BIOMASS IN THE SAN LUIS VALLEY
San Luis Valley Ecosystem Council Position Paper
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Proposals have surfaced for cutting and removing dead spruce trees on the Rio Grande National Forest (RGNF) to produce energy. Below we highlight considerations, issues, and concerns with these proposals.

SUMMARY

We believe any biomass operation in the San Luis Valley must be appropriately scaled and ecologically sustainable. A large-scale operation that uses 1000 or more acres of material from the RGNF annually may adversely affect habitat for several wildlife species, including the federally listed Canada lynx and species of conservation concern. Large scale tree removal would also delay or thwart the ecological recovery that is underway following the recent spruce beetle outbreak. Large-scale removal of biomass from the RGNF would require additional oversight from an understaffed agency to ensure legally-required compliance with the management plan for the national forest. If biomass production is pursued, areas of climate change refugia should be considered using additional analysis. An appropriate NEPA process would be needed which may require an Environmental Impact Statement (EIS).

Given limitations on availability at a landscape scale, it is unlikely that enough dead trees could be removed to significantly reduce fire risk and severity. Furthermore, fires in the spruce-fir zone, where most of the dead trees occur, are infrequent and driven primarily by climate related factors, not fuels comprised of dead trees. It is possible that there is a negative relationship between severity of bark beetle outbreaks and post-fire recovery in localized areas, however removal of standing dead trees would not likely alleviate this. Tree removal in areas close to communities (the wildland-urban interface or WUI) and where needed for safety reasons (along open roads, near campgrounds and trailheads, etc.) should be the focus for fuels reduction and perhaps a very small and sustainable biomass operation. Additional information is needed to adequately assess a biomass proposal given the risks and potential impacts identified.

THE PERCEIVED FIRE RISK WILL NOT BE SIGNIFICANTLY REDUCED BY REMOVAL OF DEAD TREES.

Proponents of biomass and others often mention the fire threat from dead trees on the RGNF as a reason for development. The spruce beetle outbreak peaked several years ago, and the RGNF can now be considered a post-beetle outbreak landscape in the initial stages of ecological recovery. Recent aerial detection surveys indicate the RGNF currently has very little spruce beetle activity (USDA Forest Service 2021).
The greatest fire hazard occurs during the first few years directly after beetle activity when dead needles and fine twigs are still on the trees (Schmid and Amman 1992).
These conditions have long since passed, with fire hazards now greatly reduced.

Wildfires in spruce-fir forests in Colorado are an infrequent disturbance event that occur at long time intervals. In the San Juan Mountains of Colorado, fire return intervals in spruce-fir may average from 200+ years (Schmidt et al. 2002).

Wildfire starts in spruce-fir are primarily associated with extreme weather events such as drought and high winds rather than fuels, stand age, or insect and disease. They also tend to be high-intensity stand replacement events when they do occur (Bessie and Johnson 1995, Sherrif et al. 2001, Veblen 2003).
A recent study conducted in the San Juan Mountains found that fire severity in spruce-fir forests was unaffected by spruce beetle outbreaks and fuels comprised of standing dead trees, and that climatic factors are primarily responsible for conditions conducive to large, high-severity wildfire (Andrus et al 2016).
Numerous research papers indicate there is no clear evidence that bark beetles or dead trees influence the frequency or severity of fire events in spruce-fir forests (e.g. Baker and Veblen 1990, Bebi et al. 2003, Andrus et al. 2016).
However, the combination of extensive spruce beetle outbreaks and high-severity wildfire soon afterwards might compound recovery in the post-fire condition (Carlson et al. 2017), which is further discussed below.

Extensive spruce beetle outbreaks in Colorado are not unprecedented. There have been at least five major outbreaks of spruce beetle in the southern Rockies since the mid 1800's, some affecting thousands of square miles (Roovers and Rebertus 1993).
Wildfires have and will occur even in forest types that do not frequently burn. Over 90% of the West Fork Fire Complex that started on June 5, 2013 burned during extreme climatic conditions (Andrus et al. 2016).
Yet even under these conditions, 50% of the area resulted in a low severity to unburned condition within the affected watersheds (USDA Forest Service 2013).

As observed in older clearcuts and harvest areas of the West Fork Fire Complex, the lack of standing dead trees did not appear to alter the stand replacement characteristics of the fire. Other than natural openings or a change in climate-related conditions, the only factor that appears to have altered fire behavior is the presence of large contiguous aspen stands. It is therefore unlikely that the removal of dead trees would have any significant effect on preventing wildfire or reducing severity during periods in which spruce-fir forests are most susceptible.

It is likely that small-diameter fuels will be produced in areas where biomass removal occurs. Created openings will be more susceptible to drying and potentially, to fire ignitions. It is possible that heavy equipment and operators in the forests during dry periods may present an increased risk of accidental fire starts.

THE RIO GRANDE NATIONAL FOREST IS RECOVERING AND VULNERABLE TO ADDITIONAL DISTURBANCE

The spruce beetle outbreak on the RGNF is the most extensive in recorded memory, and has resulted in the death of most of the Engelmann spruce trees. In the subalpine forests of Colorado, spruce beetle outbreaks may be as significant as fire to stand development since they occur more frequently and within a shorter time frame (Baker and Veblen 1990, Veblen et al. 1994). However, recovery after beetle attack can contrast sharply with stand development following wildfire.

Ecosystem recovery can occur relatively quickly after bark beetle outbreaks. The primary vegetative response from spruce beetle is the release and accelerated growth of understory vegetation rather than new seedling establishment. With the death of canopy trees, previously suppressed, understory trees can sustain high growth rates for 40 to 100 years or more (Veblen et al. 1991a, 1991b).
Recent studies involving the influence of the spruce beetle outbreak on Canada lynx indicate that small spruce, subalpine fir, and aspen are primary components in understory vegetation (Squires 2018, Squires et al. 2020).
Beetle-kill areas on the RGNF display aspen regenerating prolifically in the understory where their root systems occur (Andrus 2021).
Standing green trees such as blue spruce and subalpine fir are often growing in the canopy layers amongst the dead trees. Decomposing logs provide habitat for a variety of plant and animal species and add to the renewal of soils. The forest may look dead, but ecological recovery is occurring in many areas.

A more variable recovery response is expected in post-fire landscapes, which in some areas may be influenced by the severity of spruce beetle outbreaks prior to fire (Carlson et al 2017).
The West Fork Fire Complex started on June 5, 2013 under severe weather conditions. Unlike beetle-kill areas, new conifer seedling establishment in post-fire landscapes may take considerable time depending upon site conditions and seed availability (Veblen et al. 1991a, Bebi et al. 2003).
Aspen, however, can respond quickly. In less than a decade, aspen is growing rapidly in many areas in the West Fork Fire Complex and already several feet tall or more. In the Million Fire (2002), just twenty years later, aspen is once again a prominent tree form in some areas. Willow and other shrubs have responded positively. An understory of grasses, forbs, and other vegetation is robust.

Recent studies in the West Fork Fire Complex suggest that treatments to reduce surface fuels in beetle-killed spruce can promote ecosystem resilience from fire. However, because salvage logging is focused on the removal of dead trees in contrast to fuels on the forest floor, it would not be expected to alter beetle-fire implications for fire characteristics at the soil level. Tree removal also pose a risk toward altering recovery dynamics and facilitating future species composition shifts, and may negatively impact long-term carbon storage in forests (Carlson et al. 2017).

Tree removal can also damage residual trees. See Alexander, 1987, at 44.
Understory vegetation important for cover for wildlife can be damaged. Felling and skidding trees to a landing can result in damage to residual trees. It is possible that biomass operations would result in the complete removal of all existing dead trees from harvest areas. It is unclear if smaller green trees would be removed or how this would be accomplished while also protecting residual green trees and understory.

The openings created through biomass removal could delay reforestation. See Schmid and Hinds, 1974, at 15.[1]

[1] These authors also opined that the fire hazard in areas of standing dead spruce was "overexaggerated". Ibid.

Given that regeneration occurs slowly at high elevations, it may take considerable time before areas return to forested cover. Budgets, personnel shortages, and other factors could delay planting and reforestation of biomass areas. In contrast, areas that already have established seedlings in the understory could grow rapidly. New seedling establishment and growth, particularly aspen, can be up to four times higher in unharvested stands following overstory disturbance by bark beetles (Collins et al. 2011).
When the trees fall, they provide nourishment for young trees to regenerate and grow. Standing dead trees provide shade for regeneration.

Mechanical removal is used for logging operations, which can result in compacted soil. This condition can persist for decades. Rhodes, 2007, at 16; see also Page-Dumroese et al, 2010. Areas of soil displacement and compaction are unavoidable during tree removal. Compaction and displacement can greatly diminish, or at least delay the recovery of, soil productivity. New trees will not easily re-establish in areas of compacted soil, while non-native plants (noxious weeds) may get established in these areas. Thistles are common in areas disturbed by logging on the RGNF and persist along roadways that become conduits for spread of noxious weeds.

DEAD TREES ARE VALUABLE TO ECOLOGICAL PROCESSES AND WILDLIFE

Although variable depending upon species and site conditions, some wildlife species are likely already responding to the release of understory trees and other vegetation. Snowshoe hare are closely associated with understory horizontal cover density. Occupancy by Canada lynx is in turn closely associated with understory cover values that support high densities of snowshoe hare. Recovery for other species may take longer. Red squirrels, an important secondary prey for lynx, have declined due to loss of mature green, cone bearing trees. American three-toed woodpeckers were common during the spruce beetle outbreak but have decreased quickly and are once again uncommon to rare on the landscape as snag characteristics change (Bird Conservancy of the Rockies 2022).
This species and other primary and secondary cavity-nesting species will depend on the remaining standing dead trees and, more importantly, the remaining green trees that function as future snag recruitments after standing snags have fallen. The retention of green trees within the standing snags will be important to recovery, including to several Species of Conservation Concern.[2]

Engelman spruce snags can remain standing for decades, as has occurred in the Flattops area of northwestern Colorado. Many of the trees killed by beetles there from 1939-1951 are still standing today. Research suggests that a considerable percentage of the current beetle-killed trees could remain standing for 40 to 50 years or more (Hinds et al. 1965).
Beetle-killed spruce will therefore not fall all at once but vary over several decades, allowing time for some decomposition to occur. There will be concentrations of downed logs in areas depending on site specific factors such as vulnerability to windthrow. These have ecological value as potential lynx denning sites or habitat for American marten and other species. Most

[2] Species of conservation concern (SCC) are those species not listed under the Endangered Species Act and for which "best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area." 36 CFR 219.9(c). SCC on the Rio Grande National Forest that may inhabit the spruce-fir zone include: boreal owl, olive-sided flycatcher, northern goshawk, and American marten.

local lynx denning sites involve large downed log complexes of at least 12 tons per acre (Merrill 2005). The recent research on the RGNF focused on Canada lynx response to the spruce beetle outbreak (Squires et al. 2020).

Much of the key lynx use area overlaps the most productive growing sites for timber production and would likely be used for biomass removal. Outcomes of the research include verification that lynx are using and reproducing in spruce beetle-impacted forests, and that they strongly avoid openings with canopy closures of less than 10%. Some amount of avoidance continues until canopy closures approach around 24%.

During the winter months, lynx exhibited strong preference for areas with higher canopy cover of remaining live trees. In addition, lynx strongly selected areas with larger dead trees and areas with higher densities of dead Engelmann spruce. During summer months, lynx also selected areas with larger dead fir and Engelmann spruce trees. The dead trees were also important to high horizontal cover values and snowshoe hare densities.

Standing dead trees have numerous other wildlife values. They provide perches and nest trees for various wildlife species, such as boreal owl and olive-sided flycatcher. When standing dead trees fall to the ground, they provide many key ecological processes and functions, such as: reducing soil erosion; providing habitat for insects (like carpenter ants) that help decompose the wood and for small mammals which in turn are prey for larger animals, including avian species like boreal owl and goshawk.

The removal of dead trees may limit forest recovery, and there may be an adverse ecological impact in doing so on a large scale. Dead trees would not "go to waste" if not removed, as they are clearly valuable ecologically.

CURRENT AND FUTURE SUPPLIES FOR BIOMASS ON THE RGNF ARE LIMITED

According to the recent Forest Plan for the RGNF, there are approximately 472,000 acres that are suitable for timber production and, therefore, for biomass output (USDA Forest Service, May 2020, Appendix 3, pg. 166).
This equates to approximately 26% of the forest land base. Although spruce-fir forest accounts for 54% of the forest cover types on the RGNF, it is unclear how much of this is in the suitable timber base. It is certainly much less than the total suitable acres available for timber output. Commercial logging is prohibited in designated wilderness areas and some other designated areas such as Backcountry and Other areas.[3]; Where logging might otherwise be allowed, some areas would not be practical to enter because of any of the following: steep ground, erosive soils, lack of access roads, and the difficulty and expense of constructing access roads. The National Forest Management Act (16 U. S. C. 1604(g)(1)(E)(i)) and the Forest Plan for the RGNF (standard S-Veg-2, p. 36) prohibit logging where resources, such as soils and water quality, could be "irreversibly damaged".

Logging would be limited in roadless areas, which cover approximately 520,000 acres of the RGNF (not all of which are forested or have dead spruce trees). Plan at 73.

[3] See Forest Plan at 165-166.

The Colorado Roadless Rule limits sale, cutting, and removal of trees in roadless areas to certain circumstances. See 36 C.F.R. 294.42.
Similarly, road construction is allowed only in limited circumstances. See 294.43. Note especially the limits on sale, cutting, and removal of trees, and on road construction in upper tier roadless areas. 294.42(b), 294.43(b).

Biomass removal would be very limited in areas having the highest quality lynx habitat (VEG S-7 stands). See Forest Plan at 29, standard S-TEPC-2.
Note that this specifically applies to salvage logging (id. at 27, 29), which cutting trees for a proposed biomass plant would qualify as. Any entry into VEG S-7 areas could have impacts on the recovery of the lynx, particularly since current detections and occupancy levels remain below the long-term averages for Colorado (Odell et al. 2020).

Currently, 11 of the 29 lynx analysis units (LAUs) (38%) on the RGNF exceed the 30% unsuitable habitat threshold (Standard VEG S1) defined in the Forest Plan. USFWS, 2021 at 14-15. All of these LAUs are primarily comprised of spruce-fir cover types and likely directly overlap areas where biomass removal would occur. In these areas, no further conversion of lynx habitat from suitable to unsuitable may occur. Several other LAUs are also close to this threshold.

This current amount of unsuitable habitat is primarily due to the spruce beetle outbreak and, in two LAUs, the West Fork Fire Complex. Although understories are recovering, it is likely that it may take a decade or more before enough growth occurs for areas to function as suitable habitat again. Any further conversion of currently suitable lynx habitat to an unsuitable condition in these LAUs would be prohibited. Biomass removal would therefore be restricted to the unsuitable habitat areas for at least several years. See USDA Forest Service, 2008 at Attachment 1-2, 1-3 and Forest Plan at 29, standard S-TEPC-3

Without a rigorous GIS mapping exercise, it is unclear how much unsuitable habitat might be available for biomass removal in these LAUs. It is also unclear how suitable versus unsuitable areas or high-quality VEG S-7 stands would be communicated to operators, as they are not mapped or quantified in the Forest Plan. Operating in these areas for biomass removal therefore has a high likelihood of not complying with the Forest Plan, damaging lynx habitat, or both.

Construction of permanent roads might be necessary to access some areas for tree removal. Funding is not likely to be available for such construction. The Forest Service already has an unmanageable road system, as there is a huge backlog of maintenance needs. For the infrastructure assessment prepared for the recent forest plan revision, the road maintenance backlog was over $33 million[4]. The RGNF is also not currently in compliance with the Travel Management Regulations, both subpart B and subpart C (over-the-snow), as designations of roads and trails open to motorized use is not up to date, and designations for over-snow vehicles has not been done at all. This results in a continued risk of cumulative effects regarding road-related disturbances and forest fragmentation.

[4]See https://www.fs.usda.gov/project/?project=46078 at 4.

***In sum**: the areas on the RGNF potentially available for logging to supply a proposed biomass plant are much less than all the acres with dead spruce trees.*

CONCERNS EXIST REGARDING THE RIO GRANDE FOREST PLAN AND STAFFING LEVELS

The production and feeding of a biomass plant would be a long-term commitment to wood removal from our local public lands, particularly the RGNF. Implementation of such a commitment would require close involvement and oversight from resource specialists such as wildlife, soils, botany, fisheries, and hydrology. The need for monitoring and tracking of changes to lynx habitat alone would be extensive. There are also concerns about the adequacy of the current Forest Plan for protecting wildlife resources, and at least two lawsuits have been filed to correct these deficiencies. It seems prudent to resolve these issues prior to making a long-term commitment to biomass removal.

Also of concern is the absence of a wildlife or ecology program, with no qualified oversight at the forest-level. A biomass proposal, or any other long-term commitment with high risks to particular resource areas on public lands, should not be approved without the appropriate type of staffing to ensure that this important oversight occurs.

THERE IS UNCERTAINTY ASSOCIATED WITH CLIMATE CHANGE

The SLVEC recognizes that climate change is likely already influencing our local ecosystems. It is possible that the frequency and extent of fires in the spruce-fir zone will increase due to climate change. We also recognize that there are uncertainties associated with climate change trajectories and outcomes. We believe that a focus on biomass output will not specifically address these concerns. The RGNF is a post-disturbance forest in various stages of recovery, and a vegetation conversion to tree species such as aspen is already being facilitated through passive restoration. Because of existing post-wildfire and bark-beetle conditions, our local spruce-fir zone will not likely be conducive to another spruce-beetle outbreak for decades if not longer (Veblen et al. 1994). Large wildfires may or may not occur, regardless of dead tree removal.

In a warming climate, some wildlife species may move to higher elevations to find more suitable habitat, or perhaps find localized areas that function as habitat refugia as recovery occurs over time. If biomass or other large-scale manipulation of dead trees is pursued, we encourage the RGNF and/or partners to develop a strategy for climate change adaptation similar to that suggested for the upper Gunnison River Basin (Rondeau et al. 2017).
A key aspect of this strategy would be to identify and protect climate refugia sites in a manner that maintains or enhances their resilience while allowing for vegetative transition in non-refugia sites.

Lynx in Colorado are rare, low in density, and spatially restricted. The high-quality lynx habitat (VEG S7) identified in the RGNF Forest Plan occurs only in certain areas and is possibly an example of a spruce-fir climate refugia. Identifying and managing for movement between these high-quality stands and the high-use area will be important to any strategy that allows for biomass removal in the spruce-fir zone. These areas may also function as refugia for other species such as American marten and snowshoe hare, and other spruce-fir associated species. Comprehensive review of possible impacts and ways to mitigate them would be necessary prior

to approval of any major biomass extraction. This would be done under the National Environmental Policy Act (NEPA) and involve the public from the earliest stages.

A LARGE-SCALE MANUFACTURING FACILITY IS INAPPROPRIATE FOR THE SLV AREA.

The San Luis Valley is distant from large industrial outlets. Some people move to the area for that reason. It is also an area whose economy depends largely on agriculture, tourism and recreation.

An industrial size wood processing facility is not appropriate for the San Luis Valley. Such a facility would demand a guaranteed and consistent supply of logs, mostly from the RGNF. It is likely that many acres would need to be entered each year, and availability is unclear. The number of logging truck trips needed each day for hauling could conflict with recreational and other traffic. Biomass removal would likely have negative effects on wildlife habitat, grazing areas, scenery, recreational activity, and other local values of high demand.

There are risks associated with a long-term industry such as biomass. Available supplies of dead trees will eventually end, and efforts may occur to access areas where environmental concerns are high. Demands for wood may eventually include green trees that are essential to ecological recovery in a post-beetle outbreak landscape where some habitat attributes may take decades or even centuries to recover.

MORE INFORMATION IS NEEDED ON POSSIBLE BIOMASS EXTRACTION

To fully evaluate a biomass proposal that relies on cutting and removing dead trees from the RGNF to produce energy, more information is needed. This includes but is not limited to:

--Safe production and storage of hydrogen. Hydrogen is a flammable and explosive gas. Proponents need to demonstrate that it can be safely produced and stored.

--Markets for hydrogen and/or other fuels produced. Could the energy produced from wood on the RGNF be reliably sold for a price that would at least cover the costs of production?

--Air quality. Converting wood into energy likely involves air emissions. Since the San Luis Valley is subject to temperature inversions in winter, emissions from a major biomass plant could decrease air quality.

-- What type and sizes of forest vegetation is being targeted for removal? Is the focus on dead trees or are green trees also in the mix? Does the proposal only involve the spruce-fir zone or would other forest types be included such as mixed-conifer, aspen, ponderosa pine, or pinon-juniper?

- Will other resources such as water be needed for cooling or other operations?

-- Who is expected to supply the biomass material, i. e., is there an estimate of supply by private land versus public land? (Example: 40% private, 60% public – national forest).

--Up to date information on wildlife habitat and use of areas where biomass might be extracted. This would be necessary to evaluate potential impacts on lynx and species of conservation concern, and to design operations to minimize such impacts.

--The amount of energy needed to produce hydrogen or other fuel from wood or other material versus the new energy produced. It may not be worthwhile to use fossil fuel energy to produce another type of fuel.

--How would the energy produced by a biomass plant be added to the existing energy grid and transferred from the Valley? Is there a need for additional transmission capacity?

CONCLUSION

A large-scale biomass energy production facility is not appropriate for the San Luis Valley. Impacts to soils, understory vegetation and further fragmentation of wildlife habitats may occur when the forest is in the initial stages of ecological recovery from an extensive spruce beetle outbreak and wildfire events. Removing dead trees from the RGNF at a rate sufficient to support one or more large biomass processing facilities would likely result in conflicts with forest plan requirements at a time when the plan is also being challenged legally. Impacts to federally listed and vulnerable wildlife species are likely and would occur without appropriate oversight.

It is unlikely that biomass removal could occur at a rate or scale that would make any measurable difference in regards to wildfire risk, and might even increase that risk. We support the finding that by Carlson et al (2017) that dead tree removal located close to communities in the wildland-urban interface (WUI) may be warranted because it might contribute to fire breaks and community and firefighter safety, and also provide confidence in allowing some natural fires to burn. Research by a former Forest Service employee showed that fuel reduction more than about 30 meters from a structure is not effective in protecting that structure. See Cohen, 1999.
A focus on the WUI and along open roads may be warranted given the need to address public safety.

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