance of establishment. The IFPA provides an incentive to take advantage of this type of research because members can benefit by improving the site's ability to produce timber.

Although the original intention of the IFPA program was to develop truly

innovative forest practices, the focus has shifted more toward increasing allowable cut levels. This is not surprising, considering that this is one of the few rewards offered in return for participating in the IFPA program. Originally, the Ministry of Forests established a “Forest Renewal” fund to support innovations in forest practices, and this helped to develop some of the IFPA projects. The fund was eliminated due to budget constraints in 2001, and since then, some feel that innovation has dwindled.²³

Nevertheless, the IFPA approach ensures more long-term and broad-scale management from volume-based licensees and British Columbia Timber Sales. It allows several interested parties to collaborate on management at a landscape level, instead of working independently on smaller parcels. Also, participants have an incentive to increase site productivity and to be involved in management beyond just harvesting and reforestation.

Case 3: Iisaak Forest Resources *First Nations*

Iisaak Forest Resources²⁴ is owned and operated by First Nations groups in Clayoquot Sound on the west coast of Vancouver Island. It was born out of “the War in the Woods,” large-scale disputes between loggers, environmentalists, and First Nations in the Clayoquot area in the 1990s.

Native groups have lived in Clayoquot Sound for thousands of years, with cultures based on cedar and salmon. These cultures were interrupted by European settlement in the nineteenth century. Beginning in the 1950s, Canadian timber giant MacMillan Bloedel took control of most of the timber harvesting rights in Clayoquot. The area was logged extensively in the 1960s and 1970s, but by the late 1970s, local native communities experienced declining employment opportunities in the forest sector. Also, they became aware of damage to fisheries and other resources caused by poor logging practices. Fifteen First Nations groups came together to form a Tribal Council to investigate forest management issues in Clayoquot Sound (Iisaak Forest Resources 2000).

In 1980, the Tribal Council claimed the tribes’ traditional lands on Van-

**FIGURE 9:
HELICOPTER LOGGING AT IISAAK**



Helicopter logging operations like this one at Iisaak may have less impact on the environment than road-based logging, but they also can be more costly.

Photo courtesy of David White.

couver Island, and the Canadian federal government agreed to enter into negotiation of their claim. The native groups felt that the resources in the area belonged to them and were being sold without their permission to MacMillan Bloedel. Throughout the 1980s, indigenous groups joined environmental activists to protest commercial logging activities in the area. The protests escalated to a 1993 event in which more than 800 protesters were arrested for blocking

**FIGURE 10:
WILDLIFE HABITAT**



Downed trees like this one can provide habitat for wildlife. A bear made its den underneath this log in a harvested stand in the Mission Municipal Forest.

Photo courtesy of Kim Allen.

access to a logging road used by MacMillan Bloedel (Stefanick 2001). The provincial government responded with a series of panels, special investigative studies, and task forces, but the issue remained largely unresolved.

Progress came in the late 1990s when MacMillan Bloedel decided to change its forest management practices in Clayoquot Sound. It switched from

clear-cutting to variable retention logging in which patches of trees are left standing for ecological purposes such as wildlife habitat and erosion prevention. Also, MacMillan Bloedel formed a joint-venture company with local First Nations to take over forest management in the area. This joint venture eventually became Iisaak, which is now 100 percent native-owned.

Iisaak holds a Tree Farm License and two Timber Licenses on Crown land in Clayoquot sound. The Tree Farm License has been certified by the Forest Stewardship Council, one of the more stringent certifiers. Iisaak is committed to preserving intact old-growth areas and trees that have historical cultural value. Its timber policy relies heavily on helicopter logging to reduce disturbance and erosion from road-building (Chadwick 2003). (See Figure 9.) Also, the original agreement with MacMillan Bloedel emphasized the development of non-timber forest products and value-added wood products.

Time will be the test of whether Iisaak can sustain itself in the long run. Helicopter logging and variable retention are more expensive than other techniques such as clearcutting and produce less timber per amount of time spent. Thus it may be difficult for Iisaak to generate sufficient revenues to cover the high costs of low-intensity logging.

Nevertheless, Iisaak represents an alternative approach to forest management. Long-term and secure access to forestlands give Iisaak an incentive to manage for future environmental amenities. This is a substantial achievement and, considering the bitter disputes during the last decades, Iisaak may represent a viable solution for conflict resolution in the timber industry.

Case 4: Mission Municipal Forest *A Forest Community*

Although the structure of a forest tenure can influence forest management, the characteristics of the tenure holder are also important. Consider two different area-based tenures, one held by a corporate timber company and the other by a neighboring community organization. The corporate timber company will manage for profit maximization. The community organization may also manage

FIGURE 11:
VARIABLE RETENTION IN MISSION MUNICIPAL FOREST



This cutblock encompasses both Crown and private land in Mission's Tree Farm License. Mission has harvested here using variable retention methods as opposed to clearcutting. Variable retention emphasizes leaving behind trees and snags to preserve habitat for wildlife.

Photo courtesy of Kim Allen.

for profits, but its leaders will also likely consider the type of forest that they would like to live near. Corporate interests may not favor non-timber outputs that produce little or no revenue, but community preferences may focus on environmental amenities, so that the community can enjoy the benefits of high environmental quality.

One example can be found in the town of Mission, located 40 miles east of Vancouver. Mission holds an area-based Tree Farm License covering 25,688 acres (10,400 hectares). It includes both Crown land and private land owned by the municipality. The private land in the Mission Municipal Forest came under town ownership as a result of non-payment of taxes, mostly in the 1930s. In the 1950s, Mission secured a Tree Farm License on the municipal forest and nearby Crown lands in order to reduce local unemployment and provide a wood source for local mills (District of Mission Forestry Department n.d.).

Mission Municipal Forest (MMF) still provides wood for local mills, but also manages for multiple uses, including wildlife, recreation, and education. (See Figure 10.) For example, MMF uses variable retention harvesting, leaving trees and snags for wildlife habitat (Mission Municipal Forest 2005). Figure 11 shows an example of variable retention harvesting on a cutblock that includes both Crown and private lands in Mission Municipal Forest. MMF also maintains trails and provides opportunities for forest education and tours.

Although Mission holds the same type of tenure as many industrial forest companies in British Columbia (a Tree Farm License), its management is affected by the fact that its owners and managers are a municipality that neighbors the forest. Most planning, supervisory, and technical functions are performed by a staff of nine municipal employees who are managed by the mayor and the municipal council (Mission Municipal Forest 2005).■

LESSONS FROM BRITISH COLUMBIA

Examples from British Columbia show that some aspects of its system encourage long-term forest management. Area-based tenures, for example, generally induce more responsible forest management than volume-based tenures—as measured by reforestation, investment in silviculture, and environmental compliance.

By adopting similar tenures, U.S. federal forests could experiment with a range of management regimes. It would not be necessary for the United States to incorporate the tenure system as it is in British Columbia. Instead the United States could focus on the parts of the tenure system that best encourage responsible forest management—long-term, area-based tenures.

The timber tenure system in British Columbia has other benefits: It makes room for collaborative management of forest resources and allows a variety of interests to become involved. IFPAs allow groups to work together over broad landscapes; community-based forests like Mission permit local control over forest resources; and Lisaak shows that conflicts can be resolved among industry, First Nations, and environmental groups.

The case studies above also illustrate how these different tenure holders can use the same type of tenure to achieve different management results. Industrial forest companies, First Nations, and community organizations all have different approaches to forest management, each of which can be manifested on the landscape.

The timber tenure system in British Columbia is not perfect by any account, and debate about tenure reform is ongoing. Some people feel that tenures grant too many rights to the tenure holders, especially to the large, industrial forest

companies which hold the majority of timber tenures. Jessica Clogg, Staff Counsel at West Coast Environmental Law in Vancouver, British Columbia, claims that the development of the tenure system reflects a “lack of concern with non-timber forest values, and with the interests of individuals and organizations other than corporate tenure holders” (Clogg 1997, ch. 1b).

Others push for privatization of timber lands, and claim that private ownership of forests is better for both the environment and the economy (McCarthy and Chittick 2003). Former University of British Columbia Department of Forestry Dean Clark Binkley says, “B.C. needs more private forest land to achieve better management of B.C.’s magnificent forest estate” (Binkley 1998).

A limitation of British Columbia tenures is that they only apply to the timber resources on Crown lands. Thus, even with long-term agreements, this policy does not always encourage tenure holders to address other forest uses such as recreation, wildlife, or water quality (except by meeting existing government standards). If other forest uses could be incorporated into timber tenures, holders would undoubtedly pay more attention to multiple forest outputs. For example, if tenure holders are able to generate revenues through recreation fees, hunting permits, or water permits, they will have an incentive to develop these non-timber resources. This sort of multiple-resource tenure could be useful on U.S. forests, where federal policy mandates multiple uses.

In the United States, previous attempts at long-term agreements for forest management have had a similar weakness: They also excluded non-timber resources, which may explain why these agreements have enjoyed only limited success. For example, sustained yield units only granted rights to timber from

U.S. Forest Service lands and did not address other forest uses. As other forest uses became more valuable, the value of the long-term agreements for timber declined. In the Pacific Northwest in the 1980s, as old-growth forests became increasingly valued for habitat for endangered species such as the northern spotted owl, timber companies' access to these forests was restricted. If, instead, tenure holders are compensated for establishing and maintaining habitat, they will manage the forest resources in ways that encourage such non-timber outputs.

Recommendations for the United States

The federal timber sale policy in the United States is outdated and not adaptable to emerging demands for non-timber uses. It carries little incentive for long-term forest stewardship and management of multiple resources, including non-timber resources such as recreation. Public participation is limited to commenting on forest plans and environmental impact statements.

In comparison, the timber tenure system in British Columbia encourages a variety of approaches to forest management, incorporates different types of forest managers, and provides incentives for responsible, long-term forest management by the private sector. Community groups, timber interests, First Nations, and the B.C. Ministry of Forests and Range all participate in the timber tenure system in British Columbia.

Thus there is great potential for private management on publicly owned lands in the United States. A timber tenure system would create opportunities

for long-term stewardship and collaboration among a variety of groups. It would also relieve federal agencies of the current costly timber sale program.

It would be unnecessary to adopt the British Columbian tenure system as it exists and apply it to all federally owned forests in the United States. Only certain aspects of the tenure system would be chosen, and applied on a trial basis in discrete areas. U.S. federal lands could experiment with area-based licenses, or with community-based forests.

Worries about environmental degradation due to private management are unfounded. Examples from British Columbia show that long-term, area-based, renewable licenses encourage stewardship. Also, in the United States, private managers on public lands would still be subject to strict environmental regulations. Therefore, a high standard of environmental quality can be maintained.

In sum, demands for uses of public lands have shifted in the United States, and the timber program needs to adapt. Since timber production must co-exist with other forest uses, the timber sale program must incorporate a greater degree of flexibility. British Columbia offers many examples of how timber management on public lands can benefit from collaborative, community, and private management. ■

NOTES

1. USDA Forest Service timber revenues include timber sale receipts and appropriations (based on telephone conversation with Jim Culbert, staff budget assistant, USDA Forest Service, May 24, 2006).

2. The Forest Service, an agency of the Department of Agriculture, is the chief agency, but the Bureau of Land Management, part of the Interior Department, also produces timber.

3. The term “tenure” is an allusion to the medieval feudal land tenure system, under which tenants occupied land in exchange for services (Clogg 1999).

4. Fees vary with tenure, the quality of the timber, and accessibility to mills. Annual rents range from \$0.32/m³ to \$0.52/m³ (British Columbia Ministry of Forests and Range 2003). Stumpage fees, or fees for harvested timber, range from \$0.20/m³ to more than \$39.00/m³ (email communication with Ron Greshner, Senior Timber Tenures Forester, British Columbia Ministry of Forests and Range, April 27, 2005). Here and throughout, financial data are in 2005 US dollars, except as noted.

5. Telephone communication with Alex Ferguson, Chief Forester, Canadian Forest Products (Canfor), Vancouver, British Columbia, October 17, 2005.

6. Email communication with Dennis McPhail, Senior Timber Tenures Forester, British Columbia Ministry of Forests and Range, Victoria, BC, January 5, 2006.

7. All timber tenure holders in British Columbia are subject to the regulations of the British Columbia Forest and Range Practices Act (FRPA). This law establishes the requirements for planning, road building, logging, and reforestation.

8. The British Columbia Ministry of Forests defines site productivity as “the inherent capabilities of a site to produce or provide the commodities or values for which the area will be managed . . . that is, timber forage, recreation, fisheries, wildlife, and water” (British Columbia Ministry of Forests 2001). For a proxy for site productivity for timber, Zhang and Pearse use site class, which is based on tree height at a given age and expressed as either good, medium, poor, or low.

9. Two-tailed t-test 1 percent significance level.

10. Wald Chi-square 10 percent significance level.

11. Wald Chi-square 20 percent significance level.

12. Two-tailed t-test 10 percent significance level.

13. Reforestation includes planting and seeding. Surveys are used to determine stocking levels and appropriate reforestation methods. Site preparation refers to preparation for reforestation and includes brush removal through burning, chemical application, or mechanical removal. Stand maintenance is ongoing activity on estab-

lished seedlings or trees such as fertilization, brush control, and thinning.

14. T-test 99 percent significance level.

15. T-test 90 percent significance level.

16. The Coastal Fisheries and Forestry Guidelines were replaced by (and incorporated into) the Forest Practices Code of British Columbia in 1995 (Moore and Bull 2003).

17. T-test 20 percent significance level.

18. Telephone communication with Alex Ferguson, Chief Forester, Canadian Forest Products (Canfor), Vancouver, British Columbia, October 17, 2005.

19. Telephone communication with Alex Ferguson, Chief Forester, Canadian Forest Products (Canfor), Vancouver, British Columbia, October 17, 2005.

20. Email communication with Vincent Day, Silviculture Coordinator, Prince George Operation, Canadian Forest Products (Canfor), Prince George, British Columbia, November 2, 2005.

21. So far, price premiums in U.S. markets have failed to materialize (Cashore et al. 2004, 116; Forsyth et al. 1999; Fletcher et al. 2002), but environmental groups have succeeded in pressuring some of the larger retailers of wood products such as Home Depot into favoring certified wood in their purchasing policies (Fletcher et al. 2002).

22. Most tenures in British Columbia are allocated an Annual Allowable Cut (AAC), which is a harvest limit based on the principles of sustained yield. This ensures that maximum harvest rates do not exceed timber growth within a broad area. Overharvesting above the level of the AAC can be penalized by fines and reductions in future allowable cut levels. There is no minimum harvest level; tenure holders may choose not to harvest without penalty. Any unused portion of AAC cannot be carried forward to subsequent years, however (email communication with Dennis McPhail, Senior Timber Tenures Forester, British Columbia Ministry of Forests and Range, January 5, 2006).

23. Email communication with Paul Jeakins, Registered Professional Forester and former Manager, Arrow Innovative Forest Practices Agreement, Victoria, British Columbia, November 16, 2005.

24. Pronounced “E-sock,” Iisaak means “respect” in the native Nuu-chah-nulth language.

25. Telephone communication with Jessica Clogg, Staff Counsel, West Coast Environmental Law, Vancouver, British Columbia, September 22, 2005.

REFERENCES

- American Forests. 2005. *A Survey to Assess Perceptions of and Interest in Stewardship Contracting*. Online: www.pinchot.org/community/moneval/reports_publications/SC_perceptions_2005.pdf (cited May 8, 2006).
Online: www.perc.org/pdf/CanadianForest.pdf (cited March 17, 2006).
- Binkley, Clark S. 1998. Five Reasons why BC Needs More Private Land. Presented at the Private Landowners Association Annual General Meeting, June 5, 1998, Delta, British Columbia. Online: www.bcpf.org/Feature%20Essays/Binkley%20-5%20Reasons%20.pdf (cited March 21, 2006).
- British Columbia Ministry of Finance. 2004/05a. Office of the Comptroller General. Public Accounts 2004/05. Consolidated Revenue Fund Supplementary Schedules for the Fiscal Year Ended March 31, 2005. Online: [www.fin.gov.bs.ca/ocg/pa/04_05/SectionC.pdf](http://www.fin.gov.bc.ca/ocg/pa/04_05/SectionC.pdf) (cited May 24, 2006).
- . 2004/05b. Office of the Comptroller General. Public Accounts 2004/05. Consolidated Revenue Fund Extracts (Unaudited). Online: www.fin.gov.bc.ca/ocg/04_05/PA_2005_CRF.pdf (cited May 24, 2006).
- British Columbia Ministry of Forests. 2001. *Glossary of Forestry Terms*. Online: www.for.gov.bc.ca/hfd/library/documents/glossary/index.htm (cited January 27, 2006).
- . 2003/04. Volume of all Products Billed in 2003/04, by Region and Land Status. Detailed Statistical Tables for 2003/04, Table 9.2 (formerly listed at Table C-2b). Online: www.for.gov.bc.ca/hfd/pubs/docs/mr/annual/ar_2003-04/tables (cited February 6, 2006).
- . 2005. Ministry of Forests—Apportionment System: Provincial Summary Report. Online: www.for.gov.bc.ca/hth/apportionment/Documents/Aptr032.pdf (cited January 5, 2006).
- British Columbia Ministry of Forests and Range. 2003. *Annual Rent Regulation*. British Columbia Reg. 122/2003. March 28, 2003. Online: www.for.gov.bc.ca/tasb/legsregs/forest/faresgs/annrent/arr.htm (cited January 5, 2006).
- . 2005. 2005/06-2007/08 Service Plan Update Ministry of Forests and Range and Minister Responsible for Housing. September Update Budget 2005. September 14, 2005. Online: www.bcbudget.gov.bc.ca/2005%5FSept%5FUUpdate/sp/for/ (cited April 22, 2005).
- . 2006. *Timber Tenures in British Columbia: Managing Public Forests in the Public Interest*. Online: www.for.gov.bc.ca/hth/timten/documents/timber-tenures-2006.pdf (cited June 1, 2006).
- Burda, Cheri, Deborah Curran, Fred Gale, and Michael M'Gonigle. 1997. *Forests in Trust: Reforming British Columbia's Tenure System for Ecosystem and Community Health*. Report Series R97-2 (July 1997). Eco-Research Chair of Environmental Law & Policy. Faculty of Law & Environmental Studies Program, University of Victoria: Victoria, BC.
- Canfor Corporation. n.d. Sustainability Certification. Online: www.canfor.com/sustainability/certification (cited December 12, 2005).
- Cashore, Benjamin, Graeme Auld, and Deanna Newsom. 2004. *Governing Through Markets: Forest Certification and the Emergence of Non-State Authority*. New Haven, CT: Yale University Press.
- Chadwick, Douglas H. 2003. Pacific Suite. *National Geographic* 203(2): 104–28.
- Clary, David A. 1986. *Timber and the Forest Service*. Lawrence, KS: University Press of Kansas.
- Clogg, Jessica. 1997. Tenure Reform for Ecologically and Socially Responsible Forest Use in British Columbia. Master's Thesis. Department of Environmental Studies, York University, North York, Ontario, Canada. Online: www.wcel.org/forestry/11655 (cited March 21, 2006).
- . 1999. Tenure Background Paper. Presented at Kootenay Conference on Forest Alternatives: Forest Tenure Reform: A Path to Community Prosperity? November 4–6, 1999 Nelson, BC. Online: www.wcel.org/wcelpub/1999/13015.html (cited January 4, 2006).
- Cortex Consultants. 2001. *A Quick Reference: British Columbia's Timber Tenure System*. Victoria, BC. September 2001. Online: www.cortex.ca/TimberTenSysWeb_Nov2001.pdf (cited June 1, 2006).
- Demsetz, Harold. 1967. Toward a Theory of Property Rights. *American Economic Review* 57: 347–59.
- District of Mission Forestry Department. n.d. Tree Farm License 26 History and Background Information. Online: www.city.mission.bc.ca/AssetFactory.aspx?did=31 (cited April 26, 2006).
- Fedkiw, John. 1998. Managing Multiple Uses on National Forests, 1905–1995. FS-628. USDA Forest Service, Washington, DC.
- Fletcher, Rick., Mark Rickenbach and Eric Hansen. 2002. Forest Certification. Report EC1518. Corvallis, OR: Oregon State University Extension Service.
- Forsyth, Keith, David Haley, and Robert Kozak. 1999. Will Consumers Pay More for Certified Wood Products? *Journal of Forestry* 97(2): 18–22.
- Fretwell, Holly Lippke. 1998. *Public Lands: The Price We Pay*. Bozeman, MT: PERC. Online: www.perc.org/perc.php?subsection=9&id=134 (cited April 20, 2006).

- Haley, David and Martin K. Luckert. 1990. Forest Tenures in Canada: A Framework for Policy Analysis. Information Report E-X-43. Ottawa, ON: Forestry Canada, Economics Branch.
- Hardin, Garrett. 1968. Tragedy of the Commons. *Science* 162: 1243–48.
- Hayward, Jeffery, and Ilan Vertinsky. 1999. High Expectations, Unexpected Benefits: What Managers and Owners Think of Forest Certification. *Journal of Forestry* 97(2): 13–17.
- Iisaak Forest Resources. 2000. Our History. Online: www.iisaak.com/history.html (cited December 1, 2005).
- McCarthy, Tim, and John Chittick. 2003. Why We Should Privatize British Columbia's Forests. British Columbians for Private Forests. Online: bcpf.org/Feature%20Essays/why_we_should_privatize_bc.htm (cited May 10, 2006).
- Mission Municipal Forest. 2005. Information for Mission Municipal Forest and General BC Forestry. March. Online: www.city.mission.bc.ca/AssetFactory.aspx?did=218 (cited December 7, 2005).
- Moore, Keith, and Gary Bull. 2003. A Global Review of Guidelines, Codes and Legislation Pertaining to Fish-Forestry Interaction. Forest Trends and University of British Columbia: Vancouver, BC. Online: [www.rinya.maff.go.jp/code-h2003/PART_3/Gary_Bull\(Canada\).pdf](http://www.rinya.maff.go.jp/code-h2003/PART_3/Gary_Bull(Canada).pdf) (cited January 30, 2006).
- Natural Resources Canada. 2005. *State of Canada's Forests 2004–2005: Profiles Across the Nation-British Columbia*. Online: www.nrcan.gc.ca/cfs-scf/national/what-quoi/sof/sof05/profilesBC_e.html (cited February 6, 2006).
- Nicola-Similkameen Innovative Forestry Society (NSIFS). n.d. a. About Us. Online: www.nsifs.bc.ca/?f15=aboutus (cited December 6, 2005).
- . n.d. b. Vision and Strategic Objectives. Online: www.nsifs.bc.ca/?f15=object (cited December 6, 2005).
- . n.d. c. Plans and Accomplishments Objectives. Online: www.nsifs.bc.ca/?f15=plans (cited December 6, 2005).
- Sierra Club. 2002. Restoring America's Forests. Online: www.sierraclub.org/forests/report02/restoration_report.pdf (cited February 2, 2006).
- Stefanick, Lorna. 2001. Baby Stumpy and the War in the Woods: Competing Frames of British Columbia Forests. *BC Studies* (Summer): 41–68.
- USDA Forest Service. 2003. *America's Forests 2003 Health Update*. Online: www.fs.fed.us/publications/documents/forest-health-update2003.pdf (cited April 12, 2005).
- . 2004a. FY 2004 Stewardship Contracting Accomplishments. Online: www.fs.fed.us/forestmanagement/projects/stewardship/reports/documents/FY2004_Stewardship_Contracting_Accomplishments.pdf (cited January 4, 2006).
- . 2004b. Timber Harvested on the National Forests, FY 2004 Fourth Quarter. Online: www.fs.fed.us/forestmanagement/reports/sold-harvest/2004q4harv.html (cited January 4, 2006).
- . 2005a. Fiscal Year 2006 President's Budget Overview. Online: www.fs.fed.us/publications/budget-2006/fy2006-forest-service-budget-overview.pdf (cited January 26, 2006).
- Zhang, Daowei. 1996. The Effect of Forest Tenure on Environmental Quality in British Columbia. International Conference on Land Tenure & Administration. Orlando, Florida. November 11–14. Online: www.surv.ufl.edu/publications/land_conf96/zhang.pdf (cited December 15, 2005).
- Zhang, Daowei, and Peter Pearse. 1996. Differences in Silvicultural Investment under Various Types of Forest Tenure in British Columbia. *Forest Science* 42(4): 442–49.
- . 1997. The Influence of the Form of Tenure on Reforestation in British Columbia. *Forest Ecology and Management* 98: 239–50.