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Challenges to temperate forest stewardship—focusing on the future

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Too many participants in the current forest policy debates—stakeholders, media, politicians, and resource professionals—appear focused on the past rather than on the future. Major economic and social changes are dramatically altering the context within which forest policy will be created and implemented. Equally important are shifts in the types and intensities of challenges that we face in sustaining critical forest functions—such as protection of watersheds—and forest biodiversity.

In North America and many other regions of the world, stakeholders and politicians continue to fight the resource war of the 20th century—preservation versus exploitation. These battles are familiar and comfortable. But the major challenges of the 21st century are not likely to repeat those from the previous century. Few of the forest policy debates, alliances, and ‘solutions’ of the 20th century are likely to be relevant to these new challenges.

Society—by continuing to focus on old issues—is also failing to recognise the fundamental changes that are occurring our interrelationships with native forests, including the human stewardship necessary to assure the continued health and functioning of native forests, and their declining role as sources of wood products. In this essay I share my perspectives on some of the important circumstances and issues regarding forest resources that national and global societies must address in the 21st century. The focus is primarily on temperate regions and the developed world. Because of the variety of social and economic factors, the challenges of tropical forest policies are currently and likely to continue to be very different from those affecting temperate and boreal regions.

Globalisation of the wood products industry

Globalisation of the wood products industry is, I believe, the most significant factor influencing the developing context for forest stewardship. Technology and globalisation of the world marketplaces are creating a new model for production of the bulk fibre needed to provide for the mass markets in wood products, such as paper and common wood construction materials.

The global marketplace, with its emphasis on moving activities to areas where lowest per unit cost of production can be achieved, fits perfectly with basic corporate goals. Consolidation also appears to fit the global paradigm so we can expect that a few very large, international, publicly traded corporations will increasingly dominate global markets in wood products. The goal of these corporations is to maximise their return on investment; hence, the net present value model will continue to dictate corporate forestry practices just as it has for at least 50 years. Net present value is the discounted values of the revenues and costs from the use of forest resources over time and allows investors to compare returns from different forest resource investments as well as with returns from alternative investments. Maximising net present value is, consequently, taken as the overall goal for forest management under this model.

Technological developments in forestry—as well as the fortuitous discovery of some unusual biological potentials—fit very well with the goals of global corporate forestry. First, there has been the recognition of the extraordinary production potential of some exotic tree species—initially, some pines and later (with development of appropriate pulping processes) eucalyptus species—on temperate, subtropical, and some tropical sites, primarily in the southern hemisphere. Second, there has been the increasing potential for enhanced production using bio-engineered trees—initially by traditional breeding methods and more recently by direct manipulation of genes.

As a result of these developments, corporate forestry is moving to an agronomic model of wood fibre production and away from traditional forestry models. In effect, the move is towards the development of fibre farms in which intensively managed ‘fields’ of engineered poplars, exotic pines, and eucalypts are grown on short rotations of two or three decades—perhaps eventually in only a single decade. Adoption of the agronomic model has many advantages from the corporate perspective including much shorter investment cycles, high efficiency in per unit production costs, and reduced environmental constraints, since societies often have fewer expectations of farms—including fibre farms—than they have of areas that are clearly forests.

Temperate and subtropical regions of the southern hemisphere are primary sites for the development of corporate forestry’s fibre farms for many reasons (Marchak 1995). Locations include Australia, New Zealand, Chile, Argentina, Uruguay, southeastern Brazil, and South Africa. Productivity of exotic species is extraordinary on many southern hemisphere sites, often at the very upper limits of known wood production. Many of the sites have been previously used for agriculture or grazing so costs of preparing sites or mitigating environmental impacts is often low. The ability to use efficient equipment for tending and harvesting the plantations substantially reduces labour costs. Furthermore, labour and other production costs, including those related to environmental concerns, are typically lower in many countries at lower and southern latitudes than in North America and Europe.

The implications of these new opportunities for corporate investment in fibre production are inevitable. Few, if any, forest sites in the northern hemisphere can compete directly with fibre farms in the southern hemisphere even in terms of biological productivity, let alone total cost of production. Only the very best of the forest sites in the northern hemisphere can approach the productivity levels of exotic plantations in the southern hemisphere. When you add in the costs of labour, taxes, and environmental mediation in North America and Europe the advantages of investing in agronomic wood

fibre production in the southern hemisphere are very large. Indeed, the only advantage of north temperate forests appears to be in their proximity to large markets; unfortunately, transportation costs for finished products are typically not a high proportion of the total cost.

Hence, following trends in global production and marketing of the last several decades we can expect that corporate wood production is going to continue to move (1) to the agronomic model and (2) primarily to southern latitudes. It is inevitable based on the imperative of maximising return on investment. Please note that this shift is not about exporting North American or world demand for wood fibre to ‘third world countries’ that ‘do not know how to manage their forests and have no environmental laws or regulations’ as suggested by some observers. Also, generally we are not talking about cutting down native forests in order to provide space for exotic plantations, although this has occurred in the past. The majority of these plantations are on abandoned agricultural or grazing lands. Furthermore, these developments are not likely to significantly affect the fate of tropical forests. Over 85 per cent of the tropical tree harvest used for wood products is used in-country and does not enter world trade; the only significant global market for such wood is in environmental rogue states, such as Japan, China, Taiwan, and South Korea. These shifts in the locale and techniques for the wood products industry *are* the consequence of corporate decision-making based on standard business models and practices. These current developments have made a major contribution to the current glut of wood fibre in the global marketplace. They are likely to continue to provide excessive amounts of wood, at least until the consequences of the shift to fibre farming are fully recognised and appropriate adjustments are made. We can expect that there will be a significant competitive ‘sorting out’ among countries and regions that are heavily invested in fibre farming; factors affecting the outcome will include relative productive capabilities and total costs of production. Substantial improvements in productive capacity and reductions in costs of production can be expected in subsequent generations of fibre farming as a result of genetic modifications (traditional and genetically engineered) of the farmed species and technological developments in harvesting and processing.

Significant competitive ‘sorting’ among fibre farming countries and regions is likely to occur with these and other developments. In any case, the new-age fibre farms will certainly have the capacity to meet and grossly exceed global needs for bulk wood fibre for the next century, even in face of the rising global population. They can do so, efficiently and almost certainly without any need to use native forests, except as a source for particular specialised and valued wood products that cannot be mass produced under a short rotation agronomic regime.

Consequences of globalisation for stewardship of native forests

So, isn’t it a good thing that we can provide for the wood fibre needs of the world without having to manage any of our native forests? Certainly many participants in global and national forest policy debates think so. Substituting fibre farms for cutting in native forests has been a primary goal on environmentalists in Australia for well over a decade. New Zealand took its native forests ‘off the table’ as a matter of national policy over a decade ago to the joy of most environmentalists.

There are many stakeholders—institutional and individual—that favour ‘solving’ all our global forest policy debates by substituting exotic plantations for wood production from forests of native species, whether of primary or secondary status. These stakeholders span the spectrum from the wood products industry to hardcore environmentalists and are united in their desire to disengage from the intense conflicts over native forests that characterized the 20th century.

However, a major shift in the global wood products industry from forests and plantations of native species to fibre farming using exotic and bio-engineered species in southern latitudes creates an incredible array of new challenges for society. These include issues of:

- land ownership and use in an environment with decreased potential for economic return from those lands
- stewardship of public forest lands, including provision of the financial resources needed to monitor, protect, and appropriately manage these lands
- the health of the rural communities that are located within forested regions.

For example, in a region like northwestern North America, what will happen to private forest lands, especially the large corporate holdings, when forestry is no longer a profitable enterprise on these lands? Who will acquire them and for what purposes? How will those purposes fit with primary societal needs, such as maintenance of high-quality, well-regulated streamflows or secondary needs, such as open space for recreation and wildlife habitat?

On public lands, where are we going to get the financial resources needed to carry out essential stewardship and how are we going to maintain the skilled woods work forces that will be needed to do this work? How can we retain a capacity to process wood removed from these lands—a capacity that I believe will be important to achieving stewardship objectives on both private and public forest lands. What about the local communities whose fate is strongly linked to that of the forest? And trusts that depend on income from forest lands?

Most temperate forest regions are already struggling with the impacts of massive change, including globalisation, whether or not the ultimate dimensions of the change have been recognised. Some regions, such as the northeastern United States, have already had to cope with the departure of corporate forestry and the disposition of the large tracts of forest that they owned. Societal efforts in such regions to retain forest landscapes and values in the face of such changes provide valuable examples of both the challenges and potential solutions.

The complexities of all of these issues, including some of the potential solutions, are beyond the scope of this essay. However, one issue that I would like to address a little more thoroughly is the need for active management of native forests to maintain native forest function, biodiversity, and health, especially on public lands. As noted above, many stakeholders appear to believe that ‘preserving’ all native forests resolves

our major forestry conflicts and allows us to return their management to ‘nature’. I do not agree.

A ‘solution’ to forestry issues that divides the world’s forests into fibre farms and native forests—the former to supply all of our wood products and the latter categorically ‘preserved’ from active management—I view as potentially dangerous for the temperate native forests of the world. In my view human society will need to be continuously engaged in active management of many native temperate forests even when they are no longer used as a source of wood products. I believe that the proffered ‘solution’—fibre farms and preserves—will often lead to undesirable outcomes for native forest function, biodiversity, and health and, consequently, the failure of these forests to fulfill the expectations and needs of human society.

The need for active management of forests

So, why do we need to be concerned about our commitment and capacity to carry out active management of native temperate forests? One very important set of reasons is that we have so altered the physical and biological context from those in which the native forests evolved. A second category of important reasons relates to the societal goals that we are setting for our native forest landscapes—for example protection of watersheds and maintenance of native biodiversity—that are clearly not likely to be met with *laissez faire* management.

Alterations in the physical and biological context for temperate forests are immense and numerous including:

- altered fire and other disturbance regimes
- altered regional and global environmental regimes, including climatic and chemical changes, such as those associated with acid rain
- introductions of exotic organisms, including virulent insect and disease pests, and other fauna and flora that damage, destroy, and compete with native biota
- fragmented landscapes in which both the amount and spatial pattern of specific forest conditions have been drastically altered.

There are *no* areas of our native temperate forests that are not significantly influenced by these altered physical and biological conditions. And the impacts of altered physical and biological conditions will intensify throughout the 21st century!

Altered fire and disturbance regimes

The issue of disrupted fire regimes provides an outstanding example of the need for human beings to be continuously involved in stewardship of extensive areas of temperate forest. Pre-modern human societies were very effective at modifying natural fire regimes by increasing the number, locales, and timing of ignitions. Modern human societies have been very effective at altering fire regimes in many forest regions by suppressing natural wildfire.

Forest landscapes in western North America provide an example of where natural fire regimes have been dramatically modified during the 20th century. This has been

accomplished through a variety of activities including suppression of natural fires, logging of mature and old trees, and active management to create dense ('fully stocked') stands of young trees.

The effects of such activities have been particularly profound in the pine and mixed-conifer forests that evolved under a regime of frequent, low to moderate intensity wildfires (Agee 1993, Sierra Nevada Ecosystem Project 1996, Quigley 1996).

In these forests, fire suppression has been very effective over the short and mid term. Suppression has resulted in increased stand densities, increased fuel loadings, and greater continuity in fuels (ground-to-crown and crown-to-crown). In many forests, shade-tolerant tree species have largely replaced the shade-tolerant pioneer tree species that are important ecologically and have greater fire resistance. The potential for uncharacteristic stand replacement fires is now very high in many of these forests, putting native forest biodiversity and functions (such as watershed protection) at risk.

Active management of these forests is required to restore and maintain these ecosystems if they are to provide the conditions and services expected by local and global human societies. The negative consequences of allowing wildfire to return to these forests without prior treatment, such as by simply suspending fire suppression activities, will often be large and unacceptable. Uncharacteristic stand replacement fires would be a common consequence, resulting in dramatic and uncharacteristic changes in forest composition, structure, and function, including regulation of water and nutrient cycles, and maintenance of habitat and populations of endangered species.

Treatments to significantly reduce forest fuels and protect the resilient older trees are necessary prior to re-introduction of fire to many of these forests. Mechanical removal of fuels will often be desirable or necessary. There are also practical and social limits on prescribed fire that will make it impossible to burn all these forests with sufficient frequency to deal with fuel build-ups. There are social issues related to smoke management, and practical issues related to suitable burning periods and availability of trained crews, for example. Hence, significant continuing programs of mechanical treatment, including removal of fuels (logging?), are likely to be necessary in many areas.

Environmental change and exotic pests and pathogens

Detailed cases can be made for the importance of continuing active stewardship in native forests with regards to other stewardship challenges, such as environmental change and exotic pests and pathogens. For example, climate changes predicted for the 21st century are going to result in massive geographical shifts in locations of sites that provide optimal and tolerable environments for many temperate forest species; forest communities and types are going to shift locales and even disappear in some. Transitions will often be traumatic, involving stress, accelerated mortality, and even catastrophic loss of existing forests. Relatively rapid climatic shifts and fragmentation of the forest landscapes will make it difficult for migration of native ecosystem components (from fungi to trees) to occur with sufficient rapidity. Opportunities for replacement of native species with undesirable exotic organisms will be enhanced.

Introductions of exotic organisms—from virulent insects and diseases that attack dominant trees to exotic animals and plants that displace native species and alter ecosystem structure and function—represent an extraordinary danger to native forests. Introduction of virulent new forest insect pests and diseases is, in my view, the greatest

single threat to the native forests of the world, although regional and global environmental changes will often accentuate problems with pests. This is because exotic pests can so affect a tree species that both its current and future contribution to ecosystem function is effectively 'lost', even when the species is not rendered totally extinct. The effective loss of major tree species is *not* a hypothetical problem! The serious and often catastrophic impacts from introduced pests and pathogens are evident in every temperate forest region of the world. Few native forests have been affected more than those of North America where the litany of exotic pests and pathogens and affected or extinguished tree species is long and getting longer. Consider, for example, white pine blister rust (on all five-needled pines), Dutch elm disease (on American elm), beech bark disease (on American beech), gypsy moth (on many species), *Phytophthora lateralis* root rot (on Port-Orford cedar), and woolly adelgid (on eastern hemlock). Introductions of new pathogens with immense potential to modify native forests appear to be accelerating; the Sudden Oak Death epidemic in California is an extraordinary and as yet not fully assessed example.

Why would any rational society continue to allow the movement of live woody plants, unprocessed wood products (such as logs and wood chips), or untreated wood products (such as green lumber) between continents given this continuing and uncontested history of introductions? Furthermore, the potential for movement of pests and pathogens between continents presents as great a threat to the fibre farms on which we are going to become dependent for our wood products as it does to the native forests. The exotic tree species that are the basis of fibre farms initially left behind many of their native pathogens but some of the native pests are already 'catching up' with their host species at their new continental locations.

It is imperative that global society halts the intercontinental movement of live plants, unprocessed wood (logs and chips), and wood products that have not been treated (for example, heat dried or chemically treated). Of course, not all the pests are going to be insects and diseases affecting woody plants. An entire treatise could be written about problems created by introductions of other categories of animals (possums in New Zealand, for example) and higher plants and exotic predators (such as scotch broom and gorse in North America and Australia). Suffice to say that such introductions and naturalisations have caused and will continue to cause major modifications of ecosystem composition, structure, and function. These modifications will often be undesirable from the standpoints of maintaining native forest function and biodiversity or of achieving other societal goals.

Perhaps the most relevant point here is that the impacts of changes in environment and introduction of exotic organisms make active management programs imperative. These programs must include substantial efforts and investments in monitoring, research, and resource protection. Furthermore, active management in modifying structure or composition or both is typically going to be necessary to maintain the societal goals for native temperate forest ecosystems.

Fragmented landscapes and degraded ecosystems

Active management of many temperate forest landscapes is also required to restore conditions that will meet societal goals related to goods and services. For example, many of our temperate forest landscapes, including terrestrial and aquatic ecosystems, have

been significantly altered by timber management. Native forests have been harvested, dense regeneration stands have been created and managed, extensive networks of roads have been created, and so on. Shifts in management objectives may require restoration of more natural conditions.

For example, federal legislation has shifted management priorities on national forest lands from timber production to conservation of native biodiversity. In northwestern North America, most of the national forests within the range of the northern spotted owl, a flagship of old-growth species, have been undergoing significant clearcutting for at least 50 years. Old-growth forests are often highly fragmented. The new management goals for these forested areas call for restoring large contiguous blocks of such forest and sooner rather than later. Hence, significant silvicultural activity is ongoing (and much more is proposed) to treat young forest stands in order to accelerate the development of forest structure characteristic of late successional forest stands.

The diversity of potential scale of management activities to restore terrestrial and aquatic function and structure is very large. While we have much to learn about restoration techniques and their effectiveness, there is no question that active management will sometimes be necessary and will often be very effective in reestablishing desired structural and functional conditions.

Stewardship of our future forests: recapping the challenge

My goal here is to encourage recognition and discussion of changes in the global wood products industry and the potential impacts of these changes on management of native forests and related human societies. The global wood products industry is moving swiftly towards an agronomic model of economically efficient wood fibre production based on plantations of exotic and, eventually, genetically modified trees grown on short rotations based largely in the southern hemisphere. One consequence will be a drastic reduction in the importance temperate native forests for wood products.

Our reduced dependence on native forests for wood production is viewed by many stakeholders as an opportunity to ‘solve’ our forestry problems by preserving all or most of the remaining native forests, primary or secondary. Many environmentally oriented stakeholders appear to assume that active management or manipulation of these forests will not be necessary to maintain appropriate functions and biodiversity—that is, that we return these forests to nature and natural processes.

I do not believe that division of the temperate forest estate into fibre farms and reserves is likely to achieve societal goals with regard to the essential goods and services provided by these systems. Active management of many native temperate forests will be essential because of alterations in physical and biological conditions caused primarily by past and current human activities. In effect, passive approaches to management of the many of our native forests—depending on unfettered nature do the job—will lead to unacceptable outcomes from the standpoint of societal goals, including maintenance of native biodiversity.

Forest stakeholders (and most of us are), decision-makers, media, and the general public need to increase their awareness of the fundamental changes that are occurring in the wood products industry and the potential consequences for maintenance of native forest ecosystems, biota, and ecological functions. The evolving societal context, which has the superficial appearance of resolving forest management conflicts, actually creates

a whole new series of forest-related societal challenges. These include a clearer definition of our goals for these forests, threats to their integrity in the 21st century, and societal recognition and acceptance of the stewardship responsibilities, including how we will pay for this stewardship.

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