

ECOSYSTEM-BASED MANAGEMENT  
IN THE GREAT BEAR RAINFOREST

# Defense for Climate and Species

February 2009

Photo by Markus Mauthe, Greenpeace

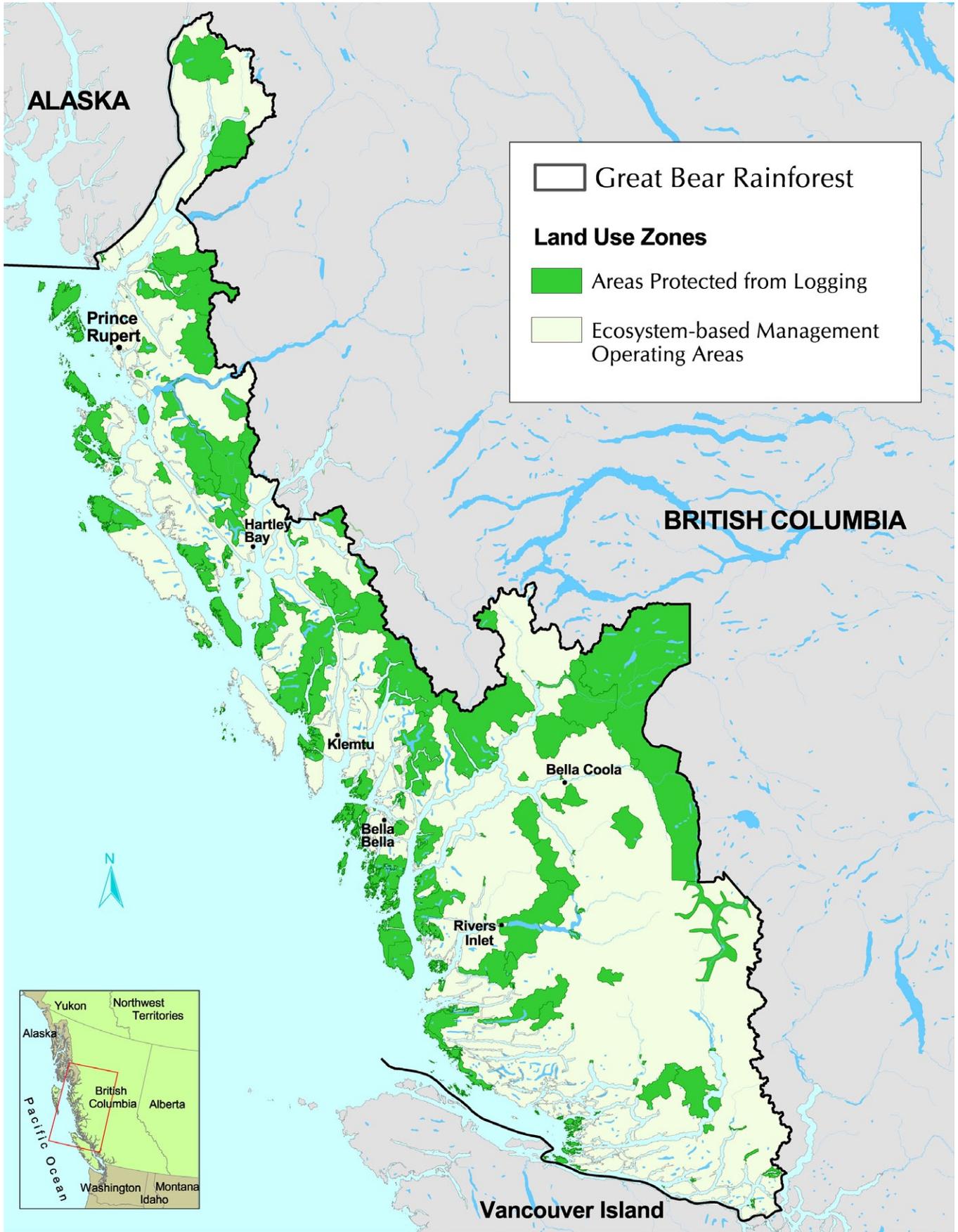
*A report based on a review of potential climate change implications of the Great Bear Rainforest Agreements by Dr. R.F. Holt. Jointly commissioned by ForestEthics, Greenpeace and Sierra Club BC.*

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Areas protected from logging and Ecosystem based Management operating areas in the Great Bear Rainforest



Photo by Jens Wieting

## OVERVIEW

# Ecosystem-based Management – A Major Component of the Great Bear Rainforest Agreements

After years of land use planning on the Central and North coast of British Columbia, in February 2006 the BC government announced the Great Bear Rainforest Agreements. Specific elements included a network of protected areas, a new governance framework between First Nations and the BC government, support for conservation-based economies in coastal communities and the implementation of new logging regulations based on Ecosystem Based Management (EBM) - to be implemented outside of the protected areas by March 31st, 2009.

Today, all of the protected areas and biodiversity areas have been legislated (around 33% of the planning area), initial steps for

new logging rules have been taken and a \$120 million Coast Opportunity Fund is in place. However, critical ecosystems remain at high ecological risk and there remains a significant gap between the current state of conservation and full ecosystem health across the region<sup>1</sup>. The BC government is working with First Nations and stakeholders to finalize the implementation of important elements of Ecosystem Based Management (EBM) to ensure conservation of these critical ecosystems for future generations. However, since the planning began, the significant impacts of climate change on our ecosystems have become apparent. This report explores how EBM is relevant to new imperatives brought about by global warming.

## KEY FINDINGS

# Ecosystem-based Management in the Great Bear Rainforest and Climate Change

Increased protection through the implementation of Ecosystem based Management (EBM) in the Great Bear Rainforest will help counter or 'mitigate' climate change by securing some of the vast amounts of carbon stored in its old growth forest. In addition, science suggests that natural, fully functioning forests like the Great Bear Rainforest are the most resilient to climate change impacts<sup>2</sup>. They will therefore likely maintain their defining characteristics for longer, even in the face of changing conditions, and so are more likely to allow biodiversity to adapt or move in order to adjust to new climates.

Modeling full implementation of EBM with parameters that meet low ecological risk<sup>3</sup> for old growth representation and only considering higher productivity forest results in 289,000 hectares of forest being maintained as old growth that otherwise would not have been maintained. Even when using the estimated average of 375 tonnes of carbon storage/ha for all productivity types of coastal forest, at least 108 million tonnes of carbon are stored in this area of temperate rainforest. Foregoing harvesting in this area would prevent the loss of approximately 50% of the area's carbon storage. Based on a conservative assumption that after harvesting about 23% of the carbon would remain locked in lumber, logging this area would result in about 153 million tonnes of CO<sub>2</sub> released. This translates into three times what the province emits annually from the use of fossil fuels (53.1 million

tons carbon dioxide equivalent)<sup>4</sup>; or the emissions of 28 million cars on the road for a year.

The forests of the Great Bear Rainforest not only store massive volumes of carbon but this storage is a relatively safe bet because the amount of natural disturbance is also extremely low. Fires and insects, which can cause huge releases of carbon dioxide in some of BC's forests are rare in coastal forests so the long-term certainty of storage is relatively high.

The best option to reduce the risks of climate change to ecological integrity and human wellbeing is to cut greenhouse gas emissions drastically in the short term to reduce future climate chaos, combined with lowering the human footprint, giving nature the best chance to adapt naturally to the shift in climate that is happening currently. Achieving the goals of EBM implementation in the Great Bear Rainforest will contribute to both goals and could serve as a model of how to adapt to a changing climate for other forests in the province and Canada.

Under a changing climate it is particularly important that implementation of EBM follows a low risk precautionary approach to forest management. Based on a review of current best available science<sup>5</sup>, low risk precautionary management requires maintaining 70% of the natural amount of old forest present in the ecosystem.

*Because of its intactness and proximity to the ocean the Great Bear Rainforest could provide a key opportunity in North America to allow natural systems to adapt to climate change without a major loss of species. Full implementation of EBM can help reduce the threat of extinction for multiple species living in the region; species that will face increasing stress from a changing climate.*



Photo by Andrew Wright

The reality of climate change could mean that our understanding of what constitutes ecological precaution today may be insufficient to maintain fully functioning complex ecosystems tomorrow. Successful implementation of EBM must include ongoing monitoring, adaptive management, collaborative planning and transparent decision-making in order to provide the flexibility to respond to changing conditions.

*Full implementation of EBM would help maintain additional old growth forest that stores at least 108 million tons of carbon. This form of lighter touch logging would result in a reduction of carbon dioxide emissions equivalent to three times the annual fossil fuel emissions of British Columbia.*



Photo by Jens Wieting

## 1. CLIMATE CHANGE IS HERE

The global average temperature has increased 0.6 °C in the last 100 years, with higher increases than average across BC<sup>5</sup>, particularly in the north of the province. The ongoing rate of increase is expected to rise. Scientists warn that without immediate significant action the implications will be immense. Globally, between 60 and 80% of species investigated are already showing life history changes consistent with a response to climate change<sup>7</sup>. With a mid-range (i.e. one where we reduce our emissions relatively slowly into the future) climate change scenario, it is predicted that one quarter of the world's species will be extinct by 2050<sup>8</sup>. In BC, already 43 percent of assessed species are of conservation concern<sup>9</sup>, and that is without considering future climate impacts. A recent study demonstrates that tree mortality along the west coast of North America has doubled in recent decades, likely caused

by global warming<sup>10</sup>. Climate change combined with habitat loss due to industrial activity and other pressures is expected to have significant impacts for a wide number of species and ecosystems in British Columbia<sup>11</sup>. Recent monitoring of key indicators – such as the polar icecaps – show changes are already occurring much faster than originally predicted, making immediate and dramatic actions imperative<sup>12</sup>.

Two types of response are necessary:

- Adaptation Actions help species and ecosystems adapt to the changes they are experiencing and will continue to experience.
- Mitigation Actions decrease the rate and extent of future climate change largely reducing emissions and removing greenhouse gases (GHG) from the atmosphere.

## 2. ADAPTATION

A one degree increase in temperature is expected to move a typical 'climate zone' northwards by 150 km; while 2-5 degrees translates into 300 – 750 km northwards<sup>13</sup>. Changes to species and ecosystems are already being witnessed and even if humans reduce their carbon output moderately today, additional significant changes are expected to occur to British Columbia's ecosystems over this century<sup>14</sup>. For example, alpine ecosystems in the province are predicted to almost completely disappear by 2085 as the tree-line increases in elevation (a decrease of 97%) while low elevation ecosystems (hot and dry) will spread over much of the southern half of the province in the same timeframe (a 700% increase in the Bunchgrass zone).

Although it is tempting to think of these broad zones simply "shifting" in space, they will not do so in a predictable manner. Plants and animals will move or disperse at different rates and those species unable to move fast enough will become locally extinct. Ecosystems as we know them will collapse and transform into ecosystems with new dominant species<sup>15</sup>. Natural disturbances, such as fires and insect infestations, will also change. British Columbia has already faced and is experiencing the mountain pine beetle outbreak, and the transition in the southern half of the province from moist forest to grassland or dry forest may be dominated by more significant catastrophic fire events. Adaptation Actions require giving all the elements of the natural world – species, water movements, nutrients cycles - the best chance of continuing to

function in their original location for as long as possible. Given our crude understanding of how natural systems work, the most effective way to achieve this goal is to reduce the footprint of all the other ecosystem stressors and allow nature to adapt as best it can<sup>16</sup>.

In particular, the direct impacts of global warming for forest dependent species will be less severe in an undisturbed, older forest compared to a young forest after a clear cut where temperatures and moisture regimes are modified by the existing forest and complex ground cover.

### *Climate change and adaptation in the Great Bear Rainforest*

Climate change will have ecological implications for the coastal temperate rainforest: for instance, models reveal the disappearance of a climate suitable for the survival of western redcedar along the outer coast of BC<sup>17</sup>, yellow cedar is already showing dieback due to reduced snowloads in some areas, and increasing temperatures are expected to have significant impacts on salmon stocks at least in more southerly regions of the coast<sup>18</sup>. However, the Great Bear Rainforest has some natural advantages. Temperature changes are expected to be moderated by the region's proximity to the ocean. Because the rainforest stretches a long distance from south to north, key attributes may remain functional, at least in the north. The Great Bear Rainforest is also relatively intact compared to many other ecosystems in BC

and other forested regions of the world. Although significant forest harvesting has occurred, particularly in the southern region, overall human pressures on the landscape have been relatively low impact. Achieving the goals of EBM will increase the chances for ecosystem wellbeing and species survival in a time of climate change.

*The best option to reduce the risks of climate change to ecological integrity and human wellbeing is to cut greenhouse gas emissions drastically in the short term to reduce future climate chaos, combined with lowering the human footprint, giving nature the best chance to adapt naturally to the shift in climate that is happening currently. Achieving the goals of EBM implementation in the Great Bear Rainforest will contribute to both goals and could serve as a model of how to adapt to a changing climate for other forests in the province and Canada.*

### 3. MITIGATION

Forests provide carbon storage and carbon removal from the atmosphere. But they can also release massive amounts of carbon into the atmosphere when disturbed. Overall, Canada's forests can be a carbon source (they release carbon) or a carbon sink (they sequester/store carbon), depending on the annual rates of growth and disturbance<sup>19</sup>. Many factors influence the long-term carbon storage capacity of an individual forest, including:

- the size of the trees (big trees = more storage)
- rate of carbon uptake (high growth rates = higher sequestration potential)
- build-up of carbon in the soil (many ecosystems, including temperate rainforests, have 50% or more of their carbon storage below-ground)
- rate of natural disturbance (little disturbance = long-term storage)

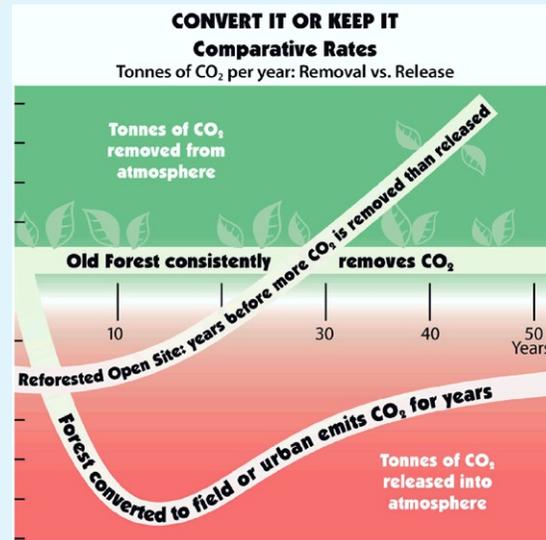
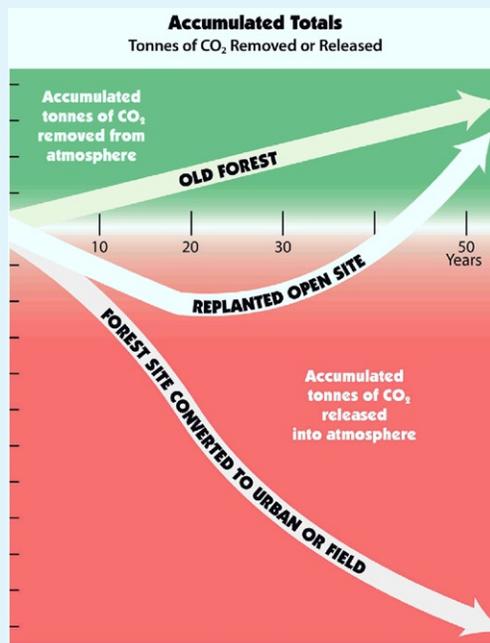
Coastal temperate rainforests in British Columbia contain some of the largest stores of carbon per hectare of forests anywhere in the world. Equivalent areas are rare, but include areas such as the giant eucalypt forests of Australia<sup>20</sup>. Harvesting such old-growth forests, even if second growth forest is allowed to regrow, results in an immediate and a long-term release of carbon (as various gases) into the atmosphere. Depending on the ratio of different gases released, 1 tonne of carbon can be associated with around 3.67 tonnes of carbon dioxide – resulting in harvest (assuming

50% carbon release) of one hectare of 'average' forest being equivalent to putting 126 more cars on the road for a year, or adding the electricity use of 90 average homes for a year<sup>21</sup>. A Pacific Northwest study also found that typical carbon storage was more than twice that in a 400 year old compared to a 60 year old forest stand<sup>22</sup>, and the ability to recover total carbon stores are limited for many hundreds of years<sup>23</sup>.

A study examining higher productivity stands on Vancouver Island showed individual old forest stands store between 600 – 1,300 tonnes of carbon/ha<sup>24</sup> - considerably higher than the 'average' number often used for coastal forests. For stands such as these, maintaining a single hectare of forest intact rather than harvesting it and releasing the carbon, can be equivalent to taking between 200 and 450 cars off the road for a year (1,000 to 2,300 tonnes of CO<sub>2</sub>).

Modeling full implementation of EBM with parameters that meet low ecological risk<sup>25</sup> and only considering very productive and medium productivity forest types<sup>26</sup> results in 289,000 hectares of forest being maintained as old growth that would not have been maintained under the previous management regime. Even when using the estimated average of 375 tonnes of carbon storage/ha for all productivity types of coastal forest, at least 108 million tons of carbon are stored in this area of the Great Bear Rainforest. Harvesting this area could release approximately 50% of its carbon storage. Even when optimistically assuming that 23%

of the original carbon storage would get stored in 2x4s<sup>27</sup>, the amount of carbon dioxide added to the atmosphere would translate to three times the annual emissions of the province originating from the use of fossil fuels (53.1 million tons carbon dioxide equivalent)<sup>28</sup>, or the emissions of 28 million cars on the road for a year.



Old Forest Carbon Storage versus Reforestation and Conversion Impacts on Carbon Storage<sup>3</sup>

### Old vs. young forest

It has been suggested<sup>29</sup> that young trees are a good source of GHG mitigation because planting them results in the removal of carbon from the atmosphere. However, new science is showing this argument<sup>30</sup> fails to acknowledge that the total carbon stored in natural forests is much higher than in plantation forests. In the eucalypt forests of Australia (which are similar in total storage to the coastal forests of BC), the stored carbon is 40 – 60% lower in plantations after harvesting<sup>31</sup>. Harvesting forests releases a huge volume of carbon into the atmosphere – both from the trees themselves and also from the soil - and it can take many hundreds of years for that original volume to be restored. Similarly, in a coastal temperate rainforest, harvesting old-growth

forest results in the massive release of carbon, and growing such forests to a similar volume will take many hundreds of years.

It has also been argued that using wood products doesn't contribute to climate change because wood products 'store' carbon. This is partly correct but as studies show a significant amount of waste occurs during processing (23% of the harvested biomass ended up stored in a 2 x 4<sup>32</sup>) and only 20% of the average 2 x 4s end up in long-term use though this could obviously be improved with increased recycling efforts. However, currently, most wood products have a useful lifespan of only a few years and end up in landfills. When storage in products is calculated, it is important to consider their lifespan and

what they replace (e.g. for a percentage of new houses built, old houses are torn down and release GHG emissions at the end of their lifespan). Carbon storage in wood products, unless they are made into antique furniture kept for hundreds of years, typically does not constitute long-term storage.

### *Benefits of Old Forest Carbon Storage Versus Reforestation*

Oceans and terrestrial ecosystems currently remove about 50 to 60% of human-caused greenhouse gas emissions (fossil fuel and land use emissions) from the atmosphere, and have buffered intense global climate change to date, however, concerns are being raised that they may no longer continue to do so into the future as ecological 'tipping points' are reached<sup>34</sup>. The consequences of land use and mitigation choices are most obvious when looking at the accumulated CO<sub>2</sub> effects in the atmosphere. After 50 years, a BC coastal forest that has been 'converted' from old growth to second growth might have released hundreds of tonnes per hectare of carbon dioxide into the atmosphere. However, an equivalent area of replanted forest will not have a positive effect on atmospheric CO<sub>2</sub> for decades. Depending on the specific conditions, the

replanting strategy won't be able to match the accumulating benefits of carbon dioxide removal from a conserved old forest for at least half a century. The slow and steady carbon dioxide removal benefits of a conserved old forest are superior to that of a replanted stand, even in the short and medium term<sup>35</sup>.

The forests of the Great Bear Rainforest not only store massive volumes of carbon, this storage is a relative safe bet because the amount of natural disturbance is also extremely low. Fires and insects, which can cause huge releases of carbon dioxide in some of BC's forests are so rare in coastal forests the long-term certainty of storage is high as long as we don't experience run-away climate change leading to significant changes in forest ecosystem disturbance dynamics (e.g. increases in forest health issues which may occur as drought increases).



Photo by Jens Wieting

#### 4. ECOSYSTEM BASED MANAGEMENT IN THE GREAT BEAR RAINFOREST: A MODEL FOR MANAGING NATURE UNDER A CHANGING CLIMATE

A recent report by the Pacific Institute for Climate Solutions<sup>36</sup> says “adaptation to the stresses induced by climate change builds resilience, and there is ...now an opportunity to effect the transition from a traditional resource-based economy to an ecosystem-based economy that recognizes and values environmental goods and services, and diversifies the economic base at a time when the traditional base is being challenged” The report identifies the Central and North Coast Land and Resource Management Plans as “the only example to date in BC in which resources are legally managed on an ecosystem basis”

Achieving the goals of full implementation of EBM in the Great Bear Rainforest provides an opportunity to help reduce future climate change by maintaining massive stores of carbon locked in coastal temperate rainforests. At the same time, EBM can help foster species adaptation to climate change with a higher likelihood of maintaining fully functional ecosystems. Full implementation of EBM will provide one of the best opportunities to maintain some of the biodiversity values that give British Columbia high global biodiversity responsibility.

This rich biodiversity includes some of the most intact coastal temperate rainforests left in the world and the fauna and flora that inhabit them – including healthy grizzly bear, wolf and salmon populations.

Climate change is throwing all our systems – natural and human - into unfamiliar territory. We must closely monitor these changes so we are ready to change our plans quickly when necessary. Finally, lessons learnt in the Great Bear Rainforest are equally applicable to other ecosystems - forests, grasslands, aquatic systems elsewhere in the province - where a comprehensive EBM approach could similarly improve their ‘climate change futures’. Many of these systems are indeed at higher risk from a climate perspective than coastal ecosystems, and similar policies based on credible independent science should be implemented to improve adaptation potential, reduce the chances of catastrophic events such as massive fires, and to look for synergies where carbon can remain stored as biomass in ecosystems for as long as possible. Nature is one of the best defenses we have.

## Endnotes

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*ForestEthics, Greenpeace and Sierra Club BC promote conservation options and economic alternatives to industrial logging on British Columbia's Central coast, North coast and Haida Gwaii.*

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