Data Submitted (UTC 11): 7/21/2020 6:00:00 AM
First name: Lance
Last name: Olsen
Organization:
Title:
Comments: This version of my objection to the Custer Gallatin land management plan is more accurate than my previously electronically-submitted objection, and is composed/presented in the format required.

I don't have a way to provide an electronic signature to an electronically submitted objection , but I have today mailed a printed hardcopy of this objection that includes my signature.

To : Objection Reviewing Officer, Northern Region, 26 Fort Missoula Road, Missoula, MT

59804.

Subject : Objection to Custer Gallatin Land Management Plan, Custer Gallatin National

Statement of issues and/or parts of the plan revision to which the objection

applies:

In its FEIS Vol 1, for example, the Forest refers to resilience 71 times, but only refers to

regeneration failure 2 times. This is objectionable simply because the Forest has itself

documented that resilience depends on regeneration, and has itself cited references to

evidence that regeneration has been increasingly implausible across the western United

States including in Montana (e.g., Stevens-Rumann 2018, Davis et al 2019, and Coop et al

2020).

Concise statement explaining the objection and suggestion how the proposed plan

should be improved:

? The reasons for this objection are:

Broadly put, the Forest is at risk of misrepresenting the viability of its intended

management for resilience, ecological integrity, and desired future condition, all

within a natural range of variation.

Proposed Solution: There is no easy solution, largely because the future of forests is and will increasingly be determined by the future of the atmosphere, where elevated concentrations of greenhouse gas are already creating a climate-driven forest crisis expressing itself as, for example, seedling death in hot, dry conditions. That said, the Forest needs to more explicitly and more publicly align its management with the direction recommended by Coop et al (2020); [ldquo][hellip]management and conservation efforts should align with expectations of increasing forest vulnerability to conversion. In an era of change, the forest that was there before the fire may not return.[rdquo] As the forest knows, there has already been an expanding area where forest has not returned. Indeed, the Forest could and should offer an increasingly realistic outlook as expressed by physicist and climate scientist Kate Marvel; [ldquo]The world we one knew is never coming back[rdquo]<< https://onbeing.org/blog/katemarvel-we-need-courage-not-hope-to-face-climate-change/>>. As I will show herein, the Forest knows that this risk exists. It is a risk of such considerable material interest that the Forest is obliged to play a role in alerting the public to its existence. The Forest will, as a precondition to implementation of its Land Management Plan, have to work out for itself how it can best help convey this message to an unsuspecting public. The Forest may find that the most expedient way to help convey this message is to include it in the final Record of Decision.

Statement demonstrating the link between objection and prior formal comments:

As I previously noted during scoping, the Forest faces a dicey, risky situation, being forced into a reactive mode by consequences of a hotter and drier conditions that have been raising increasing evidence that forest is being converted to non forest in the western United States, a well-documented trend to which the Forest cannot be immune. This was the risky situation I stressed during scoping, and it[rsquo]s that same risky situation now behind the Forest[rsquo]s scramble to manage for desired future conditions of forest persistence via management for resilience and ecological integrity, and the Forest[rsquo]s increasingly implausible

assumption that there is still opportunity for forest management within a natural range of variation.

I can readily sympathize with the Forest[rsquo]s attempt to manage for desired future conditions of forest persistence via management for resilience and ecological integrity, in a context that assumes there is still opportunity for forest management within the natural range of variation. That said, I will emphasize herein that the Forest faces a risky climate crisis which is on a path toward a forest crisis which is, in turn, becoming more risky, and that the Forest has reacted by putting on a brave face, mustering up a can-do facade, incessantly referring to this frequently repeated intent to manage for desired future condition, resilience, and ecological integrity, and all that within a natural range of variation.

Good luck with that.

It has been getting increasingly obvious that risks associated with climate change have forced the Forest and the Forest Service in general into an attempt to make the best of what can only be described as an increasing bad situation, namely an already documented trend of climate driven deforestation. Considering that evidence, I must object to the Forest[rsquo]s insistence on repeating its key claims of managing for resilence et al, because the Forest knows full well that its attempt at achieving resilience, ecological integrity, and desired future is at some appreciable risk of failure and, accordingly, at risk of being a pretense.

First, some background, specifically that the Forest knows that a National Forest Management Act requirement of sustained yield of timber has already been effectively mooted on the Ashland, where ~100,000 acres of ponderosa pine stands have already been converted to non-forest grass and shrub after successive fires. I think the Forest will concur that few if any stakeholders, members of the public, or policymakers had defined conversion of forest to non-forest grass and shrub as a desired future condition, or as

evidence of resilience or sustained ecological integrity.

And the Forest knows that most if not all stakeholders, members of the public, and and policy makers far prefer that it doesn[rsquo]t happen again. Instead, and I expect the Forest to concur, most if not all stakeholders, members of the public, and and policy makers would define persistence of forest as the desired future condition and, furthermore, many if not all will specify persistence of commercially valuable tree species such as the Ponderosa pine and Douglas fir [mdash] or, more generally, the persistence of conifers [mdash] as the desired future condition and evidence of a persisting ecological integrity.

All in all, they[rsquo]d all likely like to see persistence of the familiar forest they see today. In other words, the status quo.

And, indeed, the Forest plainly and frequently states that this is its intent to effect these desired status quo conditions, specifically via the Revised Plan[rsquo]s repeated emphasis on a plan for resilience, ecological integrity, and desired future conditions, within NRV.

The Forest would better serve the interest of present and future generations if it directly conveyed the same plain-language message that eminent climate scientist Michael Mann conveyed during an interview with the PBS News Hour in August, 2018, when he said that, if we keep burning fossil fuels, we will get [ldquo]worse and worse[rdquo] heat, drought, and fires <<https://www.pbs.org/newshour/show/climate-change-is-making-wildfires-moreextreme-heres-how>>.

The Forest knows that it[rsquo]s aim for a status quo forest via resilience is at risk of failure, and even at risk of being a pretense

For example, on pp 170-171 FEIS Vol 1, the Forest advises stakeholders and other reviewers that, [ldquo]While many effects of climate change are anticipated to be gradual, there is also the potential for interacting disturbances such as insects, drought and fire to drive systems towards sudden large-scale transformations (Millar and Stephenson 2015).[rdquo]

So the Forest knows not only that resilience is at risk, but also knows that [ldquo]transformation[rdquo] away from the desired status quo can be sudden, and large-scale.

It is to the Forest[rsquo]s credit that it does indeed make this point.

Having established that much, the Forest immediately goes on to say, [ldquo]For example, dry forests that already occur at the edge of their climatic tolerance are increasingly prone to conversion to non-forests after wildfires due to regeneration failure (Stevens-Rumann et al. 2018, Davis et al. 2019),[rdquo] and adds that, [ldquo]This trend is likely to continue in the future across all forest types as large wildfires remove local seed source and suitable climate space for tree regeneration becomes increasingly rare (Bell et al. 2014, Harvey et al. 2016b, Andrus et al. 2018).

The key phrases above are [ldquo]climatic tolerance[rdquo] and [ldquo]regeneration failure[rdquo] and, as the Forest knows full well, regeneration failure after [ldquo]large wildfires[rdquo] is, in fact, a post-fire failure of the much-touted resilience. Thus, although never explicity stated in these terms, the Forest is recognizing risk of climate-driven forest crisis in the form of expanding areas deforestation.

For example, the Forest knows that Stevens-Rumann et al (2018) explicitly define regeneration as key to resilience; [ldquo]Forest resilience, or the capacity of a forest to return to a pre-disturbance state (Gunderson 2000), is strongly dependent on sufficient tree

regeneration (Johnstone et al. 2016).[rdquo]

However, while the Forest has read Stevens-Rumann et al, it has somehow decided not to directly quote their finding that resiience depends on regeneration. This is unfortunate because many stakeholders, members of the public have not had the opportunity to read Stevens-Rumann et al, which means that the Forest knows what many stakeholders might not know.

Namely, and in plain language, that hot dry conditions help set a forest up for fire, and that those same hot dry conditions kill seedlings after fire has come and gone. This is plain language accessible to many people, but it is plain language never set forth in either FEIS or the draft Rod where it is certainly needed.

And so, while the Forest plausibly knows better than many in the public have yet had a chance to learn, the fate of seedlings sets the fate of a forest[rsquo]s future. It is unfortunate that the Forest has not conveyed that basic message in those direct terms necessary to science communication. Instead, the Forest has biased its reporting toward those familiar with academic journals typically beyond the reach of the general public.

Knowing what it knows about the critical importance of seedling death or survival, the Forest intends to monitor their status, and will monitor seedlings explicitly in order to know when and where it will need to change course via adaptive management; On pp 171-172 FEIS Vol 1, [ldquo]Another key plan component that is critical in the context of future climate change is the establishment of a monitoring plan to inform an adaptive management approach. This enables the intentional use of monitoring to evaluate effectiveness of our plan direction and resulting management actions. For example, monitoring tree regeneration will provide critical information on possible climate change effects to this vulnerable life stage (Stevens-Rumann et al. 2018). [ldquo]

The monitoring of seedlings is so important that the Forest must make an effort to gather public support. Among other things, public support will be essential to monitoring seedlings of high economic value. However, the Forest cites Davis et al (2019), and knows but somehow has decided not to directly quote their finding that such thresholds have, already, been crossed for economically valuable ponderosa pine and Douglas fir. In this case, the Forest thus again knows more than it confides for the illumination of stakeholders, the larger public, and policymakers

These matters are of such considerable material interest to present and future generations that they demand a full and coherent disclosure to stakeholders, the larger public, and policymakers. The Forest may claim that it[rsquo]s done that, but, for example, the crucially import topic of regeneration gets only the most superficial and passing reference only on 2 pages of the draft Record of Decision, and neither of those 2 mentions includes risk of regeneration failure, a.k.a., failure of resilience.

As the Forest knows well from actually having read Stevens-Rumann et al (2018), what might be most aptly described as climate-driven deforestation, thanks to failure of regeneration/resilience, has been a repeated trend, one documented across the western United States including in Montana. The certainty of this broad trend of climate-driven deforestation crisis has since been well-confirmed by Coop et al (2020), and in western Canada by Brecka et al (2020).

In a system where researchers[rsquo] investigations will inevitably lead to lingering unresolved details, prompting them to bid for more research, it[rsquo]s not as if we[rsquo]re left clueless. The risk of post-fire resilience failures is well within the realm of certainty, and the fact that[rsquo]s been happening is in the realm of high certainty. The big question is how many more resilience failures will occur, and when and where they will occur, in the Forest[rsquo]s planning area, and, thus, how soon the Forest must adapt its current management plan to a new certainty, and get on with pursuing a necessary course away from the status quo forest familiar today.

The Forest knows that it[rsquo]s aim for a status quo forest via ecological integrity is at risk of failure, and even at risk of being a pretense

For example, the Forest cites Halofsky et al (2018) as its main source, and cites their reporting how climate change translates to forest change ; [ldquo]Increasing air temperature, through its influence on soil moisture, is expected to cause gradual changes in the abundance and distribution of tree, shrub, and grass species throughout the Northern Rockies, with drought tolerant species becoming more competitive.[rdquo]

This above direct quote from Halofsky et al is rich in meaning for any rigorous analysis of a sustained status quo of forest conditions implied by ecological integrity.

First, their reference to increasing air temperature is a direct reference to climate change.

Second, their reference to changes in [ldquo]abundance[rdquo] of species alone suggests a climateforced departure from the status quo conditions implied by ecological integrity.

Third, their reference to changes of [ldquo]distribution[rdquo] of species alone suggests a climate-forced departure from the status quo conditions implied by ecological integrity.

Fourth, their reference to changing competitiveness of [ldquo]drought tolerant[rdquo] species suggests a further climate-forced departure from the status quo conditions implied by ecological integrity.

Having actually read Halofsky et al, the Forest knows that these above findings do not bode well for the Forest[rsquo]s plan to achieve or sustain the ecological integrity remaining within the planning area today.

For another example of what the Forest knows; [ldquo]Plan direction, which emphasizes ecological integrity and resilience, will be critical to minimizing the undesirable effects of these increasing and interacting stressors. Nevertheless, managers and the public should expect climate change to drive profound and often surprising changes on ecosystem structure, function, and composition in the coming decades.[rdquo]

The operative words here are [ldquo]nevertheless,[rdquo] [ldquo]the public,[rdquo] [ldquo]should expect,[rdquo] and [ldquo]changes.[rdquo]

In that one sentence, the Forest does approach adequate disclosure of risk. That is to the Forest[rsquo]s credit, but, again, this example of disclosure is obscured by the Forest[rsquo]s persistent references to hope of resilience, ecological integrity, and achievement of desired future conditions.

To its credit, the Forest says on that same page that, [ldquo]Successful management of

vegetation and ecosystems during this period of rapid environmental change will require [lsquo]anticipatory[rsquo] planning and management.[ldquo]

Aye, there[rsquo]s the rub. The most evident elaboration the Forest provides about this anticipatory approach is, ahem, a constant drumbeat of managing for resilience, ecological integrity, and desired future conditions [mdash] by remaining within a natural range of variation.

As the Forest knows full well, Millar and Stephenson (2015) say that a serious threshold has been crossed when a forested area converts to an area without trees. As the Forest further knows, that [ldquo]serious threshold[rdquo] has already been crossed on ~100,000 acres of the Ashland, specifically with loss of the economically valuable ponderosa pine.

Can the Forest legitimately leave an impression among stakeholders, the larger public, and policymakers that the Forest Plan[rsquo]s direction, which emphasizes ecological integrity and

resilience, therefore rules out the need to anticipate further, additional crossing of this serious threshold?

The Forest knows that its attempt to deliver future desired conditions is at risk of failure, and even at risk of being a pretense

While many [mdash] including conservationists [mdash] may continue to assume a permanence of forest cover, the Forest itself knows that post-fire heat and drought kill seedlings which are the foundation of a forest[rsquo]s future. The Forest also knows that there will be fire, and that there will be drought.

The Forest could, should, and plausibly does know that a remaining opportunity for forest management within a natural rate of variation is a lot cause, and, indeed, that continued insistence that it still has opportunity to manage forests within the natural range of variation is, now, already a pretense.

NRV (natural range of variation) is specifically defined in the Forest Service planning rules:

[ldquo]NRV is the variation of ecological characteristics and processes over scales of time and space that are appropriate for a management application. The pre-European influenced reference period considered should be sufficiently long, often several centuries, to include the full range of variation produced by dominant natural disturbance regimes and should also include short-term variation and cycles in climate.[rdquo].

While the Forest may or may not know it, the larger Forest Service parent agency is well aware that keeping within the natural range of variation indicated in the past several centuries will be, at a minimum, difficult.

For instance, [ldquo]Current projections indicate that a further 4[deg] to 6[deg]C global warming could be reached by as early as the end of this century (IPCC 2007), when global temperatures could exceed any reached in the last several million years.[rdquo] Nathan L. Stephenson and Constance Millar. USDA Forest Service RMRS-P-71. 2014.

Furthermore, [ldquo]The climate change metric represents when the average annual temperature is projected to permanently depart from the prevailing climate of the past century under a [lsquo]business as usual[rsquo] scenario.[rdquo] (https://www.fs.fed.us/pnw/sciencef/scifi197.pdf)

Even more Forest Service awareness is evident here; [ldquo][hellip] all global circulation models

(GCMs) predict unprecedented increases in temperature for the western US [hellip][rdquo] (https://www.fs.fed.us/wwetac/brief/western-forests-and-climate-change.php)

I think the Forest will concur that the third Forest Service analysis cited just above was describing a departure from a natural range of temperature variation when citing prediction of [ldquo]unprecedented increases.[rdquo]

It is considerable interest, then, that the Forest can report, on p 165 of FEIS Vol 1, the Forest included this passage; [ldquo]The natural range of variation has been criticized as less relevant in an age of climate change (Millar 2014). There is potential for ecological transformations to occur in temperate ecosystems, based on the potential for interrelated

drivers such as chronic and acute drought, wildfire, and insect outbreaks to push ecosystems beyond their thresholds for resilience (Millar and Stephenson 2015, Golladay et al. 2016).[rdquo]

Now, having read both Millar and Stephenson (2015), and Golladay et al (2016), the Forest knows what these researchers actually said, which is something that many stakeholders, members of the larger public, and policymakers may not know.

That includes their shared outlook that climate-driven change of forests weighed herein are [ldquo]inevitable[rdquo].

I expect the Forest to concur that risk of inevitable forest change does not leave the Forest immune. I further expect the forest to concur that its main source of information, Halofsky et al (2018) suggest at least some inevitability of climate-driven forest change when saying, in Chapter 5 by Keane et al, Effects of Climate Change on Forest Vegetation in the Northern Rockies, that, [ldquo]Increasing air temperature, through its influence on soil moisture, is expected to cause gradual changes in the abundance and distribution of tree, shrub, and grass species throughout the Northern Rockies, with drought tolerant species becoming more competitive. The earliest changes will be at ecotones between life- forms (e.g., upper and lower treelines). Ecological disturbance, including wildfire and insect outbreaks, will be the primary facilitator of vegetation change, and future forest landscapes may be dominated by younger age classes and smaller trees. High-elevation forests will be especially vulnerable if disturbance frequency increases significantly. Increased abundance and distribution of non-native plant species, as well as the legacy of past land uses, create additional stress for regeneration of native forest species.[rdquo]

I further expect the Forest to concur that any degree of inevitability of a changing forest is a

matter of material interest to many stakeholders, members of the larger public, and

policymakers, who may have had opportunity to read [mdash] but need to know [mdash] important studies that the Forest has read.

The question of inevitable change unavoidably includes risk of conversion from forest to non-forest, and the Forest knows that Millar and Stephenson refer directly to this possibility. Equal knowledge may not exist for every stakeholder, member of the public, or policymaker.

Additionally, having read Millar and Stephenson, the Forest knows that they say, [ldquo]Because the scope of the challenge is vast, triage exercises will almost certainly be necessary [hellip][rdquo]. Triage would of course be of special prominence as evidence of conversion from forest to non forest accumulates. But again, while the Forest is aware of a stated need for triage exercises, it is not likely that very many stakeholders, members of the larger public, or policymakers know what the Forest knows about inevitable change leading to need for triage in forest management.

A big and lurking question is how many conversions like that on the Ashland will have to occur before the Forest issues full disclosure about this matter. In this, the Forest can and should give a hard look at the comment by Coop et al (2020) that, [ldquo] [hellip] the prospect of directional climate change beyond historical ranges of variability, and increased frequency and magnitude of extreme disturbance, compels us to consider the pos- sibility of profound and persistent ecological change across forested ecosystems. [ldquo]

Finally, this finding of relevance to the Forest[rsquo]s claim to manage within natural range of variation; here, the atmosphere as a whole will, within the lifetime of the Forest[rsquo]s revised plan, take a significant departure from the past several centuries of variation specified in the planning rules.

Physorg. JULY 10, 2020

By 2025, carbon dioxide levels in Earth's atmosphere will be higher than at any time in the last 3.3 million years

by University of Southampton

<<https://phys.org/news/2020-07-carbon-dioxide-earth-atmosphere-higher.html>>

By [i.e., before] 2025, atmospheric carbon dioxide (CO2) levels will very likely be higher than they were during the warmest period of the last 3.3 million years, according to new

11

research by a team from the University of Southampton published today in Nature Scientific Reports [OPEN ACCESS pdf]<<https://www.nature.com/articles/s41598-020-67154-8.pdf>>.

Dr. Thomas Chalk, a co-author of the study, added: "Focussing on a past warm interval when the incoming insolation from the Sun was the same as today gives us a way to study how Earth responds to CO2 forcing. A striking result we've found is that the warmest part of the Pliocene had between 380 and 420 parts per million CO2 in the atmosphere. This is similar to today's value of around 415 parts per million, showing that we are already at levels that in the past were associated with temperature and sea-level significantly higher than today. Currently, our CO2 levels are rising at about 2.5 ppm per year, meaning that by 2025 we will have exceeded anything seen in the last 3.3 million years."

Professor Gavin Foster, who was also involved in the study, continued: "The reason we don't see Pliocene-like temperatures and sea-levels yet today is because it takes a while for Earth's climate to fully equilibrate (catch up) to higher CO2 levels and, because of human emissions, CO2 levels are still climbing. Our results give us an idea of what is likely in store once the system has reached equilibrium."

Concluded Dr. de la Vega, "Having surpassed Pliocene levels of CO2 by [i.e., before] 2025, future levels of CO2 are not likely to have been experienced on Earth at any time for the last 15 millions years, since the Middle Miocene Climatic Optimum, a time of even

greater warmth than the Pliocene."

Elwyn de la Vega et al. Atmospheric CO2 during the Mid-Piacenzian Warm Period and the M2 glaciation, Scientific Reports (2020). <<https://www.nature.com/articles/s41598-020-67154-8.pdf>>.

The Forest may well be presenting too optimistic a view of increasing water use efficiency in response to rising levels of atmospheric CO2.

For example, on p 208 of the FEIS Vol 1, the Forest advises reviewers that [ldquo]Elevated CO2 may counter the effects of higher temperatures and evaporative demand by improving water-use efficiency of plants (Morgan et al. 2011).[rdquo] In this analysis, trees might have some chance of surviving the changes being driven by drought. The Forest asserts that possibility specifically for ponderosa pine. On p 197 of FEIS Vol 1, the Forest asserts that [ldquo]Ponderosa pine dominance type provides important wildlife habitat, particularly as late- successional or old-growth forest on the warm dry potential vegetation type. It is a [ldquo]drought avoider,[rdquo] meaning it tolerates dry soil conditions by efficiently closing stomata to avoid water loss and xylem cavitation and stay alive during deep droughts.[rdquo]

However, two studies published in 2020 cite evidence that the understanding of water use efficiency circa 2011 no longer holds. Adams et al (2020) find [ldquo]diminishing[rdquo] CO2-driven gains in water-use efficiency because, instead of countering the effects of higher temperatures and evaporative demand, rising levels of CO2 are pushing trees to their [ldquo]intrinsic physiological limits.[rdquo] Brookshire et al (2020) find, more broadly, that increasing water use efficiency by plants is unsustainable.

Forest permanence/persistence under drought thus appears less likely under drought than the Forest implies with its reference to what seemed true back in 2011.

The Forest is at risk of misleading stakeholders, the public and policymakers about feasibility of maintaining old growth.

For example, on p 260, the Forest claims that, [ldquo]the trajectory of large tree size class and

prevalence of large tree structure (discussed above) indicate that the amount of old growth should also be increasing forestwide under all alternatives.[ldquo]

However, McDowell and Allen (2015) find that, [ldquo][hellip] tall trees of old growth forests are at the greatest risk of loss[rdquo] in a climate being forced into change. Similarly, Stoval et al (2019) find that, [ldquo]Forest mortality is accelerating due to climate change and the largest trees may be at the greatest risk, threatening critical ecological, economic, and social benefits. [ldquo]

Also on p. 260, the Forest voices a belief that, [ldquo]Succession will continue to be the primary means by which old growth forest is developed.[rdquo] Well, succession of course depends on succession by younger trees, including whatver seedlings die in (expected) hot, dry conditions. So it is of material interest then that Xu et al find that trees are at risk of death at both ends of the age/size spectrum -- a finding that cast doubt on any Forest claim of ability to retain ecological integrity.

The Forest knows that alternatives to non-forest may exist when and where the Forest[rsquo]s intended management fails in the face of an increasingly unfavorable climate.

With drought a certainty, and fire another certainty, one such alternative to increasingly treeless conditions may be at hand via conifers with combined resistance to fire and tolerance of drought. Any such conifer might be resilient/resistant enough to persist and, therefore, offer an alternative to non forest.

Any such conifer would thus be a high-value tree, worthy of special attention, but I found no such conifer identified in the Forest[rsquo]s recent documents.

This raises another question I couldn[rsquo]t find answered in the Forest[rsquo]s recent documents; if no such conifer happens to exist in the Forest[rsquo]s planning area, might one or more such conifers exist elsewhere? If so, would the Forest then shift into adaptive management mode via assisted migration? And how many more conversions like the one on the Ashland need to

happen before the Forest moves into that new mode of management?

It is encouraging, then, that the Forest has said, on p 20 of Appendix F, Response to Comments, that , [ldquo]The plan does not preclude the use of assisted migration,[rdquo] and that [ldquo]The Custer Gallatin may adopt a strategy of assisted migration if and when there is sufficient information to guide this activity.[rdquo]

Would some next conversion to non forest have to be as extensive as the ~100,000 acres on the Ashland before the Forest would adopt a strategy of assisted migration for conifers that are both fire-resistant and drought tolerant but are not now in the Forest[rsquo]s planning area?

These questions gain increased urgency when management within a natural range of variation is a lost cause, and when, at the same time, a general public desire for forest persistence is evident at many levels including scenics and wildlife.

And it[rsquo]s not as if assisted migration is a novel topic within USDA Forest Service. If not the Forest, the larger parent Forest Service has given assisted migration some serious attention. I[rsquo]ll be uploading the pdf of each of the three examples of in-house, Forest Service studies discussed below.

The Forest, stakeholders, the larger public, and policymakers at every level need to know what the Forest Service knows about assisted migration. At a minimum, all concerned need to know that assisted migration is not a novel topic, but instead has been a matter of serious consideration within the Forest Service.

As a first example, consider Handler, S.; Pike, C.; St. Clair, B.; 2018. Assisted Migration. USDA Forest Service Climate Change Resource Center. These authors observe that, [ldquo]A land manager may first need to make decisions about which species are appropriate to favor in a given area,[rdquo] and immediately go on to say that, [ldquo]In some cases, however, it is clear that climate change and other conservation challenges make the risk associated with doing nothing greater than the risk associated with intervening.[rdquo]

A second example is available via the USDS Forest Service Rocky Mountain Research Station[rsquo]s website on Climate Change and Assisted Migration <<https://rngr.net/publications/assisted-migration>>. This website allows Forest Service staff and others to [ldquo] [hellip] search more than 840 articles discussing assisted migration, climate change, and native plant transfer guidelines by author, title, subject, or keywords.[rdquo] In providing this service, the website [ldquo][hellip] provides a central foundation for collaboration in generating research questions, conducting studies, transferring and acquiring data, expanding studies to key species and geographic regions, and guiding native plant transfer.[rdquo]

A third example is available as part of a broader conference sponsored in part by the Forest Service; i.e., Browning, J. Comp. Proceedings of the 60th Annual Western International Forest Disease Work Conference; 2012 October 8-12; Tahoe City, CA. 1 USDA Forest Service, Washington, DC. 2 Northern Institute of Applied Climate Science, USDA Forest Service, St. Paul, MN. 3 USDA Forest Service, Pacific Northwest Region, Pendleton, OR. 4 USDA Forest Service, Northern Research Station, Delaware, OH.

One session of that conference was titled, [ldquo]Policy and strategy considerations for assisted migration on USDA Forest Service lands,[rdquo] and was co-authored by Forest Service personnel including Leslie A. Brandt, Douglas A. Boyce, and Louis R. Iverson. This Forest Service coauthored session on [ldquo]Policy and strategy considerations for assisted migration on USDA Forest Service lands[rdquo] reported that, [ldquo]Assisted migration has been defined as the movement of species, populations, or genotypes to places outside the areas of their historical distributions to maintain biological diversity or ecosystem functioning with changing climate (Richardson et al. 2009; Schwartz et al. 2012).[rdquo]

The above authors point out that [ldquo]Assisted migration changes the land management focus from past to future,[rdquo] a value also stressed by Golladay et al (2016), where the value of considering today[rsquo]s youth and future generations assumes its rightful importance in an age

of mounting risk and worries.

The above three examples of Forest Service attention to assisted migration demonstrate an awareness that requires dissemination beyond the agency, to stakeholders and the larger public, who may be unaware of serious consideration this topic has received even within the agency.

The big [ldquo]what if?[rdquo] and a tree of last resort

The big [ldquo]what if?[rdquo] question here is what if no conifer on the Forest or elsewhere is sufficiently fire resistant and, also, sufficiently drought tolerant to be resilient in the face of expected and plausibly inevitable increased frequency of fire and drought?

A broadleaf tree might serve where the needleleaf conifers can[rsquo]t. Because the broadleaf green ash does already exist within the Forest[rsquo]s planning area, including the Ashland, might this tree offer an opportunity to avoid treeless conditions? It[rsquo]s certainly fire-resilient, capable of resprouting back from roots where fire kills it aboveground. But alas, as the Forest points out on p 199, FEIS Vol 1, [ldquo]Green ash is on the western and most arid margin of its range on the Ashland and Sioux Districts and is likely at the limit of its environmental tolerances. Because of this, extended periods of drought may have an adverse effect on regeneration and probably promote other problems.[rdquo]

The green ash is thus an unlikely candidate, one that is also at risk from the emerald ash borer.

In that scenario, it is encouraging that the Forest can say, on p 104 Appendix F, Response to Comments, that [ldquo]The Forest Service acknowledges the natural history traits of bur oak that would confer resilience to climate change. Currently, bur oak does not occur within the plan area.[rdquo]

The bur oak might be a tree of last resort, but its resilience does make it a high value tree that deserves broader attention. And its current absence within the boundaries of the plan area makes it another plausible candidate for assisted migration any time or place where a

conversion to a treeless condition is not desirable or desired.

A white oak, the bur oak is not known to be affected by sudden oak death, which appears, at least so far, to be limited to the red oaks.

It is also known for high value to wildlife, including a broad range of species including but not limited birds, squirrels, and bears. In fact, its value to birds, squirrels, and bears makes it an interesting and potentially valuable counterpart to whitebark pine [mdash] a troubled tree that my not be as resilient as the bur oak.

To assist the Forest in making the bur oak[rsquo]s attributes more available to stakeholders, the larger public, and policymakers, I[rsquo]ll be uploading the USDA Plant Guide for this resilient tree.

And, for the Forest[rsquo]s sake as well as others, I[rsquo]ll be uploading this peer-reviewed analysis in hope it will help all concerned prepare for project level decisions as future conversions to treeless conditions develop:

SCANDINAVIAN JOURNAL OF FOREST RESEARCH, 2017 VOL. 32, NO. 6, 535[ndash]543
http://dx.doi.org/10.1080/02827581.2016.1249022

Assisted tree migration in North America: policy legacies, enhanced forest policy integration and climate change adaptation

Adam Wellstead
and Michael Howlett

ABSTRACT

The weight of much expert forest management opinion is that issues such as climate change can be effectively addressed only if forest policy-making moves from a purely sectoral focus and undergoes a shift to a more integrated multi-issue, multi-sector policy-making process. This is because credible adaptation policies in the sector require greatly enhanced multisectoral policy integration if they are to succeed. But this requirement may be beyond the

capacity of many countries to deliver. This article explores the integration challenges faced by forest policy-making in Canada and the United States and uses the case of assisted tree migration to probe the reasons for the failure of institutions in both countries to develop and manage better vertical and horizontal integration in a climate change-related forest policy area. The article emphasizes the importance of previous rounds of policy-making or [ldquo]policy legacies[rdquo], which serve to constrain contemporary policy options. It argues that due to the presence of many such legacies, forest policy development will continue to feature incremental adjustments through policy layering and policy drift, processes which limit the prospects for greater integration and better climate change adaptation in this sector.

The Forest[rsquo]s plan to monitor post-fire status of seedlings deserves full and broad support across stakeholders, the public at large, and policymakers who want evidence brought to hand.

The Forest and others do know that post-fire seedling mortality has been documented with increasingly hotter, drier conditions. And it is a certainty that success or failure of seedlings predicts the future of forested conditions, desired or otherwise. Therefore, monitoring of seedlings is of high material interest for present and future generations.

However, and without any diminishment of the importance of post-fire monitoring, postharvest or post-logging monitoring will be just as important. After all, seedlings will die in hot dry soils no matter whether those conditions follow fire or logging.

Review

The Forest faces an increasingly situation, and is gambling that it[rsquo]s management strategies will get it through a western US forest crisis following on the heels of a global atmospheric crisis. The Forest needs to make extra effort to convey the risks it and the forests under its management face in a hotter, drier region that is on a course to get additionally hotter and drier as households and industries continue a dependency on energy derived from fossil

fuels.