

# **EXPERIMENTAL TENURES IN THE FACE OF RAPID CHANGE**

**Dr. Bruce Fraser, Chair, Forest Practices Board  
Address to the Western Silviculture Contractors Association,  
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The province is already making significant changes in the pattern of forest tenures by expanding the types of holdings, the groups that are eligible for tenures, the magnitude of timber allocation and the range of resource production opportunities that are considered legitimate. The Forest Revitalization Plan is bringing Forest and Range Agreements into place with First Nations and providing allocations to communities under Community Forest Pilot Agreements. In addition, the allocations to BC Timber Sales have the potential to reach many smaller tenure holders. These changes, while often limited by economic size, resource value, duration, or spatial definition they represent directional change. To date these allocations are largely a response to demand for increased share of commercial opportunity. They could become the leading edge of a more fundamental demand for increased capacity to adapt to environmental change.

I have been proposing the expansion of the number and types of tenures. Some could be dedicated to ecological restoration of damaged forest areas, some to exploitation of non-timber forest products, and some to more comprehensive use of the full array of forest resources. These emerging tenures should be spatially defined, have enough flexibility to respond to varying markets, have specific objectives for biophysical restoration and have commitments to sustainability. When I first made such suggestions it looked like the un-salvaged portion of the extensively beetle damaged, pine dominated forests, created the opportunity to experiment with tenure models without infringing on existing forest allocations. Much land was going to need active restoration to meet future forest resource needs. I quickly found that the northwest US states were already offering “restoration contracts” and that local foresters had harboured such ideas for a long time, albeit in vain.

More recently, I have been impressed with the mounting evidence for accelerating climate change and indications of the many and varied consequences. While economic diversification for First Nations and communities are in themselves laudable near term goals, it is our response to global warming that most demands a rapid expansion in land use and tenure innovation. Thus I lead off this discussion with the overwhelmingly important issue of climate change to demonstrate the need for adaptive experimentation.

## **Evidence for Global Warming**

### **Lines of evidence include the measurement and monitoring of:**

- Atmospheric greenhouse gas concentrations
- Earth surface and satellite based atmospheric temperature records
- Antarctic and Greenland ice core gas isotope contents
- Continental shelf sediment cores
- River system flows and water availability status for all natural and human uses

- Glacial retreat rates and volumes in ice-field bearing mountain ranges
- Sea ice thickness changes in the Arctic
- Permafrost melting in north America, Siberia and Western Europe
- Changing ocean currents, temperatures, sea levels, pH and salinity
- Rainfall and snowfall amounts, proportions and seasonality of hydrographs
- Gas exchange activity of plants, both CO<sub>2</sub> and methane
- Agriculture and forestry crop performance, nutritional quality and contributions to greenhouse gas exchange
- Soil carbon: dynamics of contribution to the carbon cycle
- Overall biodiversity change, extinctions and species populations and distribution in the ocean and on land
- Bird migration geographic patterns and seasonal timing
- Animal, plant and human pest and pathogen distributions
- Peat bog fossil pollen and bog carbon release rates
- Geographic and temporal disassociation of biotic communities; pollinators, predator/prey balances, food chain disruptions
- Extreme weather conditions; hurricanes, torrential rain events, floods, drought

## **EMERGING CONCLUSIONS AND WARNINGS**

### **Measured Changes**

Objectively measured changes in physical and biological conditions are consistent with a warming climate and are not, themselves in any reasonable dispute. They are accumulating daily on all continents.

### **Natural Forcing and Anthropogenic Forcing**

The prevailing scientific opinions arising from the measured evidence are that both natural and anthropogenic forcing of climate change are taking place. The natural regime is part of long term cycles that have occurred periodically as indicated by ice core records going back 750,000 years. Anthropogenic greenhouse gas emissions, along with deforestation and other land use changes, are widely considered to have the largest impact and greatest influence on both the currently measured gas levels and the pace of change. This conclusion is supported by the evidence from the core materials. The argument that human influence on the atmosphere is insignificant is not consistent with the current measured evidence.

### **Thresholds: Positive Feedback Leading to Exponential Change**

One of the most disturbing elements of the current climate change evidence pattern is the emergence of positive feedback in greenhouse gas emission sources. Melting of permafrost in Siberia is releasing large quantities of CO<sub>2</sub> and methane from soil, lakes and bogs, a release which is both sped up by and speeds up a warming climate trend. Warming is also releasing increased CO<sub>2</sub>, Methane and NO<sub>2</sub> from soils and methane from plants as temperatures rise. Acidification of the ocean from greater CO<sub>2</sub> concentrations in the atmosphere is also seen as a threshold situation in which the ocean's CO<sub>2</sub> sink capacity is diminished and eventually turned into a net source. Increasing evidence of positive feedback to warming raises the potential of exponential change

which may shorten the time span available for human response. Many scientists are now suggesting that the evidence of having breached thresholds into positive feedback means that some changes are irreversible and that de-stabilization of the carbon cycle cannot be rectified for centuries, even if we halted all anthropogenic sources immediately.

The authors of “**Limits to Growth – the 30-Year Perspective**” of 2004 characterize our situation as being in ecological overshoot since the 1980’s, that is, the existing human ecological footprint is already beyond the sustainable carrying capacity of the Earth. Overshoot runs the risk of permanently degrading the function of the planet’s ecosystems, the main message of the United Nations’ 2005 Millenium Assessment which documents this decline.

### **The potential for Sudden Change: Thermohaline Circulation**

Salinity levels of the north Atlantic are falling. Evidence from 12,700 years and 8,200 years ago from ice and sediment cores illustrates that large inputs of fresh water into the north Atlantic can slow and stop the thermohaline circulation in the ocean that sends the Gulf Stream north. Decreasing salinity of the north Atlantic is evidence that the current melting of circumpolar glaciers, sea ice and permafrost are taking us in that direction. The turnover from active northward transfer of heat from the tropics to the north Atlantic region to a significant regional cooling cycle is quite volatile and can happen within a decade, not centuries.

### **The human influence controversies: Cause or Effect, Magnitude, Source**

The only real controversy remaining about global warming is the interpretation of the magnitude of human influence and the methods to be used to reduce or eliminate that influence. It is mainly about the short term costs and who should bear them or how to avoid them. There is also some disagreement about the rate of change and the rate of arrival of the consequences and therefore the urgency of the need to make short term changes in the distribution of economic benefits of current behaviour. One counterintuitive controversy, emerging in the last few weeks, is about the contribution of temperate and boreal forests to carbon sequestration. Recent studies are suggesting that tropical forests have a net cooling effect but that the more northerly forests have a net warming effect arising from limited transpiration, radiation absorption by darker foliage and, surprisingly, emissions of methane.

### **Projected Consequences of Global Climate Change for Water, Agriculture, Forestry, Human Health and Welfare**

The consequences of global warming are numerous, extensive and onerous. They include rising ocean levels whose rate of rise has doubled since the industrial revolution, changes in hydrology of streams and rivers leading to water shortages, altered conditions for pathogen distribution and predator prey relationships, limitation on agriculture productivity by regional droughts and nutritional degradation and shifts in the viability of forest crops at time scales shorter than commercial rotations. In British Columbia we have only to look at Andreas Hamann’s biogeoclimatic zone projections for 2055 and 2085, or the accelerated emergence of other insect pests, or the pine beetle attacks on

juvenile pine plantations, or the rise of *Dothistroma* in northern pine stands, or the decline in cedar and arbutus at the coast to see the shape of the future close to home.

### **Implications for China and India: Our Proposed Major Trading Partners**

All of the global warming consequences are more severe in populous countries with lesser margins of affluence or environmental resilience. Both China and India, on which we are projecting our future marketplace diversification, are particularly vulnerable to large scale environmental changes. China's deputy environment Minister has indicated that the ecologically stressed western regions of China can no longer support their current population. He suggests that the country will need to resettle some 186 million residents from twenty two provinces and cities. As China's remaining provinces and cities are said to be able to absorb only 33 million of those, he envisions a problem of 150 million internal environmental refugees.

In India, the projection for this century is for significantly increased monsoon rains, increased intensity of cyclonic storms, expansion of the transmission window for malaria, sea level damage to its southern coastline, declining harvest of rain-fed crops generally with falling wheat and rice productivity in particular, and the large scale dieback of forests.

### **INTELLIGENT FORESTRY RESPONSES**

The evidence for anthropogenically forced global warming, emergence of positive feedback in the system and a growing list of substantial consequences in Canada and our major trading partners places a premium on our ability and willingness to respond. In temperate and boreal forestry, with such long lead times from harvesting to subsequent rotation age, the pace of climate change presents an exceptional adaptation challenge. NH Ravindranath, Chairman, Centre for Sustainable Technologies and associate faculty at the Centre of Ecological Studies, Indian Institute of Science, puts it succinctly ..."*As climate change could cause irreversible damage to unique forest ecosystems and biodiversity, there is a need to develop and implement adaptation strategies, like identifying forest management practices and forest policies to reduce vulnerability of forest ecosystems.*"

*That is where the idea of restoration tenures fits into the picture.*

### **Design of the Future Forest: Experiment and Redundancy**

The Mountain Pine Beetle infestation in British Columbia is one of the local consequences of the warmer winter temperatures now regarded as an outcome of global warming. Our logical short term response is to recover the value of beetle killed timber while it lasts and get a new crop in place. Our logical long term response would be to design a future forest that is more resilient to the warming consequences that are the root cause of the problem in the first place. It would be logical to project ahead to the anticipated future conditions in which our replacement forests are to grow. We are in significant danger of re-creating a juvenile forest oriented either to the rapidly disappearing conditions of the present or in anticipation of rates of change over a rotation which are likely to be exceeded as positive feedback propels us into accelerating change.

### **Scenario Divergence**

There is considerable divergence among possible future scenarios, from gradual to accelerated warming and from mild to severe ocean current stimulated cooling. A single strategy for forest replacement cannot serve in all these potential futures. In a time of such fundamental uncertainty, what is the logical response? I would submit that the intelligent response is to greatly expand the scale of silvicultural experiment. Species mix planting trials over our complete geographic range, intensive micro-site cropping, intentional restoration of disturbed sites, extensive provincial productivity monitoring grid, genetic manipulation of crop species to extend range suitability, mycorrhizal cocktails and so on...you are among the technical experts on whom we depend to design and deliver the specific initiatives. These experiments and field trials should each be attached to a corresponding effort to address a product market of commercial scale, both domestic and global. This effort must be a much greater proportion of our investment if we expect to have a forest industry resembling our current economic level by the time the rotation we are now planting matures.

As our concern for biodiversity and threatened individual species is also likely to become more acute, we must also begin to adapt our forest management practices to conserve and enhance values that now compete with but may well in the future be more valuable than fibre. The most obvious of these is water – for drinking, for agriculture, for fish, for energy production – and ultimately for export. But, it could be non-timber products, recreation, micro climate amelioration, fire control, flood and soil erosion control – a host of the wider ecological services of forests, all of which we will need to design.

### **Diversification of Land Uses: Hedging our Economic Bets**

We are already in the midst of a land use explosion. Our ecological footprint is rapidly expanding to encompass the furthest reaches of the province, for forestry, mining, commercial and public recreation, oil and gas, hydro wind and biomass energy, transmission corridors, water impoundment, non-timber forest products extraction, recreation and habitation. Each mix of enterprises, depending on their fundamental resource base, will be affected by the consequences of climatic change. Each of these industries will need to undertake the experimental innovation demanded of forestry and all will have to respond in concert as the landscape closes in economically and transforms ecologically. The challenge of global climate change will require a level of integration for which we have, at present, only the most rudimentary of collaborative structures and processes.

### **Broadening the Concept of Forest Assets**

As exponential change takes hold, the value of forest based assets will also undergo accelerating change. For instance, the short list of biophysical values represented in our current Forest and Range Practices legislation is only valid for a snapshot in time. The volatility of what humans will conceive to be of value is increasing. Land and resource managers will have to take on the more comprehensive task of looking after the functioning of ecosystems, rather than the management of individual values, in order to

address the rising importance of seeing the forest as a package of ecosystem services. A new form of “essential services legislation” is waiting to be born!

### **Restoration Contracts**

The BLM, Forest Service in the US has introduced “stewardship contracts” into its system of tenures. The philosophy behind this practical measure is provided by this quote from its manager in the Pacific Northwest, Brad Flatten:

*“A more holistic ecosystem management approach would recognize that the value generated by marketable products within an area (defined either ecologically or socially) should be made available to address a wide range of restoration activities and sustainability issues, not just those traditionally related to the timber harvest. Although traditional post-harvest activities such as reforestation will continue to rank as high priorities it makes sense that they should not be considered sacrosanct and other ecosystem and social objectives should have the opportunity to fairly compete for timber receipts. Allowing local communities to participate in this prioritization exercise is an important aspect of our stewardship projects.*

*This healthy competition for the value generated by valuable forest products may in fact help to reveal flaws in our traditional ways of allocating timber revenue. For example, given probable long-term climate change does it make sense to address reforestation in the same manner? Should we continue to invest heavily to reforest areas that may no longer be sustainable as forested ecosystems?”*

### **Tenure Reform**

I began with the idea of talking about tenure reform. I believe that our suite of experimentation should include tenures dedicated to intensive restoration and shaping of our landscape to provide for a broader management response to change. The base of community and aboriginal forest allocations is there to build upon. The need to connect communities with the forest resources in their immediate economic sphere of influence is rising as the commodity industry concentrates and retreats to fewer locations. The insights and capacities of silvicultural contractors is an essential source of the experience that we need to make alternative tenures practical as they face environmental change.

We need to have the foresight and the courage to experiment with tenure models that will diversify our forest base and the way we make use of it. We need to learn how to add design value to smaller and more locally distinct biological resources. And we need to be tracking the changes in ecosystems and plant pathogen/pest associations that could vitiate our best laid reforestation plans.

My digression into the wages of climate change is the necessary presentation of reasons to justify the magnitude of response that is demanded of us all.

## Conclusion

For silviculture contractors the challenge is not just in re-planting a depleted fibre supply for the future bulk commodity trade to China. The challenge will be to reconstruct our forested ecosystems in a resilient form that will support diversified economic purposes and provide the adaptability needed to withstand rapid climate change and its consequences. The proposed WSCA **Green Plan** would be a practical step in this direction.

**Ladies and gentlemen, start your (fuel cell) engines!**

