The Price of Compromise: Why We Should Wind Down Our Forest Industry

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L'industrie forestière canadienne fait face à deux problèmes majeurs. Biologiquement, la liquidation de la forêt boréale naturelle et son remplacement par un nombre limité d'autres essences de même âge poussant dans la même région risquent de réduire la biodiversité et de changer les systèmes climatiques et d'écoulement des eaux. Économiquement, le lent taux de croissance de la forêt boréale implique que l'investissement dans le reboisement n'est pas très intéressant. Mais sans reboisement, nous allons manquer de bois dans quelques décennies. Des points de vue biologique et économique nous devrons donc apporter des changements majeurs à notre industrie forestière pour conserver une portion suffisante de la forêt naturelle de façon à s'assurer d'avoir les ressources nécessaires à la régénération à long terme de nos forêts si nos efforts de reboisement échouent. Ceci va comporter un changement vers un approvisionnement en bois de haute qualité et vers des utilisations de la forêt qui permettent de la conserver.

Canada's forest industry faces two major problems. Biologically, the liquidation of the natural boreal forest and its replacement by even-aged stands of a limited number of species poses major risks of reducing biodiversity, and changing climatic and water-flow patterns. Economically, the slow rate of growth of the boreal forest means that any investment in replanting makes little sense, but without replanting we will run out of wood in the next few decades. On both biological and economic grounds, then, we need to make major changes in our forest industry, specifically by retaining sufficient portions of the natural forest so that if our attempts at artificial regeneration fail, we will have sources for the long-term natural regrowth of our forests. This will entail a shift in focus to high-quality wood supplies, and to an increased emphasis on the non-consumptive uses of the forest.

Recent developments in the Canadian forest industry indicate a growing awareness that drastic changes are needed in forest policy. The announcement by MacMillan Bloedel that it was moving from clear-cutting to more environmentally sensitive logging techniques (WTS 1998; also *The Globe and Mail* 1998*a*; Martin 1998), and provincial government changes intended to better protect ecosystems (Ontario 1995; British Columbia 1994) reflect heightened consumer concern in world markets over the long-term destruction of forests (Abramovitz 1998, p 53; *The Globe and Mail* 1998*b*). It is not yet clear, however, whether these changes represent a genuine shift in the attitudes of those who make policy, or are simply an attempt to placate critics while continuing to place the extraction

of wood from the forest as the predominant value (Howlett and Rayner 1995; Wildlands League 1998). This paper examines two key problems with Canada's present forest policies: first, that they do not give sufficient weight to the ecological risks involved, and second, that they provide a substantial public subsidy to the forest industry. To overcome these problems, I propose a major scaling down of the industry and a change in its harvesting techniques.

With some four million km^2 of forest area, Canada has the second-largest forest estate in the world, some 10 percent of the world total (Cayford 1990). Canada was one of the first signatories to the Convention on Biological Diversity, which attempts to maintain the world's biodiversity, and has been a leading force for a global forestry convention, which in theory would put all the world's forest harvesting on a sustainable basis. Unlike most tropical forests, Canada's forest areas are not coveted for clearing by land-hungry farmers; they are primarily regarded as sources of wood fibre, with recreation, hunting and trapping, and watershed protection as secondary uses.

All of Canada's major forest regions are currently being heavily logged, although this is a relatively recent phenomenon in many areas. While much of the Maritimes, the pines of southcentral Ontario and Quebec, and parts of the British Columbia forest had been logged for a century or more, the move toward present-day volumes could not occur until the advent of the chainsaw in the 1950s and a series of later technological developments such as the skidder, the feller-buncher, and other means of speeding up the harvesting of trees (Swift 1983, pp. 131-42). These technological developments have pushed the forest industry toward large-scale clear-cutting, which now is the technique used for about 90 percent of all logging in Canada. How recent this expansion has been is suggested also by the fact that approximately 90 percent of all logging still takes place in areas that have not previously been commercially cut (Canada. Environment Canada 1995).[1]

The Biological Implications of Present Forestry Practices in Canada

Ecosystems are complex networks of interdependence among organisms, the workings of which we are just beginning to understand. For example, it is only recently that we have come to understand the workings of the symbiotic relationship between certain types of root fungi and coniferous trees, which provide the fungi with sugars in exchange for the fungi's superior ability to gather inorganic nutrients from the soil. A critical part of this relationship is the role played by rodents such as flying squirrels, which feed on the fruits of the fungus and in doing so, spread the spores to new areas (and thus to new roots of conifers) through their faeces (Maser 1990, pp. 22-36). The squirrels, in turn, need the cavities provided by old dying trees which characterize the mature or "old growth" forests. Thus, for a healthy growth of new conifers, the forest needs a supply of those older trees that foresters call "over-mature."

Even though we do not fully understand the dynamics of forest ecosystems, Canada's wood-producing provinces are in effect conducting a massive experiment whose results may affect much of the world. This experiment involves cutting most of the boreal forest and replacing it with a limited number of commercially valuable tree species. The unknown elements in this experiment include not just the question of whether the limited range of trees that are planted to replace the natural forest will produce as much wood as that forest, but also whether the world's climate, atmospheric carbon dioxide, water flows, and biodiversity will be altered by converting natural forest ecosystems to simplified, almost agricultural ones.

Overlaying this experiment is the even more massive one being conducted — again largely unwittingly, by all the world's industrial powers — to see what long-term effects acid rain, changes in both ground-level and stratospheric ozone, and global warming have upon life on earth (Schneider 1997). Despite widely hailed agreements to curb sulphur

emissions, the overall impact of acid rain has at best been stabilized at levels substantially above what most ecosystems can handle (MEE 1998, p. 4; Nikiforuk 1997). Upper atmosphere ozone depletion continues, with a resulting increase in ultraviolet radiation, while the major industrial powers have not yet managed to move toward reducing their emissions of greenhouse gases even to 1990 levels, levels that would push us toward global warming. While these phenomena are beyond the power of any one country alone to deal with, they still will likely have long-term negative effects upon the ability of forests to grow at present rates, and quite probably upon the dynamics of forest ecosystems. For example, studies suggest that continuing high levels of acidification of the soil will reduce the numbers of soil-enriching micro-organisms and essential nutrients such as calcium and magnesium, while increasing the uptake of elements that have harmful effects on trees (Likens, Driscoll and Buso1996; Schulze 1989); and global warming seems likely to increase the incidence of both forest fires and pathogens in the boreal forest.

Even apart from these larger problems, some current techniques of industrial forestry give grounds for concern. The scale of clear-cutting means that very large contiguous areas of our boreal forest are comprised of immature stands (< 40 years old), which in turn means that organisms which depend on old growth forest are disappearing over these areas. Furthermore, we have no idea how our concentration on replanting only conifers of commercial value will affect the overall functioning of our forest ecosystems, although we can say that because the process of clear-cutting does not emulate natural forest replacement processes such as forest fires, it is unlikely to produce the same kind of ecosystem as the natural one that preceded it (Pielou 1996; Heinselman 1981).

Clearly we need some baseline areas against which to evaluate the long-term effects of these changes, as well as a source from which to replenish species extirpated through these practices. Such baseline protected areas need to be large enough to sustain viable populations of all species living in them, up to and including top predators such as wolves and grizzly bears, which means that they need to be several thousand square kilometres in extent. Yet according to the Canadian Council of Forest Ministers' statistics, only some 3.6 percent of "productive" forest land[2] is presently protected by the federal and provincial governments (CCFM 1997, Table 1.1). With the exception of Wood Buffalo, no national park that is predominantly forested contains as much as 4,000 km^2, and most are under 1,000 km^2. Furthermore, even if we do succeed in setting aside more substantial areas for permanent protection, if we do not modify our treatment of the areas around them, these will become "biological islands," surrounded by a sea of habitat which is unsuitable for the range of species and genetic variations that comprise the biodiversity of a natural boreal forest (see e.g., Buchert *et al*. 1997; Mikusinski and Angelstam 1998), which means these "islands" over time will also lose biodiversity (Shafer 1990, esp. 111-19, 137-40). We might also note that the whole theory of islands' re-population by chance migration of organisms implies the continuing existence of "continents" from which these organisms can come; if all the mature boreal forest is reduced to a series of biological islands, with no vaster ecosystem to provide a reservoir of species, there is nothing to offset the local random extinctions that will occur (Harris 1984, p. 89).

Within the productive forest, changes in methods of logging in recent decades have had largely negative effects on the ability of forests to regenerate themselves. "Whole-tree logging," in which a tree's branches are stripped at the roadside so that very few nutrients return to the soil in which the tree grew, has become widely used, as have the herbicides intended to eliminate nitrogen-fixing alders and other plants seen as competitors to the desired pine and spruce. The long-term effects of these practices on food chains and other aspects of the ecosystem are still unclear, although one effect is almost certainly an impoverishment of the soil and thus a slowing

down of tree growth. We should also note the concern, now being voiced, that by mimicking hormones some pesticides may be disrupting the embryos of a wide range of species at critical stages of their development, with long-term effects on the perpetuation of these species (Colborn, Dumanoski and Myers 1996).

From a biological point of view, then, we are highly likely to see major changes in our boreal forest ecosystems, such as an overall drop in biological diversity and a decreased growth rate for commercially valuable trees, as well as shifts in weather patterns and in flows of fresh water throughout the country, including the Great Lakes basin and the salmon rivers of British Columbia. We should also note that some of these effects are essentially irreversible; species once extinct cannot be brought back, and ecosystems take tens of thousands of years to evolve. We are, in short, gambling the future of both our forests and the ecosystems based on them in a huge experiment whose outcome will not be known for at least a century.

An ironic aspect of this situation is that Canada has been a world leader in promoting the Treaty on Biological Diversity, with its commitment to maintaining the full range of indigenous species of plants and animals present in a country. While there are no sanctions attached to this treaty, and few other governments would be in a position to censure Canada for failing to honour this commitment, there is a worldwide constituency of scientists and environmentalists in whose eyes Canada would suffer a substantial loss of credibility. We also have other treaties such as the Migratory Birds Convention with the United States whose subjects will be affected by the outcome of our forest experiment.

The Economics of Forestry in Canada

Forestry is Canada's second largest resource-based industry, providing some $16 billion in output, or nearly 3 percent of our GDP, and some 370,000 direct jobs. Some three-quarters of the lumber and nearly 90 percent of the newsprint is exported, with the United States being by far our largest customer. It is an industry which is significant in almost every province, particularly in hundreds of small, somewhat isolated communities. At the same time, in the pulp and paper sector ownership is concentrated in the hands of a few large companies. Ownership of lumber operations is more diversified, but the location of jobs means that both paper and lumber industries can wield formidable lobbying power.

The forests themselves are for the most part owned by provincial governments, which lease cutting rights on varying terms to the companies (Haley and Luckert 1992). The responsibility for managing the forests thus generally rests with government forestry departments. At present, all provinces except British Columbia spend more each year in forest management (including fire protection) than they collect in royalties from logging (CCFM 1997, Tables 7.3 and 8.1). See Table 1.

Even if we say that half the cost of fire suppression is to protect communities rather than timber stands for future harvesting, on a current balance sheet, all provinces apart from British Columbia are selling their forests at less than cost, or in other words, subsidizing the forest industry.

Since all provinces claim to be operating "sustainable" forest programs, which implies that they want eventually to be able to cut further crops of trees, we should consider not just their current balance of revenues and expenditures, but also the replacement cost of their present forests. We have already noted that biologically speaking, there is a substantial risk that a second-growth replanted tree farm will not replace the natural forest; however, let us assume that for the purpose of providing fibre, the plantation is a sufficient substitute for the natural forest. The question here is whether it makes economic sense to create such plantations.

If we plant a preferred species today, such as black spruce or jackpine in the east, or ponderosa

TABLE 1
Amounts Spent on Forest Management, and Revenues Received, Selected Provinces, 1994
(Public Expenditures Only, in $millions)

Province	*Expenditures*	*(of which fire protection)*	*Revenues*
	$	$	$
British Columbia	489	(124)	1,884
Alberta	125	(53)	69
Ontario	238	(58)	181
Quebec	280	(27)	89
All Canada	1,393	(371)	2,279
Excluding BC	904		395

Source: Canadian Council of Forest Ministers (1997), Tables 7.3 (expenditures) and 8.1 (revenues).

pine or Douglas fir in BC, it will take at least 50 years to grow to pulp log size and from 80 to 120 years to grow to lumber size. If we assume no inflation, a reasonable return for money invested in a very low-risk investment over such a period would be about 3 percent. However, an investment with such a long time horizon faces a wide range of risks, such as fire, diseases, and changes in consumer demand or in public attitudes, which might well require a much higher rate of return. Even a modest risk premium of (say) 5 percent raises the cost of an investment considerably, as Table 2 shows.

If we take the average cost of replanting a hectare of softwood in northern Ontario, about $1,200, as representative of replanting cost, and at the end of 80 years are able to harvest an average yield of about 200 m^3/ha (Nelson 1997), we have had to make an initial investment of $6.00 for each m^3 harvested. If we want a return of 5 percent, we need to recoup just under $300 per m^3 in stumpage fees. In Ontario in 1997, the average stumpage fee per m^3 was about $15 (Ontario. MNR 1997). Even in the moister and milder British Columbia coastal forests, where present yields from old growth can run to 600-800 m^3/ha, a replanted forest in 80 years would do well to provide 400 m^3/ha, since by that age trees would seldom be more than 30-50 cm. diameter, so we would need to recoup at least $150 in stumpage fees alone. As of June 1998 the BC coastal stumpage rate was $24.97 per m^3. (British Columbia. Ministry of Forests 1998). As Paul Samuelson observed years ago, if the interest rate and rent on the land involved in replacing our natural forest were borne by the forest industry, forest companies would be bankrupt (Samuelson 1976, p 471). The industry is quite aware that replanting makes no commercial sense (Johnson 1997); as far as possible, they leave this investment to taxpayers, who are thus subsidizing any future for the forest companies. The policy question for governments is whether this long-term subsidy to the forest industry yields sufficient public benefits to justify its cost.

In economic terms, the argument generally made is that the taxes and wages paid by the forest industry more than make up for any cost to the taxpayers. Most economists would respond, however, that while

TABLE 2
Return on Investment

If a tree costs $1.00 to plant today, how much would a provincial government need to recoup at harvesting time to justify this investment?

	Rate of Return on Investment		
Time to Harvest	*3% p.a.*	*5% p.a.*	
15 years	$1.56	$2.08	(tropical rotation)
50 years	$4.38	$11.47	
80 years	$10.64	$49.56	(Canadian planned rotation)
120 years	$34.71	$348.91	

this may be true in the short run, resources would be more efficiently employed if they were shifted to industries that needed no subsidies. Furthermore, these benefits are only obtained by using up the forest asset, an asset whose successful replacement is not at all certain. On economic grounds, then, the best that can be said for current pricing of the forest resource is that it provides a temporary cushion until more sustainable activities can be developed.

By biological and physical criteria, our present approach to forest management is even more questionable. If we could get a supply of wood and still maintain the benefits a standing forest provides (for example, maintenance of streams and aquifers, carbon sequestration, protection of fish habitat, recreational opportunities, wildlife biodiversity) we could justify not charging forestry companies the full cost of managing and regenerating the forests. Unfortunately, present forest management methods provide almost none of these benefits (Maser 1990, esp. pp. 53-102). Large-scale clear-cuts contribute to rapid runoff of snow melt in the spring (and thus contribute to acid shock in fish spawning grounds just when eggs are hatching), reduction of water infiltration into aquifers, silting of fish spawning grounds, loss of species diversity, and loss of recreational opportunities for fishing, most types of hunting, skiing, canoeing, hiking, and photography. Even the alleged benefit of carbon sequestration from new growth has been shown to be non-existent, because of the release of large amounts of carbon when old growth forests are cut (Harmon, Ferrell and Franklin 1990).

There are alternatives to present management methods which would provide considerably more of the non-timber values of the forest at only a moderate increase in timber costs. One proposal is the "long rotation" put forward by Larry Harris (1984, pp. 127-44), which would involve planning logging operations over a period of approximately 320 years instead of the 80-year rotation currently promoted by foresters. Under this scheme, logging could still be done by clear-cutting, but in a mosaic pattern so that there were always contiguous blocks of older growth forests (oldest growth plus immediate successor), with approximately two-thirds of the total area comprising forest older than 100 years. In this way species dependent upon old growth would be able to populate new areas and establish themselves before their old habitat was destroyed; and if the clear-cuts were modest in extent (say no more than ten hectares) most blocks would regenerate themselves without replanting. However, this approach would require comprehensive planning for large areas over a time span almost an order of magnitude greater than any planning anywhere in recent history, as well as a commitment to keep such areas as production forest. It seems doubtful that successive governments over such a length of time could be counted on to maintain such commitments.

Another option is to move immediately to a more micro-managed system of harvesting. If we were to use selective cutting which left a proportion of mature seed trees of the desired species, or to small-scale (< 1 ha) patch or strip cuts, which come close to emulating natural blow-downs or fires, the volume of wood cut would be somewhat reduced, and the cost of cutting would increase.[4] Forests whose management has been regarded as exemplary for long-term sustainable yield, such as Merv Wilkinson's property on Vancouver Island, and the Haliburton forest in Ontario, seem to have produced over an 80-year rotation rather less wood than an initial clear-cut would have produced.[5] Against this have to be set three important advantages: first, that the lumber produced is much higher quality than what would be produced on an 80-year rotation; second, that the forest is continuously available for other uses such as recreation; and third, that there is no cost for replanting, and far less uncertainty about how the forest will regenerate.

Since a fairly large proportion of Canada's wood pulp will likely be replaced over the next few years by increased recycling of paper, by the coming on-stream of larger amounts of tropical pulp (Marchak 1995, pp. 6-8), and probably also by the replacement of wood pulp with fibres such as hemp and

kenaf (Rosmarin 1997), the decrease in wood volume from a switch to these more sustainable methods of obtaining fibre may not be so serious as it appears. Where we still will have a product that is in demand is in larger softwood logs capable of providing wood for housing construction, plywood, and furniture, with any fibre for pulp coming essentially as a by-product from lumber mills. Under a regime of selective cutting or patch or strip cuts, the cost of replanting would be negligible, which would more than offset the higher labour costs involved. This suggests that selective cutting is probably the wave of the future, the more so because if it is carefully done, and does not just remove all the best specimens of desired species, the forest from which logs are taken can continue to provide all the other benefits I have noted above. While selective cutting clearly modifies these areas, and since we need a baseline of old growth which has not been so modified, selectively logged areas can still maintain a significant proportion of a forest's biological values.[6]

While the total cost of obtaining lumber under such a system would not be much greater than at present, there would be a shift in costs from the public sector (*viz*., most replanting costs) to the forest companies. There would also be a major cost in the transition from present methods to small-scale, community-based operations, mainly because of the retraining costs involved in redeploying workers both in forests and in factories. Total employment probably would not go down, since thinning and logging operations would be much more labour-intensive (see M'Gonigle and Parfitt 1994, pp. 59-105; also Hammond 1991, pp. 240-43), but the kinds of skills needed would be considerably different, and it is doubtful that pay rates could remain at present levels, particularly if most remaining forest operations and lumber mills were small-scale private businesses. However, present policies have seen a steady reduction in forestry jobs in recent years and more are projected for the future. Overall employment in logging from 1975 to 1995 dropped from 53,622 to 44,659 (Canada. Natural Resources 1998, Table IV-3); and a federal study in 1993 predicted that in the pulp and paper sector, which had already dropped from 84,000 to 68,000 from 1975 to 1993, an additional 15,000 to 20,000 jobs would disappear as older mills were closed (Price Waterhouse 1993).[7] Furthermore, a study of the Rocky Mountain areas in Canada and the United States showed that the communities with the greatest increase in jobs in recent years have been those that have moved away from extractive industries to a wide range of other activities — from ecotourism and retirement homes to light manufacturing and service industries (Rasker 1998).

Social Implications of Present Industrial Forestry

One feature of forestry workers throughout North America is that, as dwellers in small towns necessarily remote from major urban centres, they tend to feel marginalized and undervalued by the dominant urban elites (Dunk 1994; also Dumont 1996). While they tend to enjoy natural surroundings and the recreational hunting and fishing that these make possible, and while they frequently are concerned about the environmental damage caused by industrial forestry techniques (Dunk 1994, pp. 20-23), they have little sympathy for city environmentalists who appear briefly and display limited understanding of life in a small resource-based community. Many forestry workers have been recruited into "Wise Use" and "Share the Forest" movements which aim at perpetuating the status quo. Despite some evidence that protecting wilderness increases an area's prosperity more than does resource exploitation (Rasker 1998), forging alliances between forestry workers and environmentalists against the impact of industrial forestry has been difficult, since it is seldom the forest workers who gain the benefit of this prosperity.

Basic decisions in the forest industry — how much wood to cut, how to cut it, how many people to employ, and whether to invest more in Canada or seek opportunities elsewhere — are made essentially

by the owners of paper and lumber mills, subject only to conditions prevailing in their markets and whatever constraints governments choose to place on their activity. Through their ability to decrease the level of their investments if they do not get their way, paper and lumber mill owners are in a much stronger position than any other stakeholders in the forest community. Unlike forestry workers, they can choose whether or not to stay in a particular province or even in Canada. Also, because of their status and economic importance, they have far easier access to political decisionmakers than do environmentalists.

Other business interests tend to play relatively minor roles in determining the fate of the forests. Tourist lodges dependent upon an intact forest for hunting, fishing, and non-consumptive activities are relatively small players compared to the forestry companies,[8] while trapping and commercial freshwater fishing are carried on mainly by marginalized (largely aboriginal) groups. Recreational users of the forest also are limited in their economic significance, and can to some extent be fobbed off with a few protected areas such as provincial wilderness parks.

Against this we do find a widespread unease among the public over environmental matters generally, and specifically over various forest practices such as clear-cutting. For example, an Environics Environmental Monitor survey in 1988 found just under 45 percent of respondents replying to the question "How well do you think our forest resources are being managed to ensure adequate supplies of trees in the future?" said "not very well" or "poorly" (Environics 1988). Another survey in 1994 asking whether respondents preferred clear-cutting or selective cutting as the primary method of logging found 81percent opposing clear-cutting, while 52 percent disagreed with the statement that more trees could be cut in their province (Environics 1994). Such attitudes suggest that there is a substantial constituency that could be mobilized in favour of reducing the scale of forestry, but that it needs to be organized.

What Forest Policies Should We Pursue?

One option for political decisionmakers is to ignore long-term sustainability and continue to maximize wood output by present methods, which clearly are "efficient" from the forest companies' viewpoint, so long as they do not have to pay the full costs. As long as the natural forest lasts, which could be for another 40 or 50 years at present rates,[9] this approach probably could maintain Canada's place as a major wood producer, provided that the pulp component had not been supplanted by cheaper supplies from elsewhere. After the accessible parts of the natural forest have all been logged, of course, the decrease in volume would be dramatic and most of the forest industry in Canada would disappear, but this is an eventuality well beyond the time frame of most politicians.

A second option would be to continue the liquidation of the natural forest through present techniques, but at a slower rate, so that new plantations would (perhaps) be available by the time the old growth was all gone. This would produce a gradual reduction of the workforce, and a decline in the role of the forest industry in Canada's economy, but the patterns of production and range of occupations would not need to change greatly. If human activities could be carried out without regard for natural constraints, this option would offer a long-term future for the industry and all those dependent on it.

Unfortunately, the forest industry cannot operate free from biological constraints; more clearly than most sectors of the economy, it is imbedded in the world's natural ecosystems.[10] To liquidate our natural forests would be to gamble that the changes in global temperatures, water runoff, and loss of species would not cause problems for Canada, and that the managed forest that we seek to put in its place would provide the essential benefits that we desire.

A third option, then, would put more emphasis on the biological impacts of forestry, and would seek to reduce these impacts substantially (see e.g.,

Hammond 1991; Maser 1990). Specifically, a biologically sound policy would include the following actions: (i) stopping all cutting of old growth forests in the Acadian, St. Lawrence, southern boreal, and British Columbian coastal forests, and setting aside adjacent areas that could mature into old growth forests; (ii) in the remaining forest regions, setting aside large tracts of about 10,000 km^2 in unlogged forest; and (iii) in the areas still open for logging, requiring the use of far less ecologically disruptive methods, such as patch cutting and selective cutting, so that most attributes of forest ecosystems would continue to exist.

Such policies would bring about a substantial reduction in the amount of wood available for pulp and lumber, although their effect on employment would be less drastic, since they would involve a shift to small-scale patch- and shelter-belt cutting, with much less use of large capital-intensive machinery; logging operations would have to be carried out by more labour-intensive methods. A large number of paper mills and some sawmills would be forced to close, to bring capacity into line with the available supply. Some large companies would undoubtedly wind down their investment in Canada and decamp to other countries, assuming they could find countries still willing to provide them with either original or plantation forest at a cheap price. What would be left would be an industry focused much more on high-quality wood, a larger proportion of which would be used as lumber rather than pulp, and in which there would be a good deal of pressure to promote more value-added re-manufacturing.

To enumerate the interests affected by such policy changes is to see why they are unlikely to be adopted. The case for scaling back requires a major shift in values to give much more weight to maintaining biodiversity and much less concentration on those aspects of the forest ecosystems that have immediate economic benefits. Because of the complexity of ecosystems, the biological arguments for conservation simply cannot be expressed with the same degree of certainty as the economic arguments for immediate exploitation. Furthermore, the scientists and others concerned about the risks of forest liquidation do not have nearly as ready access to the political decisionmakers as do those seeking immediate economic benefits (Wilson 1990). About the only factor pushing political decisionmakers to adopt this precautionary approach is the diffuse concern among much of the public that somehow we are not managing our natural heritage very well, a concern that provides support for environmental groups working to protect specific areas such as Clayoquot Sound or Temagami, but which needs to be much more fully organized if it is to be translated into votes at an election.

The present policies have the support of the major players. The forest companies are very clear about what they want: as much wood as they can get, as cheaply as they can get it. In this they are supported by most of the professional foresters in provincial forestry departments, and to the extent that these goals help provide jobs, by most of the forestry trade unions. They are also helped by the mind-set of many politicians, who believe that economic growth is good, and that the best way to achieve growth is to make full use of our natural resources. Against this, any plea to reduce the level of forest cutting is seen not just as a threat to particular jobs and local prosperity, but as a deviation from the industrial world's whole way of life.

We have, in short, a well-organized, specifically focused interest working within existing patterns of thought versus a diffuse, less well-organized one which questions some of the basic assumptions of society.[11] Even when politicians heed the concerns expressed by scientists and environmentalists, their inclination is to balance these against the economic concerns of the forest industry. The danger is that this compromise will produce irreversible long-term damage to whole bio-regions. We simply do not know what portion of the existing biodiversity of these remnants will survive, or what the consequences will be, although clearly there is a high probability of significant environmental costs.

Given the long-term risks inherent in our present policies, a more prudent approach would be to maintain substantial portions of existing ecosystems at least until policymakers were certain that they understood all the consequences of changing these ecosystems. However, since those interests benefiting from the status quo are concentrated and working within the dominant paradigm, their pursuit of short-term gains will likely continue to win out over any broader but more diffuse long-term societal interest.

NOTES

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[1]Elizabeth May's recent book, *At the Cutting Edge*, provides details on rates of cutting, logging techniques, and supplies of timber across all the provinces and territories of Canada. See May (1998).

[2]"Productive" means "capable of growing merchantable timber within a reasonable time," that is, most forest apart from the stunted growth near treeline, around rocky outcrops and acid bogs, etc.

[3]Costs of replanting a hectare in northern Ontario are estimated to range from $800 to $2,500, depending on the terrain and the amount of preparation needed, with $1,200 being about the average cost. Yields per hectare also range widely, with black spruce and jackpine on Class 3 land giving about 130 m^3/ha, while on Class 1 land they give about 250 m^3/ha of pulp logs (Nelson 1997).

[4]A study in British Columbia found that the costs of patch cutting and "green tree" cutting (leaving a limited number of seed trees) was 10 percent more than the cost of large clear-cuts, while a shelterwood cut leaving 150-200 trees per hectare (about a quarter to a third of the trees) cost 38 percent more (Phillips 1996, pp. 10, 13). This, however, did not take into account the cost of replanting, which would be considerably less for any of these techniques than for large clear-cuts, nor did it put any value on the environmental benefits of these methods, all of which have substantially less impact on natural ecosystems.

[5]The Haliburton forest of some 20,000 hectares takes out some 7,500 m^3, or 0.375 m^3/ha. annually. Over 80 years, therefore, it provides some 30 m^3/ha of high-quality lumber. If it were clear-cut, it might yield as much as 200 m^3/ha, although much of this would be from immature trees rather than prime old growth. Wilkinson's property has yielded 135 m^3/ha over the past 55 years, with no diminution in the volume of standing timber. Over 80 years, then, he can expect 240 m^3/ha. If he had clear-cut initially, then waited 80 years for a first rotation, he might obtain 300-400 m^3/ha on the first rotation. For the Haliburton case, see Wildlands League (1996); for Wilkinson's property, see Loomis (1995).

[6]Andrew Johns has shown that in tropical forests, low-intensity selective logging does not seem to have negative effects on most plants and animals (see Johns 1985). In our coniferous forests, some animals that are sensitive to human intrusion — such as wolverines and woodland caribou — might be affected, but this could be met by ensuring that large blocks of forest remain untouched.

[7]In fact, to 1997 the drop in employment in the pulp industry was only about two-thirds of what Price Waterhouse had anticipated (see Canada. Natural Resources 1998, Table I-1); however, they had also noted that Canadian productivity was only about three-quarters that of their counterparts in the southern United States (p. 74), which suggests that when a slump does hit the industry, many less productive mills will close.

[8]While Statistics Canada's data on tourism and travel does not allow us to single out those tourists seeking natural surroundings, we can use as a minimal surrogate for this figure the number visiting national or provincial parks, some 6.6 million or 4.8 percent of all trips in 1996 (Statistics Canada 1996, Table 6). If we were to assume that these visitors generated proportionate amounts of tourism expenditures and employment, they would account for some $2 billion, and some 23,600 jobs

(Statistics Canada 1997, Tables 1, 21). Tim Gray of the Wildlands League has provided me with a more direct calculation from the Northern Ontario Tourism Outfitters, who estimate that in Ontario some 15,000 jobs are created by remote tourism, lodges and outfitting, although most of these jobs are seasonal (Gray 1997). Logging in Ontario employed 10,000 people in 1994, while the wood and paper industries employed 30,000 and 47,000 respectively (CCFM 1997, Table 8.1); nearly all of these would be full-time jobs. While it could be argued that the wood and paper industries could draw their wood supplies from outside Canada and thus maintain employment, given the distance to alternative sources of wood this seems unlikely.

[9]The total "productive forest" in Canada is estimated at 245 million hectares. If we continue to cut at the present rate of about one million hectares a year, and to lose about 1.5 million hectares a year to fire and insects, we would appear to have enough natural forest for another 100 years (CCFM 1997, Tables 3.1, 4.1). However, this calculation takes no account of (a) increased rates of logging, which went up by 164 percent from 1975 to 1995 (Canada. Natural Resources 1998, Table I-1); (b) the steady move of commercial logging northward into smaller trees; and (c) the probability that global warming will increase the incidence of forest fires, insect attacks, and diseases.

[10]A number of economists such as Kenneth Boulding and Herman Daly, have argued for some time that our economic calculations need to consider the value of natural services. A recent attempt to quantify these services is that provided by Costanza *et al*. (1996).

[11]This situation resembles what James Q. Wilson called "client politics," where those benefiting from a policy are concentrated and well-organized, whereas those who pay the cost are widely scattered and the individual costs are small. While the costs to the public in this case could be substantial, two further factors tilt the balance even more toward the beneficiaries: the time over which the costs will have to be paid, and the uncertainty as to what the ultimate bill will be. See Wilson (1980, pp. 369-70), as well as his observation that new technologies could produce a shift in the balance by allowing diffuse interests to become better organized (pp. 385-86), which has certainly been the case with the environmental movement.

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