An Introduction to Forest Carbon Management

Maria Janowiak*

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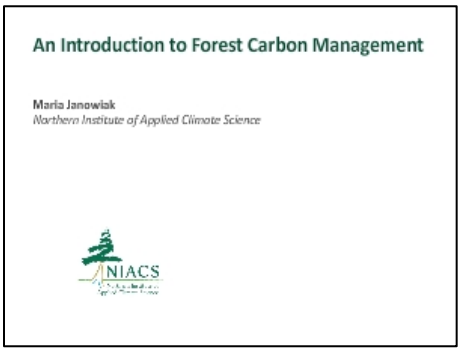
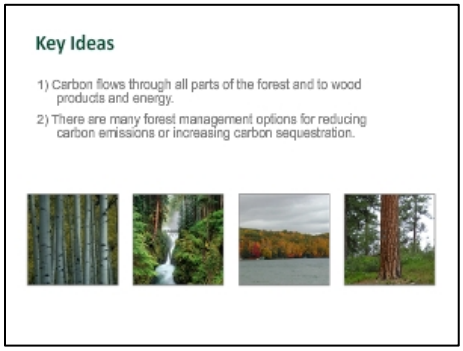
Slide 1. An Introduction to Forest Carbon Management



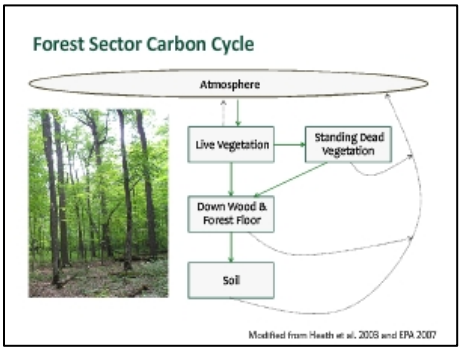
Hello, my name is Maria Janowiak and I'm a scientist for Climate Change Adaptation and Carbon Management with the Northern Institute of Applied Climate Science. And my talk for this series is an introduction to forest carbon management, and it really is meant to kind of set up some definitions and some beginning ideas and serve as an introduction to other talks in this series that talk in more depth about specific management issues on different topics.

Slide 2. Key Ideas



And I have two key ideas that I'm going to focus on in this presentation. The first, which I'm just going to touch on briefly, is that carbon flows through all parts of the forest and to wood products and energy. And then the second one is that there are many management options for reducing carbon emissions and enhancing carbon sequestration to the forest. And I'll be spending the majority of my talk on the second one in talking about how this can be done and providing some examples.

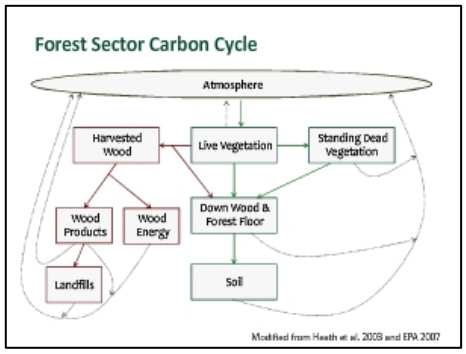
Slide 3. Forest Sector Carbon Cycle: Forests



So first, in addition to thinking about the worldwide carbon cycle or the carbon cycle at a national level, you can also think about it within the forest sector. And so the first part of this, which I think that many of us are comfortable thinking about, is the carbon cycling within the forest. And so we're all familiar with the fact that trees and other plants absorb carbon dioxide during photosynthesis and sequester carbon in their tissues and hold it there. Beyond that when those plants die they go into other pools like standing dead vegetation, down wood in forest floor, and eventually ultimately a lot of these pools end up in the soil. And carbon from any one of these sources can be transferred back to the atmosphere through decomposition or combustion.

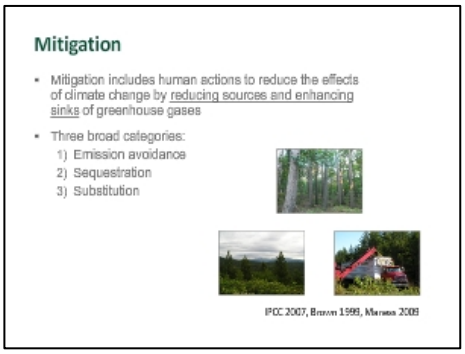
** This document transcribes the presentation given by Maria Janowiak. The presentation is part of General Technical Report NRS-93, "Forest and grassland carbon in North America: A short course for land managers." The full report, comprised of 15 presentations, is in DVD format and can be obtained at http://nrs.fs.fed.us/pubs/order/40110. The presentations and related materials can also be accessed at http://www.fs.fed.us/ccrc/carboncourse/*

Slide 4. Forest Sector Carbon Cycle: Products



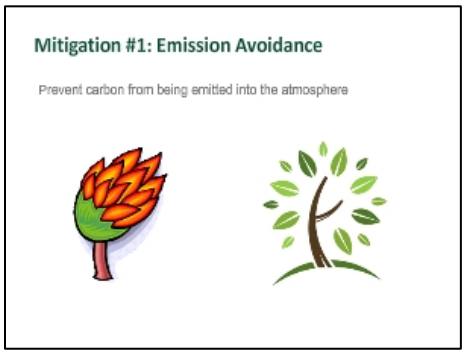
There's an additional part to this forest sector carbon cycle that focuses more on the industrial side, and so we can imagine that some of this live vegetation may be harvested, some of the residues end up with down wood in forest floor, but a lot of that harvested wood ends up being made to go into wood products which may ultimately end up in landfills and also into wood energy. And, again, similar to the forest side of cycle, all of these pools can be transferred back to the atmosphere through decomposition or combustion. It's a little bit oversimplistic, but I do like to think about managing for forest carbon as trying to put carbon into any one of these particular boxes, trying to increase the amount of carbon in any one of these pools and reduce the amount that's in the atmosphere at the top. And of course there's subtleties where you might way to focus on pools where carbon stays longer or different carbon pools depending on management, but in a simplistic way I just think about is trying to fill the boxes and make them bigger.

Slide 5. Mitigation



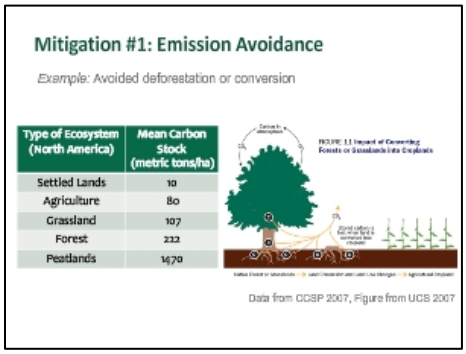
So just to define mitigation. It includes human actions to reduce the effects of climate change by reducing greenhouse gas sources and enhancing greenhouse gas sinks. And for the purposes of this talk, I've grouped these into three categories, emissions avoidance, sequestration, and substitution. And so I'll describe each one briefly, give a few examples, and then also additional talks in this set will provide more detail on the specifics.

Slide 6. Option 1: Emission Avoidance



The first category of mitigation is emissions avoidance. We're really trying to prevent carbon from being emitted to the atmosphere, and one example of this that's really important, especially on a global scale, is avoided deforestation or conversion to other uses.

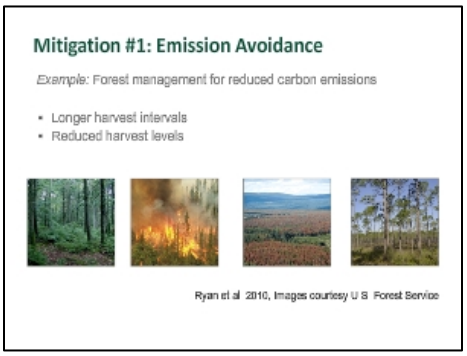
Slide 7. Avoided Deforestation or Conversion



So if you think about this, we know that forests store a lot of carbon, and we can think about in North America on this table, forests have an average carbon stock of over 200 metric tons of carbon per hectare. And if we look at peatlands, many of which are forested when you think about the Northern United States and Canada, they store even much more carbon. And so these particular land uses, carbon stored in forests, is much greater than the other land uses such as settled lands,

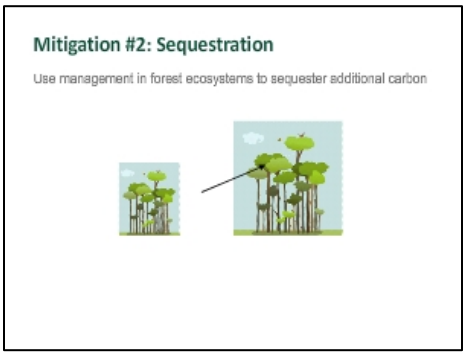
agriculture, and grasslands, on average. And so whenever we can maintain forests as forests and prevent them from being converted to other uses, we maintain the ability of that area to sequester carbon into the future, and so we really prevent emissions and also allow for potentially additional sequestration in the future.

Slide 8. Management for Reduced Carbon Emissions



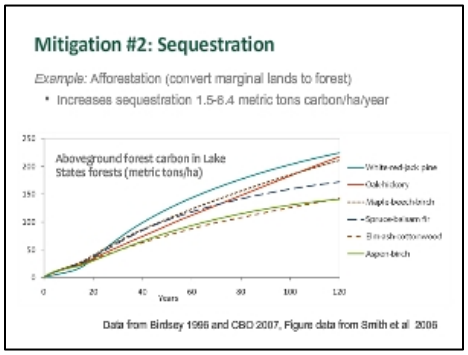
Another example of emissions avoidance is actually a whole host of activities centered on forest management for reduced carbon emissions. And a few examples would include longer harvest intervals, such as extending the amount of time between rotations or between entries during forest management, or reducing harvest levels and trying to maintain more carbon in the forest or increase the average tree size.

Slide 9. Option 2: Sequestration



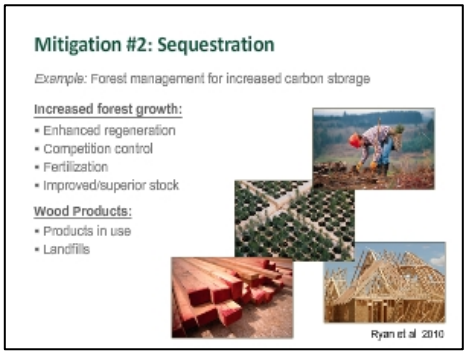
The second category of mitigation is sequestration, and really here we're using management to sequester additional carbon compared to what may be there under our normal management.

Slide 10. Afforestation



One example is afforestation which is essentially just the opposite of deforestation where we're trying to convert land to forest to get that additional carbon on the landscape. And usually when we talk about this, we're talking about marginal lands or lands that aren't being used for a lot of other activities. And doing this can increase sequestration within the U.S. on average about 1½ to 6½ metric tons of carbon per hectare per year, and the example in this figure is some afforestation of different forest types in the lake states.

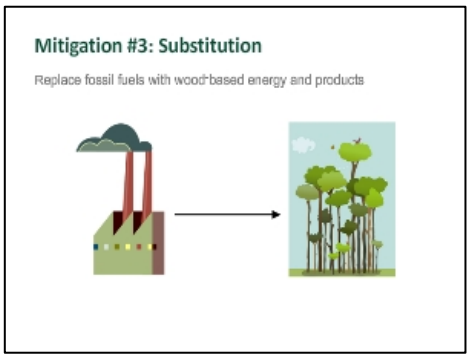
Slide 11. Management for Increased Carbon Storage



Another set of activities for sequestration is forest management for increased carbon storage, and there's a number of these activities. Many of them are focused on forest growth and are actually just silviculture practices that are already in use to increase forest productivity such as enhanced sequestration, competition control, fertilization, or the use of improved or superior planting stock for tree species when they're planted. We can also sequester carbon within

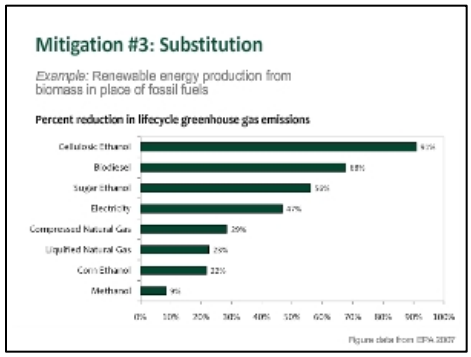
wood products, and there's a number of ways to do this. These can be thought of as products that are in use, and so we can think about the wood that might have been used to build your house, or it might be in furniture or other things around your home or office. And then after these products are in use, a lot of them end up in landfills where the conditions within the landfill really slow that decomposition process and hold carbon for extended periods of time.

Slide 12. Option 3: Substitution



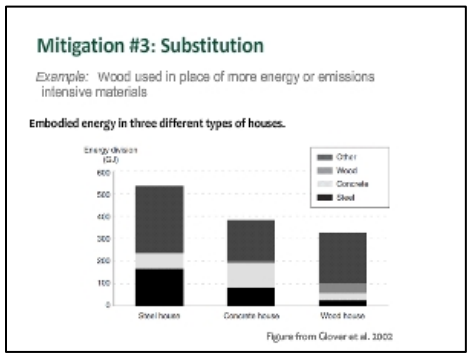
The third category of mitigation is substitution where we're trying to use energy or products that come from wood and forest sources to replace fossil fuels that require more energy.

Slide 13. Biomass vs. Fossil Fuels



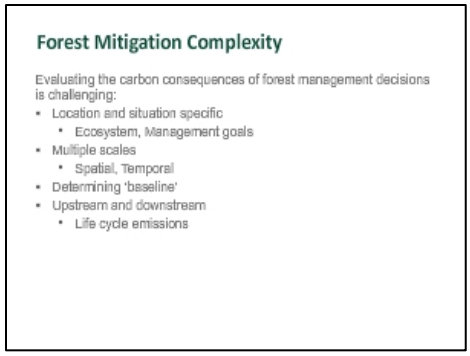
One example is the renewable production of energy from biomass that's used to replace fossil fuels, and this can be energy for heat, for transportation fuels, or for power. In this particular example, there was a study that looked at the entire lifecycle of the production of different alternative fuel sources starting with the production of any material that was used to produce the fuel, the extraction of any resources or materials, transportation, production, kind of going through the entire process used to develop these fuels and to get them to your gas tank. And what it found was that when looking at cellulosic ethanol, which is an alternative fuel source that can be made from wood or can be made from other wood-like plant materials, that there was over a 90 percent reduction in greenhouse gas emissions compared to the gasoline that it would replace.

Slide 14. Wood vs. Emissions Intensive Materials



Another example is when wood is used in place of materials that are more energy or emissions intensive, and so often it's much easier to produce a wood product than it is to produce a material from something else, something that requires a little more manufacture. In this particular example there were three houses that were built, the same house but built using different materials. One was with steel, one with concrete, and one with wood. They used all different materials, but they were primarily of those three different types, and overall, it took the least amount of energy when looking at that entire lifecycle to create and construct the wood house. And so when there are opportunities to use wood materials over other materials, it may be possible to substitute the wood product.

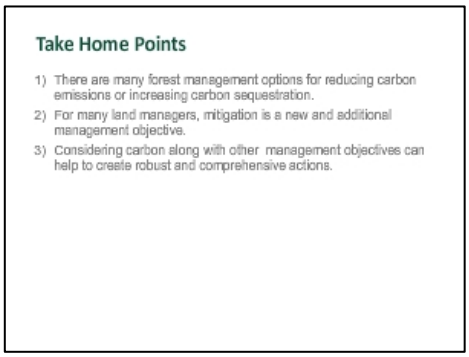
Slide 15. Forest Mitigation Complexity



Forest mitigation is a really complex topic, and while I won't be able to cover this complexity, but I think that there's a lot of acknowledgement that it's there, and a lot of the presentations in the series will talk about different aspects in more detail. One is that, like forest management in general, it's just so location and situation specific. And so the rules don't hold from place to place. The rules aren't necessarily the same, and so it needs to kind of adjust depending on the ecosystem or forest that you're working in and the management goals that you have, and that will probably drive a lot of your decisions much more than other things. Another consideration is that there are multiple scales that have to be dealt with, and that throughout all of the work that's being done related to forest carbon management, that scale is really variable, and this is both a scale in space and the amount of area that you're looking at, and in time. And so when you're talking to people about carbon and when you're thinking about carbon, you have to kind of recognize that these are highly variable, and so the interpretation that you have if you look at one acre of land or one stand is going to be very different than if you look at the landscape. And similarly, if you look at one point in time, whether it's a forest harvest or some other activity, your interpretation of what's going on is likely going to be very different than if you're looking over a much longer time period of 50 or 100 or more years.

It's really difficult to determine the baseline, which is used in a lot of these comparisons. Baseline is kind of your reference point in saying what the conditions would be going into the future, and it's just difficult to determine that because we have a hard time predicting what we're going to be doing in 10 or 20 or 50 years depending on circumstances, and so setting that reference point and measuring against it can create a set of challenges. And then similar to the spatial element there's also upstream and downstream elements when we talk about forests, recognizing that the carbon doesn't necessarily need to stay in the forest and we may be looking at different parts of this process. And so looking at lifecycle emissions can be really informative in knowing whether wood products are having other effects in other parts of the chain of producing products, as well as looking at landscapes and some of the other effects in terms of what activities may be causing changes on other lands.

Slide 16. Take Home Points



So just to summarize a few take home points. One, as I covered in this talk, there are many management options that are available for reducing carbon emissions or increasing carbon sequestration, or both, as a lot of them do, because it is really possible to do two of these at once. And then kind of two related thoughts. One is just an acknowledgement that for many land managers, mitigation is a new and additional land management objective. It's something that might be brand new to some, it might be a little bit older but still relatively new to others, and so there's a lot that needs to be figured out both in the science and how management interacts with that science. And then lastly, just given that considering climate along with other management objectives, whether it's recreation or wildlife, water, timber, really helps in thinking about these things and can be used to develop the most robust and comprehensive actions for sustaining forests that are healthy and provide all the benefits that we want into the future. Thank you.