KENTUCKY HEARTWOOD

Protecting the Beauty and Wellbeing of Kentucky's Native Forests

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RE: Kentucky Statewide Assessment of Forest Resources

March 10, 2010

Tim,

Thank you for taking time to consider these comments, and for allowing me to submit them after the deadline. In order to get these comments together quickly I have not, for the most part, included specific citations (other than what was handy on my desktop). However, when referencing "the literature" or specific aspects of forest dynamics I am frequently basing my comments on peer-reviewed literature and well-established ecological principals. If you need citations for any of the issues raised please let me know and I will do my best to provide them.

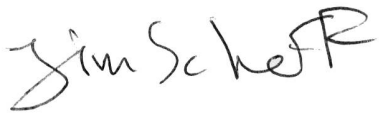
Overall, I think that this is a very good, comprehensive, document. The main issue that I saw repeated was a conflating of silvicultural and ecological principles and management. The two are not the same. Language like "overmature" and the implication that old forests and old trees, and trees with broken tops or rot, are somehow "bad" and to be avoided ignores the structural and functional forms of mature and primary native forests. The document needs to be clear when basing statements on one model or the other. The implicit message is that older forests are useless at best, and dangerous at their worst, and should be cut – a position I hope this document does not intend to adopt.

I hope that the end result will be a comprehensive resource for landowners of differing perspectives to care for their land while advancing the values they hold most dear, whether that be long-term economic returns or a dream of the return of the Great Forest.

I have organized the comments below in consecutive order, listing page number, heading, and paragraph where useful.

Again, thank you for taking the time to consider my comments.

Sincerely,



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P. 16: Issue 4: Forest Management

Regarding carbon sequestration, recent peer reviewed studies have shown that in some temperate hardwood forests there is a greater net increase in carbon storage without any logging whatsoever, with the net amount of carbon stored inversely related to the intensity of logging. This paragraph would lead the reader to the incorrect conclusion that some degree of logging is best when managing for carbon (biomass) sequestration. The "old model" of forests becoming stagnant when mature has been demonstrated over and again to be wrong. A recent meta-analysis by Luyssaert et. al. (2008) published in Nature looked at old growth temperate and boreal forests across the northern hemisphere and found that:

> "We find that in forests between 15 and 800 years of age, net ecosystem productivity (the net carbon balance of the forest including soils) is usually positive. Our results demonstrate that old-growth forests can continue to accumulate carbon, contrary to the longstanding view that they are carbon neutral."

While this paragraph does not explicitly recommend logging for carbon sequestration, the use of the term "management" usually implies logging, and the literature indicates that logging usually decreases net carbon storage.

P. 18: A. Introduction:

The document states:

> "Because Kentucky native forests have little or no resistance to foreign invaders, not managing the forests could result in losing our entire native forest ecosystem. Active management is important to improve and sustain forest health."

While active management may be good in some circumstances, this is overly broad. In some cases, active management is the precise vector by which invasive species gain entry into intact native forests – both through inadvertently carrying seed to the site and by creating the open, early successional conditions that most invasive plants need to become established. Further, the supposition that active management is needed to improve and sustain forest health belies the fact that native forests have evolved numerous characteristics that allow for flexibility in species composition and forest architecture to recover on their own from disturbance. While active management may be the best course of action in specific instances responding to specific conditions, the generalization presented here is not backed up by the facts. One need only look to Blanton Forest or Lilly Cornett Woods to see how a lack of management can lead to some of the most productive and resilient forests in the region.

P. 19: 3. Clean Air and Water

Should mention that transpiring forests dramatically decrease stream flow, mitigating floods. Look at the Hubbard Brook experiments of the 1960's and 1970's.

(Noted that this is addressed on p. 39: 3. Large Standing Forest Blocks)

P.19: 6. Carbon Sequestration

Please see comments above in **P. 16: Issue 4: Forest Management**

Additionally, removal of tree cover through logging demonstrably increases soil respiration, such that logged over forests are a conspicuous source of CO_2 for several years after heavy logging. Most biomass in forests is sequestered in the soil, with carbon turnover rates ranging from the hundreds to thousands of years without soil disturbance. With soil disturbance, soil respiration rapidly increases and otherwise sequestered carbon rapidly enters the atmosphere.

P. 20: C. Forest Resources, pp4

States that "down woody material" can be used to evaluate the health of Kentucky's forests. It should be made clear the coarse woody debris (CWD in the literature) is a vital and largely missing component of Kentucky's forest ecosystems. CWD is perhaps the most significant indicator of old-growth forest stands, and provides important habitat and nutrient cycling characteristics. There is a great deal of literature on this. The development of significant amounts of CWD in forests may be a critical part of recovering full ecosystem functions and processes in Kentucky's forests.

P. 21: C. Forest Resources, pp1

Crown condition is given as an indicator of forest health. This should be clarified. Trees with substantial canopy damage can live for centuries as part of a healthy forest. I recently studied a core sample from a ~500 year old Liriodendron that had grown quickly for about 200 years, then likely lost much of its top and slowed in growth such that it only put on about 4 inches in girth over the subsequent 300 years. The tree was still alive and part of a beautiful and healthy forests, despite the oldest trees all being in a similar condition. Again, the issue here is that you've made a sweeping generalization that is not a rule. Trees with broken canopies, and even heart-rot, can actually indicate a healthy, fully functioning forest despite being poor as merchantable timber.

P. 21: C. Forest Resources, pp2

Most large, down woody debris acts as a moisture reserve and will not burn. Logging slash and other small-diameter deadwood in dry forest conditions increases fire risk. Unfortunately, the large diameter material is frequently removed before becoming CWD, and slash is left over, and recovering forests are dominated by small diameter material. Bottom line is that, whatever you think about logging, conditions created by intensive logging in particular can increase wildfire risk.

P.23: 2. Forest Structure and Diversity

Again, the pushing of active management for healthy forests is being presented as a truism. Many forests are unhealthy precisely because active management has disrupted native forest architecture and species composition, compacted soils, and introduced invasives. This is not to say that active management can't be good – clearly it can be important, and be a part of the recovery of abused landscapes. But sometimes leaving forests alone is the best thing one can do to retain or recover native forest composition and function, increase biomass/carbon sequestration, and allow for healthy forest ecosystems (as opposed to crop trees, which is a very different goal from truly native forest ecosystems).

P. 24: 3. Fire Occurrence

It is clear that fire has had a role in the forests of our region for at least the last 3000 years. However, issues of return interval, site specificity, and overall extent are purely guesswork.

The idea that the shift in the understory from oak to maple dominance is a direct result of fire exclusion, as popularized by Abrams, has no demonstrable backing in the literature. Studies performed in the Red River Gorge and elsewhere have found contradicting results. In some cases fire promoted oak over maple while in other cases it promoted maple over oak. A recently accepted though currently unpublished paper by Neil Pederson (EKU) and Ryan McEwan (University of Dayton) discusses at length how the apparent oak to maple shift is a result of multiple ecological drivers. Included are:

- The instrumental and tree-ring reconstructed Palmer Drought Severity Index for the eastern hardwood region reveals a slightly cooler/wetter period concurrent with the increased success of maple and decreased success of oak. The more mesic conditions favor maple. Further, another study by McEwan found that oak recruitment at Lilly Cornett was decreased on more mesic sites, but fine on more xeric sites.
- Increasing deer populations alongside the loss of Castanea dentata (a preferred food source) may have led to significant displaced herbivory, decreasing the available acorns for successful germination, and adding further pressure to oak seedlings
- For anthropogenic fire to be the primary driver behind historic (and prehistoric) oak regeneration, there must have been a remarkable homogeneity of native anthropogenic behavior across cultures and regions and covering nearly every acre of the eastern oak forests. This is highly unlikely
- Most remaining old-growth oak forests (and presumably previously existing old-growth oak forests) initiated during the depopulated period, where native populations plummeted by as much as 90%. With such radical decreases in population and disruption to cultural practices, it does not logically follow that fire would have been so ubiquitously applied across the landscape during that period.
- The often cited research by Abrams looking at fire scars in an old-growth oak forest (in Maryland, if I recall correctly) to reconstruct the relationship between oaks and fire had a fundamental flaw: Abrams did not accurately cross-date and so reporting of fire events is not accurate.
- Ongoing research by Neil Pederson and Ryan McEwan is looking at the first long-term fire chronology in Kentucky, examining basal area cross-sections from downed trees at Lilly Cornett Woods. The samples go back to the mid-1600's. While the results have yet to be tabulated, initial scans of the samples indicate very little fire in this premier old-growth forest with an abundance of oak. I have been examining these samples first-hand.

The point here is not to say that fire has no bearing on oak regeneration. But the statement that "Fire exclusion is also a cause in the decline of oak reproduction" is not factually correct, despite the current popularity of this hypothesis and its application across the landscape. The over-use of fire in the wrong areas could be causing damage to forests and their ability to rebuild lost soil resources. We simply don't know.

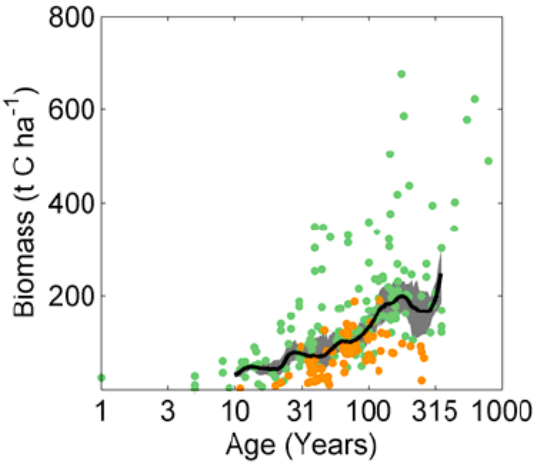
Cleary, some natural communities require fire. These areas should be burned and evaluated. But whole-sale burning of our forests is not justifiable based on the literature and status of our knowledge.

P. 29: g. Other Important Invasive Threats

Regarding Southern Pine Beetle (SPB), it is important to recognize that this is a native insect with cyclical outbreaks that were dramatically exacerbated by the pine monocultures that had been established for efficient timber production. Research after SPB outbreaks elsewhere showed how SPB outbreaks were slowed by a mixed-forest composition. This is Ecology 101 and should be clear to any gardener or farmer. When you plant large monocultures you create the conditions for pest organisms to dramatically increase in population beyond thresholds for which the ecosystem is adapted. Had there not been extensive pine monocultures it is not likely that the SPB would have had such an enormous impact across Kentucky, going so far as to "jump" stands and attack small patches of healthy, old pines. When considering how best to manage timber, and pine in particular, managers and land owners need to understand that to avoid a catastrophic impact when the SPB inevitably returns that they need to manage their forests differently, emphasizing a more complex mixed-species forest composition.

P.30: 3. Mismanagement of Forest

The idea that old trees and old forests become "stagnated, over-mature, weak, unhealthy, and susceptible to disease and insect invasion" is another sweeping, inaccurate portrayal of native forests based in models of even-aged plantation style silviculture. One need look no further than Blanton Forest, Lilly Cornett, or any of the old-growth stands in the Great Smoky Mountains National Park to see that old trees and old forests are indeed resilient. Liriodendron can live 500 years, the oldest known Quercus montana in Kentucky is nearly 400 years old, Q. alba can live over 400 years old, and so on. Yet typical rotations prescribed by even the best foresters in Kentucky rarely exceed 80 years. Further, old forests continue to accrue biomass for hundreds of years. The old models from the 1960's (Kira & Shidei, 1967, Odum 1969), of no net ecosystem productivity after about 80 years has been thrown out again and again. The graph below from Lyssaert et. al. 2008 illustrates this well. The green dots are temperate forests and the orange dots are boreal forests, both in the northern hemisphere.



The notion that aging native forests "stagnate" has no basis in the last half century of literature and should be taken out of this document.

And again mentioning my example from **P. 21: C. Forest Resources, pp1** above, and backed up by a growing body of dendrochronological analyses of old-growth trees of various species, the centuries-long

life histories of trees are complex, and can include low growth for centuries followed by release, or vice-versa. This is how native trees, and forests, grow.

P.34: 7. Prescribed Fire

See discussion above for **P. 24: 3. Fire Occurrence**

P. 36: 4. Current Status of Waters in Kentucky, pp2

This section states that the "Methylmercury and mercury in fish tissue are by far the greatest causes of impairment" and then goes on to say that the source of such mercury is unknown. It is simply bizarre to say this, when it is well known that coal-burning power plants are the primary source of mercury deposition in our environment. Again, this is exceedingly well known.

The 2003 report MERCURY EMISSIONS FROM COAL -FIRED POWER PLANTS by the Northeast States for Coordinated Air Use Management states:

> "Mercury in the atmosphere comes from both human (or anthropogenic) and natural (e.g., volcanic activity) sources, with anthropogenic emissions far exceeding those from natural sources. In the U.S., coal-fired power plants are the largest unregulated source of mercury emissions and are responsible for approximately 40 percent of the country's industrial emissions."

More information can be found at http://www.epa.gov/mercury/ , though an abundance of other sources on this issue are available.

It is important for the public to understand the well-identified source of "the greatest cause of impairment" in Kentucky's waters, so that decisions can be made regarding smart energy use. To simply say "source unknown" is dishonest.

P. 64: 1. "Hands-Off" Management

This section makes the alarming statement that "intentional neglect does nothing but promote additional extinctions and endangerment to species at risk." This is an extreme, categorical statement and not backed by reality. Frequently, what is described as "Preservation Management" is appropriate, but the sky will not fall in if landowners simply leave their forests alone. The management section describes management as happening primarily at the stand level. When looking at the Great Smoky Mountains National Park, for example, a majority (though not all) of stands within the park boundaries are not "managed" by the definitions of activity and scale in the Draft Assessment, yet they are still considered premiere regional forests. And certainly the Park Service is not "promoting additional extinctions and endangerment to species at risk." It is true that much of that landscape is managed in the "Preservation" model, but not all of it. And it's not a catastrophe.

To keep such a categorical statement in this document is misleading and would make any serious forest ecologist cringe. Further, it is disappointing that such language is reserved for those who leave their forests alone, yet no such inflammatory language is used to describe the actions of those who clearcut or high-grade their forests – as if these latter forms of management are necessarily better than leaving forests alone. I doubt this is what is meant, but this is the implication.

It should also be pointed out that while the anthropogenic disturbances of the last 100 years have been severe and novel in the context of the 10,000-year evolution of the hardwood forests of our region, our forests are nonetheless capable of responding to major disturbances without our continued intervention. Megadroughts, pest outbreaks, and large windthrows have knocked forests down and around, and they have reordered and recovered given time.

The natural response to an extreme disturbance may take several generations of forest dominants – a time span of centuries. Allowing for these natural processes to play out is not doing "nothing but promot(ing) additional extinctions and endangerment to species at risk." It is, at times, recognizing that we don't always know what's best, and allowing the successional processes that define the adaptive strategies of natural communities to proceed on their own accord.

Logging, even under the best of circumstances, necessarily removes slowly accumulating nutrients like calcium, phosphorus, nitrogen, potassium, etc., from the system, so the impacts are not benign. More intensive forms diminish the historically native presence of coarse woody debris and potential large snags, increase soil respiration (and CO_2 outputs), diminish nutrient reuptake, and fragment interior habitat. And yet logging of all sorts is implicitly presented in a more favorable light than leaving forests alone.

Again, active management – and vegetative manipulation in particular – may be appropriate in certain cases. But to make an extreme, categorical statement like the one quoted above denies that native forests have the capacity to respond and recover without continued human intervention.

P. 92: 3. Woody Biomass

Woody Biomass is dealt with in at least three instances in the document. The language included in the water quality section includes reasonable cautionary language about potential impacts of an emerging woody biomass industry in Kentucky. However, the section on p. 92 paints a rosy picture with little acknowledgement of the serious consequences that such an industry could have on Kentucky's forestlands in terms of both long-term ecological and economic productivity. There ought to be some consistency here, and more recognition in this section that there are potential hazards from this industry, other than a brief cautionary statement that is followed by the nullifying language: "The benefit of clean fuel to future generations and the environment is incalculable."