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Estimating Economic Costs of Nature Protection: British Columbia's Forest Regulations

by

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ABSTRACT

In British Columbia, regulations to protect nature have been implemented with little or no economic analysis. This paper provides an analysis of one set of regulations—BC's Forest Practices Code. Annual costs of the Code are estimated to be $492.4–$696.3 million. On the benefit side, recreation benefits are estimated to be $3.2–$12.6 million per year, while annual nonuse or preservation benefits could take on values from $85–$385 million. Social benefits are less than costs.

INTRODUCTION

In response to changing public values, the Government of British Columbia took steps in the early 1990s to protect public lands, of which it owns 95% of the Province's total. The NDP government elected in October, 1991, embarked on a number of initiatives to restructure the province's forest industry and its forest practices. It began already in 1991 with the Protected Areas Strategy (PAS), a key election promise to devote 12 percent of BC's land base to parks or ecological reserves. This was followed in early 1992 by the creation of the Commission on Resources and Environment (CORE), which was charged with finding a consensus on land-use issues, implementing PAS targets, and making recommendations about how land is to be used. Other initiatives included: the 1992 Timber Supply Review that re-examined the province's forest inventory and determined sustainable regional harvest rates to phase in the anticipated downfall in future timber supply; the 1994 Forest Practices Code that implements harvest guidelines for protecting biodiversity; a Forest Renewal Plan (1994) that aims to capture a greater share of potential forest rents, using them to train and re-employ displaced forest-sector workers; and a Forest Land Reserve (1994) for Vancouver Island that prevents private forestland owners from putting forestland into competing uses. While the PAS, timber supply reviews and the Forest Practices Code are expected to reduce the allowable annual cut (AAC), the Forest Renewal Plan and Forest Land Reserve (and other forest zones in other regions) are designed to increase future timber availability.

Implementation of these regulations has proceeded with a minimum of economic analysis. The costs and benefits of the regulations are poorly understood. One exception is the Forest Practices Code; the government published two background papers examining, respectively, ecological aspects (Dunster 1993; Kimmins 1993) and economic costs (Saunders 1993). BC's Council of Forest Industries (COFI 1994) also estimated potential costs of the Code. More recently, Haley (1996) re-visited the cost issue, concluding that both Saunders and COFI had under-estimated the likely costs to BC residents. Finally, a consultant's report (McIntosh et al. 1997) released in April 1997 examined the effect of the Code on logging costs. But no attempt has been made to estimate the non-timber amenity values that the Code seeks to protect. The

purpose in the remainder of this paper is to provide a comprehensive economic evaluation of BC's Forest Practices Code that includes both a re-evaluation of costs and estimates of the potential (non-timber) benefits. Details of the methodology are provided in van Kooten (1996).

COSTS OF BC'S FOREST PRACTICES CODE

The major economic costs of implementing the Forest Practices Code are measured by lost surplus in the markets for stumpage and wood products. In the stumpage or forest-level market, the value of stumpage generally exceeds the marginal cost of extracting the resource because of resource scarcity, with fibre available for harvest in any given period regulated by the AAC. This results in a scarcity rent associated with existing stands of natural and mature trees that grew without human intervention and a differential rent (producer surplus) that results from investments in stand tending and harvesting—the non-scarcity component of the overall land rent (van Kooten 1996). Together these constitute the economic rent accruing to the trees growing in the forest. The Code affects both components of rent by reducing the regulated harvest.

In the wood products market, BC faces a horizontal demand for pulp, lumber and other wood products, although reductions in fibre supply might raise world prices for some wood products (e.g., softwood lumber) because of BC's market power. This response is likely to be short lived, however, as higher prices stimulate supply from other producing regions, technical advances and greater use of non-wood substitutes. A reduction in fibre will reduce producer surplus in the wood products market, as measured by the difference between world price (horizontal demand) and marginal cost over the range of the output reduction.

A common error is to include the cost of excess capacity brought about by the reduced flow of fibre to sawmills and pulp mills. Excess capacity may impose a financial hardship on a firm, but no real economic cost to society as the mill investment constitutes a sunk cost. Another error is to count changes in economic activity, as measured by a reduction in gross domestic product (GDP), as a real economic cost of reducing available fibre. Resources leaving the forestry sector as a result of government regulations should find their way into other sectors, thereby reversing the decline in GDP attributable to reduced forest-sector output. As long as the economy is reasonably fully employed (causes of unemployment are structural in nature),

presumed changes in GDP (e.g., as measured with an input-output model) really constitute an income transfer rather than an economic cost.[1] However, transaction costs of re-deploying resources to other sectors are real and, in some regions, might be high but difficult to determine.

Although measuring the economic costs associated with the Forest Practices Code is difficult, it is possible nonetheless to gain some insight into the magnitude of these costs. The various costs are examined below.

Foregone Economic Rent

Saunders (1993, p.9) and Haley (1996) identify the reduction in AAC as the most important cost of implementing the Code. Current provincial AAC is 72.1 million m^3—22.3 million m^3 on the Coast and 49.8 million m^3 in the Interior (Saunders 1993, p.13). Implementation of the Code is projected to reduce the AAC by 10 to 20 percent, although a more recent analysis suggests it might be as low as 6% for the first ten years after implementation of the Code (BC Ministry of Forests 1996).[2] Economic rent includes returns to fixed capital, surplus captured by unions (if any), and government stumpage fees, rents, taxes and royalties. The scarcity rent amounts to roughly $\$25/m^3$, although it varies from one year to the next (van Kooten 1996); McIntosh et al. (1997) estimate that the average stumpage fee in BC in 1996 was $\$24.94/m^3$. However, this rent is not available in perpetuity because, as firms harvest more and more second growth timber, the available scarcity rent falls since second-growth logs are worth less. It is assumed that only half of the $\$25/m^3$ of rent is available after 30 years. Using a 4% discount rate, the $\$12.50/m^3$ available after 30 years can be converted into a perpetuity equivalent of $\$8.65/m^3$. In that case, the net adjusted annual surplus is $\$21.15/m^3$. Multiplying this surplus by the reduction in AAC determines the economic value of the lost timber—a cost of \$152.5–\$305.0 million per year, depending on the reduction in AAC.

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[1]If some cyclical employment were accepted, an option might be to shadow price labour.

[2]The largest reductions in AAC (nearly 10% in the short term) are expected in the Vancouver Forest Region. Since this region is most important in terms of potential non-timber benefits, the current analysis relies on assumed "across the board" AAC reductions of 10% and 20%.

Increased Harvest Costs: Lost Differential Rent

As a result of increased costs of road building (more roads need to be built under the Code), road maintenance, changed logging practices, planning and administration, and so on, harvest costs will increase. Harvest costs are expected to rise by $\$3.00/m^3$ as a result solely of increases in road construction costs (COFI 1994, p.2–8). To this must be added $\$0.88/m^3$ for increases in other operating costs (see Saunders 1993, p.14; COFI 1994, p.3–24). Harvest costs will increase by a further $\$0.25/m^3$ when AAC is reduced from 10% to 20% (as less is harvested per given area). It is assumed, therefore, that average harvest costs will increase by $\$3.88/m^3$ if the AAC is reduced by 10% and by $\$4.13/m^3$ if the AAC is reduced by 20%. Then the increase in harvest costs is about \$248.6–235.2 million per year; harvest costs are lower for a 20% reduction in AAC because the amount of timber to be harvested is lower as well. This turns out to be the highest cost associated with the Forest Practices Code.

The estimates provided here are likely on the low side. Some studies indicate that practices such as selective harvesting would increase costs by much more. In that case, the increase in harvest costs would be greater than the loss due to foregone timber benefits. Using data on harvest costs from Price Waterhouse, Haley (1996) suggests that the Code has increased harvest costs by $\$10/m^3$ on the Coast and by $\$8/m^3$ in the Interior. Using survey data from 94 operations within BC, 36 of which were on the Coast, McIntosh et al. (1997, p.6) estimate the Code-related cost increases to be $\$8.41/m^3$ in the Interior and $\$19.68/m^3$ on the Coast, for a weighted average of $\$12.22/m^3$ for all of BC. It appears, therefore, that the cost estimates provided above underestimate the true increased harvest costs by a factor of 2 to 3.

Loss of Producer Surplus in the Wood Products Market

There is no readily available information to estimate the loss in producer surplus in the wood products market from a reduction in AAC. A reduction in AAC will mean that mills might have to obtain logs or fibre elsewhere (e.g., from Alberta), resulting in increased costs. It could also lead to reduced output, which results in excess capacity and higher per unit costs as fixed costs are spread over a lower output. Increases in excess capacity are the result of inappropriate plant investments, but such investments constitute fixed costs and these are unrelated to

estimates of economic costs in a welfare sense—they are "water under the bridge." However, a reduction in output does lead to a loss of producer surplus. The annual loss of producer surplus is estimated to be $95.4 million for a 10% reduction in AAC and $192.5 million for an AAC reduction of 20% (see van Kooten 1996). If the remaining life for plants is 10 years and using a 4% discount rate, this translates into annual losses of $31.0–$62.5 million in perpetuity, which equals the total annual costs due to loss of producer surplus in the wood products' markets.

Increase in Government Administration Costs

Saunders (1993, pp.16–19) estimates the increase in costs to government to implement the Code to be $49.0–$71.0 million annually. These cost estimates may be low if overhead costs by the Forest Renewal BC (FRBC) are any indication. FRBC is a publicly-owned corporation created in 1994 and charged with investing forest resource rents of some $500 million per year back in the forest sector. Overhead amounts to some 40% of expenditures (Hamilton 1997).

Social Adjustment Costs

While job losses and consequent reductions in forest sector wages are important considerations in formulating policy, these do not comprise an economic cost in the true sense. Many displaced forest sector workers will find jobs at lower pay, but this constitutes an income transfer not an economic cost (van Kooten 1995). However, there are economic costs brought about by the displacement of forest sector workers. These are the costs of job search, retraining and moving, plus the psychological costs on workers and their families, and costs associated with, for example, increased alcohol abuse, crime and so on. Merchants and other businesses in forest dependent communities face similar costs, while the federal and provincial governments incur added costs in administering unemployment insurance and welfare schemes. (The actual payments made under these programs are a form of income transfer and not an economic cost.) The social adjustment costs are difficult to measure and, in the case of forestry, no data are readily available. We simply assume a one-time cost of $10,000 per worker, which is probably on the low side. Given 1.57 workers per 1,000 m^3 (Price Waterhouse 1993) and an employment multiplier of 2.5, the social adjustment cost amounts to $283.0–$566.0 million. On an annualized

basis using a 4% discount rate, the social adjustment cost is $11.3–$22.6 million.

Lost Nonmarket Amenities

While the benefits of implementing the Code will be primarily nonmarket in nature, there will be lost amenity values because there will be "negative public reaction to coarse woody debris" that results from implementing the Code (Saunders 1993, p.10). There may also be a need to restrict certain types of public access to some sensitive ecological regions and such restrictions will reduce the well-being of some citizens. These and other such costs are not quantified here—they are assumed to be negligible.

Other Costs

Reductions in the supply of BC wood fibre could raise world prices, at least in the short term. This increases the welfare of producers (including government) because rents will be higher for the AAC that remains available, but consumers are worse off. However, price increases are likely to be ephemeral as timber from other regions is brought onto the market (e.g., mills in the BC interior now import logs from Alberta and Saskatchewan) and substitute products are developed. Some of the increase in supply may come from regions that are ecologically more sensitive than BC and, to the extent that such areas are valued by BC residents, this constitutes a cost. Substitute products may be less friendly for the environment than wood products, with the environmental damage that they cause also attributable to the Code. These costs (and benefits) are difficult to trace and value, and are assumed to cancel one another.

A summary of the aforementioned costs, as well as estimates of costs provided by Saunders (1993) and COFI (1994), is provided in Table 1. The economic costs of implementing the Code, as estimated here, are $492.4–$696.3 million per annum, and fall between the estimates provided by Saunders (1993) and by COFI (1994) and Haley (1996). While Saunders includes an estimate of the benefits of higher prices, he neglects to take into account rents forgone. COFI and Haley, on the other hand, include as costs items that are more properly considered to be income transfers. It should also be noted that, if the estimates of increased harvest costs indicated by Haley (1996) are correct, then the cost estimates provided here are

more likely on the order of $740–$930 million per annum. If the reduction in AAC is 6 percent rather than the 10 to 20 percent assumed here, then the annual costs are on the order of $300 million, or close to the Saunders' estimate. On the other hand, McIntosh et al. (1997) focus only on harvest operations, ignoring many of the social costs that interest economists.

Table 1. Estimated Annual Costs of Implementing the Forest Practices Code ($ millions)

Item	10% AAC Reduction	20% AAC Reduction
Cost of foregone economic rents	152.5	305.0
Increased harvest costs	248.6	235.2
Lost producer surplus in wood products	31.0	62.5
Increased government administration costs	49.0	71.0
Social adjustment costs	11.3	22.6
TOTAL	**492.4**	**696.3**
Saunders' (1993, p.19) estimate	304	486
COFI (1994, p.1–30) estimate	1,136	1,933
Haley (1996) estimate[a]	1,400	

[a] Based on a 6% reduction in AAC

BENEFITS OF THE FOREST PRACTICES CODE

The costs of the Forest Practices Code need to be set against benefits, and these are primarily nonmarket. Measurement of nonmarket benefits and their use in analyzing public policies is often neglected in BC. The only available estimate of nonmarket benefits is by Meyer Resources (1994), but this study confounds benefits and expenditures. Meyer Resources equates expenditures by tourists with benefits, and compounds the error by making this measure of benefits an increasing function of added vegetation that is assumed to result from implementing the Code. Expenditures by tourists are not benefits because they ignore the costs of providing the services that generate the tourist dollars.

Rather, the primary economic benefits of implementing the Code are those related to use (recreation) and nonuse (preservation). It is not clear that recreation benefits will even be positive as there may be restrictions on access and/or the types of activities that can be pursued (e.g., hunting, motor homes, all-terrain vehicles and snowmobiles may be banned). Further, the Code's regulations require that coarse and woody debris be left on harvested sites, and this has a

negative impact on visual and other amenities. Ignoring these factors and using data on recreation benefits from the BC Ministry of Forests (1991), van Kooten (1996) estimated recreation benefits associated with the Code to be some $3.15 million to $12.60 million per year.[3]

Preservation benefits from the Code may also be limited even though these should be the most important benefits of implementing the Code. The reason is that many of the attributes that the Code seeks to protect are already available through other programs that the BC government has implemented, including the Protected Areas Strategy (BC Ministry of Forests 1992). Estimates of the nonuse benefits of the Code must rely on forest preservation values as these are the only data available. Vold et al. (1994) provide evidence that suggests the marginal value of wilderness preservation beyond 12% of the land base is almost negligible. In addition, BC is relatively sparsely populated so nature preservation benefits are bound to be limited. Including benefits to those outside the Province, or outside Canada, results in methodological (and measurement) issues beyond the scope of the present discussion.

Van Kooten (1996) provides estimates of the nonuse benefits associated with the Forest Practices Code under various assumptions about household willingness to pay for protection of nature and public perceptions about the attributes of forests to be protected. Data on nature protection are based on information from contingent valuation (CV) studies of spotted owl habitat in the US Pacific Northwest and wilderness set asides in BC.[4] In BC, survey respondents were asked to value "wilderness." Wilderness includes ice fields and mountaintops—terrain that is inhospitable for both humans and wildlife—and areas covered with mature forests (including ones previously harvested). Evidence from Watson (1994) indicates that some respondents do value wilderness in this sense, but others conceive of wilderness only as areas covered with

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[3]The recreation benefit data from BC Ministry of Forests are the only such data available as there has been little work (with notable exceptions in the areas of hunting and fishing) on estimating such benefits in BC, despite the supposed importance of recreation to the Province.

[4]One reviewer asked what wilderness had to do with the Code, which specifies constraints and limits on timber harvest. Unfortunately, as noted, preservation data for wilderness and species are all that is available. However, requirements to protect riparian areas and species habitat result in protection of the same attributes as those protected by programs such as PAS.

mature forest. These perceptions affect estimates of the Code's nonuse benefits.

A summary of preservation benefits attributable to the Forest Practices Code is provided in Table 2. Estimates of nonuse benefits range widely, depending on assumptions about what households are actually willing to pay for wilderness protection and about how survey respondents conceive of wilderness. If respondents to CV surveys conceive of wilderness in the narrow sense of areas covered with mature timber, estimates of the benefits tend to be higher by a factor of about four. However, the most important consideration is whether marginal benefits are assumed constant (with the assumed value given in Table 2) or determined as a downward-sloping function that allows marginal (but not total) willingness to pay (WTP) to fall to zero (denoted in Table 2 by "declining"). When marginal WTP is assumed constant, annual nonuse benefits of the Code range from \$84.8–\$169.7 million for a low value of WTP to \$192.6–\$385.3 million for a high WTP (assuming respondents conceive of wilderness in the narrow sense). Of

Table 2. Estimated Annual Nonuse Benefits of BC Forest Practices Code, 1992, \$ Millions[a]

Concept of Wilderness[b]	mature	mature	mature	mature	broad	broad
WTP for PAS level[c]	\$136	\$168	\$300	\$300	\$300	\$136
Marginal WTP[d]	\$32	declining	\$70.59	declining	\$70.59	\$32
Coast						
AAC reduced by 10%	71.09	8.61	156.81	18.91	—	—
AAC reduced by 20%	142.17	8.61	313.62	18.91	—	—
Interior						
AAC reduced by 10%	13.75	18.34	35.82	40.45	—	—
AAC reduced by 20%	27.50	18.34	71.65	40.45	—	—
TOTAL						
AAC reduced by 10%	84.83	26.93	192.63	59.36	47.13	21.36
AAC reduced by 20%	169.67	26.93	385.27	59.36	94.25	42.72

[a] Reductions in AAC are those assumed to be attributable to implementation of the Code. We assume there are 1.5 million households in BC.

[b] Individual household WTPs for wilderness benefits are assigned to area on the basis of mature forest area ("mature") or wilderness area more broadly defined ("broad"). The latter includes mountain tops, ice fields, land with scrub brush, etc.

[c] Assumed WTP for 12% wilderness protection. Low value is based on a BC government study (Vold et al. 1994), while high value is based on US studies of spotted owl and Watson (1994).

[d] The Forest Practices Code results in PAS-type benefits over and above those of PAS. Marginal WTP for those benefits is assumed constant or declining.

Source: van Kooten (1996)

course, it is very likely that marginal WTP will eventually fall to zero, because otherwise it would imply that there is no maximum that respondents would be willing to pay to protect wilderness.

DISCUSSION

The annual costs of the Forest Practices Code are estimated in this study to be $492.4–$696.3 million depending on whether AAC will fall by 10% or 20%. More recent studies indicate that they might be higher. On the benefit side, recreation benefits are estimated to be $3.2–$12.6 million per year, while annual nonuse or preservation benefits could take on values from $85–$385 million. Based on this, perhaps crude, analysis, it would appear that the estimated costs of BC's Forest Practices Code exceed environmental benefits.

Much to the consternation of environmental groups, the Government of British Columbia recently recognized the high costs that the Code imposes on forest companies and has, therefore, altered the Code (Hamilton 1996; Corcoran 1997). What has brought about these contortions in government policy? The government is charged with managing public forestlands (of which it owns some 95% of the BC total) to provide both public goods (wildlife habitat, watershed functions, scenic amenities, recreation, *etc.*) and private goods (commercial timber). Elected officials respond to political pressure which results in good will and more votes. Concern by the public and environmentalists led to the Code's implementation to begin with. But when the financial health of forest companies and forest-sector employment were threatened by the high costs of complying with environmental regulations, the government then sacrificed the interests of one stakeholder (environmentalists) in favour of those of another (forest-sector companies and workers) by changing the regulations. As the landowner, the government has a huge stake in the financial health of the companies because stumpage fees are a major source of revenue. Again, this explains a relaxing of environmental regulations (see Brubaker 1995). Non-elected officials, on the other hand, are generally not rewarded for good management, while the costs of poor management are minimal. Altruistic benefits are likely the only benefits that most government officials derive.

Does the analysis reported in this study provide support for the government's decision to

relax the Code's environmental regulations? It would appear so, but only to the extent that the nonmarket values and analysis presented here are realistic. Given the paucity of available information on nonmarket benefits, it might be wisest to rely on the political process, whereby the results of this study are only one piece of information to enter that process.

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