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Will Our Acadian Forest Tree Species Survive Climate Change?

Submitted by Dr. Colin LeRoque and Ben Phillips

Projected Climate Change in N.B.

When you talk with just about anyone who pays attention to the weather in the Maritimes they'll tell you that we're already experiencing the initial effects of climate change. The most noticeable aspect of change has been the decrease in the length and severity of our winters. Many don't mind more mild winters because they haven't had a large impact on our environment or economy…..yet.

What we haven't been able to understand so far is how much the climate in this region will change and what effect it will eventually have on our ecosystems and economy. The global climate models indicate the future temperature of the Maritimes will probably increase by 3 - 5˚C. What the climate models don't take into account is when, or if, we'll stop using fossil fuels. As it stands today, we, as a global community are emitting more CO_2 and other green house gases (GHGs) than the most extreme forecast scenario laid out by the International Panel on Climate Change (IPCC). This is due to stronger than expected worldwide fossil fuel emissions, a drop in the efficient use of fossil fuels and a reduction in the ability of the natural environment, such as the oceans and forests, to absorb CO_2 from the atmosphere.

Although our future remains uncertain we do know that climate change over the next few centuries could be extremely severe if nothing is done today. We also know that our past emissions alone will continue to warm our climate until at least 2050. So, how will these changes in our climate manifest in our Maritime forests?

Potential Forest Related Impacts

If we contemplate what future climates have in store for our region, we run up against a range of consequences for the forests. As the climate generally warms and weather patterns change, varying degrees of insect, fire, wind and other irregular weather disturbances are increasingly likely. We can also expect to see the slow migration of many of the Acadian forest species out of the region and the immigration of many new species from other regions into ours. This has occurred during past climate changes, and it is almost certain to occur again. Species living in unique environments or those which cannot respond quickly enough could become extinct. According to the IPCC, a rise in temperature of 3.5˚C will result in the global extinction of 40 – 70% of species. These potential impacts could have drastic consequences for the Acadian Forest. Since we are stuck with some change of climate, we need to learn how we can adapt along with our environment. Understanding which forest species and systems are the most vulnerable, and understanding which will be

the most robust, will help us prioritize our mitigation efforts for the future. This will help ensure a healthy forest to enjoy and derive resources from in both the short and long-term.

Enter the MAD Lab

The Mount Allison Dendrochronology Laboratory (MAD Lab) is very concerned about climate change. The lab specializes in tree rings and more specifically how tree rings relate to climate. The annual rings grown by various tree species have a direct relationship to the amounts of precipitation and the temperatures received each year. This means that trees hold a record of our past climate and the lab is set up to exploit this information through non-destructive techniques, providing insight into past climates. With the relatively recent development of global climate models, insight into the future growth rates of trees can now also be provided.

This ability has prompted master's student Ben Phillips and his supervisor MAD Lab director Dr. Colin Laroque to try to answer the following question. Given the potential changes in climate, how will the radial growth rates of Acadian Forest tree species respond? By uncovering how trees will react to climate change they can better understand the potential future composition of the forest. As the climate warms some Acadian Forest tree species will be gradually culled, while other tree species will begin to enter into the shifting Maritime climate zone. This will lead to a different forest dynamic and will greatly alter the resources that can be continually extracted from the forest.

Project Methods

To answer this question a growth forecast is completed for each tree species of concern. First, three sites where the particular species grew untouched for at least 100 years were found. Then 20 trees were sampled using an increment boring tool, which extracts a pencil sized sample of the trees rings. These samples were transported back to the MAD Lab where they were glued into slotted mounting boards, sanded to a fine polish and then the ring widths were measured to a thousandth of a millimeter using high precision equipment. This gave a very accurate record of each tree's growth history and when all trees are averaged together the result is a growth history of the particular species within a specific region. When these growth records are compared to past weather data, climatic drivers and limiters of growth can be found. For example pine trees grow large rings when they receive frequent summer precipitation. Once the climate parameters that control the growth of a particular species are known, then a forecast can be produced based on future global climate model data. Projected forecast data covers a range of scenarios from conservative estimates through to more extreme changes.

Project Results

To date, five forecasts have been produced. Our forecasts indicate that white pine will not be greatly affected by increases in temperature. Eastern hemlock should increase its

growth rate by up to 60% by the year 2100 as the growing season lengthens. Eastern white cedar reacts poorly to hotter drier July conditions and it should decrease its growth rate by as much as 75% by the year 2100. Meanwhile red and black spruces appear to hold their own or increase their growth rates slightly. What is not known exactly is if the potential for an increase in insect activity will limit their success.

Implementing the Results

In this first phase of the project the surface has only just been scratched concerning the number of species that live in the Acadian Forest. Although these results are important for these species, major decisions regarding the management of the forest resource cannot be made without further research into more species of trees. Once many more forecasts are complete a better understanding of future forest species composition would be possible.

The other important aspect of this research is that it will be best used in conjunction with other climate change forecasting such as future insect populations, forest fire frequency, as well as other types of disturbance events that could establish better projections. Radial growth forecasting could be considered the skeleton of forecasting research for the Acadian Forest onto which many other layers of research could be added. Researching the potential effects of climate change will lead to a more robust and more accurate vision of the forest we will leave for our children. It will also allow us the chance to better adapt to tomorrow's future before it becomes today's reality.

Read the full report at http://www.mta.ca/madlab/2007-02.pdf or www.Fundymodelforest.net

Contact: Dr. Colin LeRoque,
claroque@mta.ca
(Fundy Model Forest is helping fund this project.)