Data Submitted (UTC 11): 1/10/2017 7:00:00 AM First name: Lance Last name: Olsen Organization: Title:

Comments: The future condition of the Custer-Gallatin National Forest is a topic with ecological and economic ramifications. This comment will be largely limited to prospects for "desired future conditions" under increasing heat, and will emphasize 1- what industry and the Forest Service already know about forest change driven by increased heat and 2- the risk associated with underestimating this change, and 3- a suggestion for including a map and chart apropos to your subsequent documentation.

I am attaching the first two of 4 pdfs I'll provide for the 4 items cited in the text of this comment. In a moment, I'll be sending the other two, separately.

A key question re desired future condition of the Custer-Gallatin National Forest is whether it's the one we're most likely to get. Projections of hotter, drier trends indicate future forest conditions that few if any interested parties are describing as [ldquo]desired.[rdquo]

Forest industry rank and file, and the public at large, may remain unaware that climate change is and will be bringing forest change. But the first two articles cited below suggest that forest industry executives and, plausibly enough, at least a few of their major investors, may have already grasped the basics of an unfolding new situation.

1st of 3 references - Robert W. Malmsheimer et al. Forest Management Solutions for Mitigating Climate Change in the United States. Journal of Forestry. April/May 2008

[Idquo]Forests are shaped by climate. Along with soils, aspect, inclination, and elevation, climate determines what will grow where and how well. Changes in temperature and precipitation regimes therefore have the potential to dramatically affect forests nationwide.[rdquo]

2nd of 3 references - Andrei P. Kirilenko and Roger A. Sedjo. Climate change impacts on forestry. Proceedings of the National Academy of Sciences [copy] 2007 by The National Academy of Sciences of the USA.

[Idquo]Our review is focused on recent publications that discuss the changes in commercial forestry, excluding the ecosystem functions of forests and nontimber forest products. [hellip]. The response of forestry to global

warming is likely to be multifaceted. On some sites, species more appropriate to the climate will replace the earlier species that is no longer suited to the climate. Also, planted forests can be relocated to more regions with more suitable climates. In general, we would expect planting and associated forestry operations to tend more toward higher latitudes, especially from some tropical sites, should they warm substantially. Plantations would likely shift toward more subtropical regions from tropical ones. In the United States, we might expect to see planted forest moving northward, with more spilling over into Canada. In Latin America forest plantations may shift toward southern Brazil and Argentina. In some cases the same sites will be used but the choice of species will change to those more suitable to the new climate."

To summarize, something's happening here, and it's becoming increasingly clear to at least some in the forest products industry.

Industry isn't alone. The Forest Service itself has been aware of this changing situation, for instance here:

[Idquo]When replanting a forest after disturbances, does it make sense to try to reestablish what was there before? Or, should we find re-plant material that might be more appropriate to current and future conditions of a changing environment?

[Idquo]Restoration efforts on U.S. Forest Service managed lands call for the use of locally adapted and appropriate native seed sources. The science-based process for selecting these seeds varies, but in the past, managers based decisions on the assumption that present site conditions are similar to those of the past.

[ldquo]This may no longer be the case.[rdquo]

http://blogs.usda.gov/2016/11/01/looking-to-the-future-and-learning-from-the-past-in-our-national-forests/

The Forest Service, and the C-G National Forest specifically, needs to disclose for public review what it and industry can plausibly be presumed to know. It is an issue of broad importance, for example to labor, because, in raising question about persistence of forest stands, it raises questions about hopes - and community economic

planning - for the sustainability of forest-dependent jobs.

Uncertainty remains. The trouble with uncertainty, climate scientist Michael Mann points out, is that it cuts both ways.

Apropos to forest planning, this means we are vulnerable to overestimating or underestimating risk to forest and to forest harvest jobs.

An underestimate of risk would have consequences unlike an overestimate.

3rd of 3 - ECOSPHERE A journal of the American Ecological Association

ESA CENTENNIAL PAPER

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On underestimation of global vulnerability to tree mortality and forest die-off from hotter drought in the Anthropocene

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Key words:

carbon starvation; climate change; CO2 fertilization; drought; ESA Centennial Paper; extreme events; forest dieoff; forests; hydraulic failure; insect pests; pathogens; tree mortality; woodlands.

Abstract.

Patterns, mechanisms, projections, and consequences of tree mortality and associated broad-scale forest die-off due to drought accompanied by warmer temperatures -"hotter drought", an emerging characteristic of the Anthropocene -are the focus of rapidly expanding literature.

Despite recent observational, experimental, and modeling studies suggesting increased vulnerability of trees to

hotter drought and associated pests and pathogens, substantial debate remains among research, management and policy-making communities regarding future tree mortality risks. We summarize key mortality-relevant findings, differentiating between those implying lesser versus greater levels of vulnerability.

Evidence suggesting lesser vulnerability includes forest benefits of elevated [CO2] and increased water-use efficiency; observed and modeled increases in forest growth and canopy greening; widespread increases in woody-plant biomass, density, and extent; compensatory physiological, morphological, and genetic mechanisms; dampening ecological feedbacks; and potential mitigation by forest management.

In contrast, recent studies document more rapid mortality under hotter drought due to negative tree physiological responses and accelerated biotic attacks. Additional evidence suggesting greater vulnerability includes rising background mortality rates; projected increases in drought frequency, intensity, and duration; limitations of vegetation models such as inadequately represented mortality processes; warming feedbacks from die-off; and wildfire synergies.

Grouping these findings we identify ten contrasting perspectives that shape the vulnerability debate but have not been discussed collectively.

We also present a set of global vulnerability drivers that are known with high confidence: (1) droughts eventually occur everywhere; (2) warming produces hotter droughts; (3) atmospheric moisture demand increases nonlinearly with temperature during drought; (4) mortality can occur faster in hotter drought, consistent with fundamental physiology; (5) shorter droughts occur more frequently than longer droughts and can become lethal under warming, increasing the frequency of lethal drought nonlinearly; and (6) mortality happens rapidly relative to growth intervals needed for forest recovery.

These high-confidence drivers, in concert with research supporting greater vulnerability perspectives, support an overall viewpoint of greater forest vulnerability globally. We surmise that mortality vulnerability is being discounted in part due to difficulties in predicting threshold responses to extreme climate events. Given the profound ecological and societal implications of underestimating global vulnerability to hotter drought, we highlight urgent challenges for research, management, and policy-making communities.

4th of 4 references -The map and chart showing tree species' habitat loss on p. 21 of Rocky Mountain Forests at Risk offer just one of many assessments generally confirming industry and agency awareness, and does so from non-industry, non-agency perspectives.

I believe that this map and chart should be displayed in C-G National Forest documents, in part because it can serve as a rough but readily accessible guide to where the forest -- and forest labor opportunity -- might and

might not exist under new conditions of heat and drought; i.e., economic sustainability and the [ldquo]hotter drought[rdquo] problem.

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" 'Triage' is a dirty word in some conservation circles, but like many dirty words, it describes something common. Whether they admit it or not, conservationists have long had to make decisions about what to save.

"As more and more admit it, open discussion about how the decisions are best made - by concentrating on particular species, or particular places, or absolute costs, or any other criterion - becomes possible. Whichever criteria come into play, one thing remains constant. The decisions have to be made quickly."

Emma Marris, "What To Let Go."

NATURE November 8, 2007