Telephone Gap Scoping Comments

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The Telephone Gap Project Scoping (TGPS) materials, which include many documents and public presentations, represent an amazingly data rich environment on which to analyze the potential impacts of the proposed actions. The staff of the Green Mountain National Forest (GMNF) have put a lot of thought and effort into both providing public information and developing their vision for implementing the 2006 GMNF Forest Plan. The Story Map with its interactive stand map is an extremely efficient and effective way to know with specificity what is proposed. They have also been very helpful to people seeking additional information such as myself. I want to thank them for that.

Unfortunately, after looking at that information and data, I draw very different conclusions than the GMNF does on what would be the best management actions to undertake as part of the Telephone Gap Integrated Resource Project (TGIRP). These are enumerated in my comments below. The Telephone Gap project is unusual as a very large proportion of it is northern hardwood forests that exceed 120 years of age in a remote interior forest setting, and nearly all of proposed action area for harvest is a mature or old forest based on GMNF definitions. In addition, the proposed management sits in a landscape (the remainder of the Telephone Gap Integrated Resource Project that is either private land or GMNF land that is not currently proposed for timber management) that is also fairly remote and includes more old forest than is typical in Vermont. On that basis alone, as a forest ecologist, I think there should only be one of two results from the scoping phase – 1) the area is subject to a full Environmental Impact Statement (EIS) which deeply analyzes multiple scenarios of different harvest methods before any harvest is done; or 2) the action proposed is withdrawn and the entire Telephone Gap project, including the GMNF land within TGIRP not currently proposed for harvest, simply grows as a climate forest reserve to provide climate mitigation, via carbon sequestration and storage, and serves as a research site documenting how an interior mature forest transitions during climate change.

The following comments represent problems that need to be addressed or corrected in an EIS before this Telephone Gap project proposing harvests is approved, hopefully only in a highly modified form:

1) **New Science Poorly Incorporated:** There are two areas of science that are not taken into account in any meaningful way in the TGPS – climate change and the role of mycorrhizal fungi in forest health. Aspects of climate change management, like mitigating potential hazardous ash trees because of ELB attack, or planting climate adaption species or encouraging red oak, are added to the project plan. However, the fundamental problems these two areas of science present to traditional forest management in the Northeast are largely ignored. The 2006 Forest Plan essentially never mentions climate change, and all of the goals in terms of percentages of forest type and harvest methods all represent

traditional forestry as if climate change didn't exist. Any further action on this site needs to deeply incorporate all aspects of climate change, including climate mitigation as well as adaptation in the specific 30, 50 and possibly the 100- year time frames that we have to bend the curve on CO_2 levels. This should explicitly include the existing carbon storage in the 11,801 acres that make up the Telephone Gap acres to be harvested, as well as the carbon equivalents created by the harvest, and the proportion of the harvest that will have an expected life as a wood product of less than 10 and 30 years.

2) **Increasing Red Spruce:** One of the most problematic aspects of TGPS that follows from the shortcomings of the 2006 Forest Plan is that so much of the focus of the harvest actions are justified by trying to incorporate softwood (red spruce and in some locations hemlock) into what are now classed as very mature and old northern hardwood forests. The landscape assessment for Telegraph Gap is used as the basis for moving northern hardwood (93% of the suitable lands) toward a mixed-wood community type, most of which would be northern hardwood/spruce. However, red spruce is currently present in 7,371 stand acres, and spruce is widely represented in the forest communities at the higher elevation of spruce/fir. Many of the proposed actions involve much more aggressive harvests than needed to incorporate more spruce into the stands.

   Spruce trees are long-lived, very shade tolerant and require high levels of moisture. They also normally are found on shallower soils where they can compete better than some of the northern hardwood species such as maple. The much higher levels of spruce in Vermont's landscape in the original hardwood forests is a reflection of how old those forest were, and the stocking now reflects that spruce was the first tree targeted for removal from those forests. In a landscape recovering from cleared pastures that has regenerated into northern hardwoods, but where there are readily available spruce seed sources, one would expect to find spruce regenerating only once the hardwood forest was old enough to start forming its natural small-gap structure. Most of these gaps would be cool and moist, given the high humidity one finds in mature hardwoods with lots of downed material, and provide enough sun to get seedlings started. The stand data support the idea that these forests are already starting the shift to more spruce given that 62% of the stand-acres (7,371) already have pole or merchantable red spruce in them. Given the mature/old age classes of the TGPS hardwood forests and the abundant spruce seed sources, in the TGPS area one could easily shift stands toward more spruce through the use of small group selection openings of .1 up to .5 acres in size. South facing slopes should not be the focal point of spruce regeneration given expected changes from climate change.

   The TGPS represents a traditional forestry approach with no recognition of the most important ecological change to Vermont's forests that is likely to result from climate change in the next 100 years – a dramatic to nearly complete loss of red spruce. In January 2018 the U.S.F.S. Northern Research Station published General Technical Report NRS-173 that specifically investigated the Forest Ecosystem Vulnerability in the Northeast. The conclusion of the 34 authors, using three different modeling approaches, was that there was high agreement that seedlings will be more vulnerable than mature trees, and that decreases in red spruce were highly likely as there were few modifying factors that could mitigate that change. In terms of biomass, red spruce could decline 60% or 98% based on two different climate models. One the other hand, northern hardwood species (maple, yellow birch, aspen, and beech), along with white pine, would see small to little change and it was probably more adaptable. For example, sugar maple biomass could decline 8% or 28%. This adaptability to climate change would be expected given the genetic diversity within a species like sugar maple that has a very large, more southerly range, compared to red spruce's more northerly and more restricted range. Given that red spruce is unlikely to be an important component in Vermont's forest in 100 years, it makes little sense to develop a harvest plan that is specifically aimed at expanding its presence at the expense of a currently very healthy northern hardwood forest.

3) **Even-Aged Silviculture:** The other most problematic aspect of TGPS being dependent on the 2006 Forest Plan is an adherence to a largely even-aged approach (60:40 split). While that is better than the minimum management required of 20% uneven-aged by the 2006 plan it poorly acknowledges the fact that so much of the Telephone Gap project is made up of forest that exceeds 100 years of age, and that it has largely matured from past agriculture without much exposure to the invasive species load that is found in so much of Vermont's landscape. Particularly for northern hardwood forest this represents a rare forest age structure in Vermont and a unique opportunity to continue the natural shift of an even-aged northern hardwood forest to break up, through the formation of small gaps, into an uneven-aged (or all-aged) structure. It is a perfect place to practice/demonstrate Natural Dynamics Silviculture (Natural Dynamics Silviculture-A Discussion of Natural Community Based Forestry Practices, Roe and Ruesink for specifics and Silvicultural Guide for Northern Hardwoods in the Northeast, Leak et.al. 2014 for general approach) as a way optimize the balance between natural ecological processes and biodiversity of the forest with the harvest of timber. It would also create the least amount of ecological stress on the forest of all management systems, while also increasing microhabitat and age diversity; and thus, short of setting the forest aside as a climate reserve, maximize Telephone Gap project's resiliency to all aspects of climate change.

4) **Soils & Mycorrhizae:** The proposed harvest methods have a deep tradition of use in silviculture, but ignore the recent research in soil ecology and the importance of mycorrhizal networks and the rhizophere for both tree and forest health, particularly northern hardwoods which have some of the deepest forest soil organic layers, since fire is not part of their disturbance regime. Forty percent of a tree's photosynthate supports the rhizophere directly. Desiccation of the soil destroys much of the rhizophere and soil structure and we have known that specifically since Bormann & Likens research on clearcuts at Hubbard Brook, summarized in their book Pattern and Process in a Forested Ecosystem published in 1994. In the face of climate change, with increased temperatures, increased periods of summer drought predicted in the Northeast, and increased storm intensity, the size of any forest canopy openings becomes extremely important in terms of forest resiliency. There is no need for any clearcuts or shelterwoods to accomplish most silvicultural goals – they may be more economical or faster than alternatives, but under

intensifying storms and drought the chance of erosion, windfall and unexpected revegetation increases dramatically. This is particularly true in a landscape that has increasing levels of invasive species.

5) **Smaller Group Selection Openings:** The group selection opening sizes need adjusting. The TGPS proposes from .5 to 2 acres with no sense of proportion used of various sizes. I would propose from 1/20 to 1 acre groups for nearly all locations, with 1 acre used sparingly. At 1/20 acre one gets regeneration of yellow birch and white ash and it is plenty large enough for the early succession bird species found in northern hardwood. Red spruce regenerates in some of the smaller gaps, but plenty in the .25 and .5 acre gaps. In fact, .5 acre gaps are the largest one wants for spruce regeneration because when larger than that the needed moisture conditions are lost (Roe & Ruesink). Spruce regeneration should be focused on northern slopes and shallower soils.

   At 1 acre and less wind will generally travel over the gap, where at double that size soil desiccation occurs from both wind and increased sun. Given climate change, higher wind speeds within the gaps will simply create additional windthrow at the edges.

   Many foresters worry about whether the 1/20 acre group will support early succession birds, with chestnut sided warbler being the poster child. The literature shows that they successfully reproduce in such gaps, and even a bit smaller ones. Using more very small groups of .05 and .1 acres also maximizes the microhabitat diversity when compared to a few large groups, contrary to what is often stated. These regeneration groups also provide the needed nursery areas in close proximity to more mature conditions that are needed by the interior forest songbirds.

   I have personally successfully used this small opening approach in the management of the Atlas Timberlands (25,000 acres) in the northern Green Mountains when I worked at The Nature Conservancy and the Vermont Land Trust. Regeneration was measured in these small groups and the data showed full regeneration of all expected species of the northern hardwoods. During the FSC certification the silviculturalist worried that deer would remove all the regeneration in the small plots. Deer are an edge species that one cannot “swamp” by creating large plots of regeneration. I have been in many 2 to 20 acre openings filled with deer droppings. Deer like sight lines to detect predators, so regeneration by small group selection is much better as the deer don’t hang out to feed as they are feeling stressed by interior forest conditions where it is hard to detect predators. Leaving the tops in place also helps regeneration.

6) **Single Tree Selection:** Much bad forestry has been practiced under the name of single tree selection – from high grading, diameter limit cuts, and the creation of stands of nearly pure sugar maple. Based on the words in the detailed proposed action document, no expression of specific goals for this type of treatment, beyond growth and space for regeneration has been given. The description also indicates it will be applied uniformly across all acres in these stands. I am left feeling this treatment is going to end up being a massive thinning of

trees whose major goal is to bring the stocking levels down. If this treatment method was instead focused on the creation of small group openings up to .25 acres with distinct areas of unharvested forest between them it would provide for a very large volume of sustained high quality timber flow over time, while also maximizing wildlife value and old forest legacies and processes. I would call this group selection, but others call it single tree selection. The distinction, which is very important ecologically, is that the groups cut all age classes in each opening so one gets the full regeneration of northern hardwood species while continuing its fine grain structure that maximizes habitat diversity. Careful area or dbh regulation, and not harvesting much more than 10% every twenty years, would probably maintain old age classes greater than 150 years of age.

7) **Early Succession Obligates/Aspen/Birch:** These openings should be spatially explicit in the plan, and be smaller than the maximum's permitted by the Forest Plan. In an era of both climate change conditions and invasive species, placing these larger openings – I'd say 3 to 10 acres – in the landscape should be done with careful thought on the openings' unintended consequences for the surrounding forest. In a time of increasing wind intensity it would probably be best to be rather conservative in how many are created by clearcuts until we learn what openings the new natural disturbances create. It is far easier to create early succession habitat, and it appears across much larger swaths of the wider landscape because it is economically advantageous in the short term, than it is to create and sustain mature and old forest. In addition, the early succession species have evolved to easily colonize openings since they formerly were rare in the landscape; the species of mature forests generally have much more limiting dispersal abilities.

8) **Enrichment/Rich Northern Hardwoods:** This feature of the GMNF landscape is inadequately addressed and in some cases I feel harvest methods are being proposed that are inappropriate to the conditions. Parsing this out is nearly impossible given the way materials are presented in different maps and scales, and there needs to be a much more thorough analysis. Some inventory work assessing natural community conditions was done, but more probably should be done, particularly in those old stands where clearcuts or shelterwood harvests are proposed.

   There are clues that enrichment is more important at the TGIRP forests than would be typical in such a setting. In the Landscape Assessment mention was made that there are signs of calcium enrichment higher in the landscape and in areas where it is not typical. Part of this may simply be a factor of forest age, as downed woody material can catch and enrich downslope movement of nutrients. In addition, we now know that maples actively move calcium around the forest ecosystem and can, through the mycorrhizae network, even dissolve calcium out of rocks not considered calcareous. These processes are probably aspects of northern hardwood forests that increase or improve with age and so might only be expected in forests that are transitioning toward old age at 120 years. The canopy height maps really jump out as unusual because of the amount of the TGIP canopy that is over 100 feet – this is often a sign of enrichment. Finally, the fact that The Cape is a rich northern hardwood community, and there are other stands with similar characteristics of species and landscape position, means that increased analysis should be made of the many stands that share significant basal areas of sugar maple and ash, large mean stand diameter, and large volume of merchantable timber. Some of these unusually high indicators are simply a matter of stand age, but some are probably also due to enrichment. This is important because even-aged management would never be considered the normal harvest technique for any rich hardwood site.

One example of reexamining stand detail is possibly provided by stand 138-3. This a maple/ yellow birch stand with some beach that is 144 years old and has an astounding mean dbh of 14." The 10^{th} percentile average dbh is .3 inches, when nearly all stands in the area are .1 inches. The stand's total merchantable volume is quite high for a stand without softwood. It has maple pole-sized trees, but total trees per acre of just 1000 stems. These are indications that even though its age would argue it should be starting to form gaps for regeneration (with resulting stems per acre of 2000 and above) the indication of young trees without lots of seedlings, yet very large dbh and lots of height, are indications that this is a rich site – though without white ash. And yet it is only just at the A line in the stocking tables so it has lots of good growth potential. Another example would be 143-7 that is 126 years old and quadratic mean dbh of 14.6".

9) **Economic Maturity & "Capturing Mortality:"** The concepts of most efficient growth and economic maturity that the stocking guides embody are economic concepts that can help define better ecological management than if we didn't have that understanding. However, they have little connection to the balance point between harvesting timber and maximum ecological forest health or biodiversity. Much of even-aged management is also related to economic efficiency, the time value of money and the human generational time, but it comes at a cost of stand soil productivity. As public land with an infinite management horizon, the time value of money and managing forests to grow saw timber most efficiently should not be the basis of making GMNF management decisions. The role of the forest management for timber on public lands, particularly federal lands, should be on defining the best balance point between timber management and ecology – someplace clearly between a young forest cycling between the A and B lines on stocking guides, and the second-growth equivalent of old growth. For northern hardwoods that old endpoint would be a forest largely made up of age classes between 150 and 300 years of age.

The TGPS area provides a unique opportunity to think about what that balance point might be because nearly all of TGPS represents a forest close to or above the A-line in hardwood stocking, with that regrowth largely happening at a place and during a time without much invasive species load or fragmentation of the landscape. It is hard to understate how unusual it is to have thousands of acres whose quadratic mean dbh is almost 12 inches and the average stand age is 108 years old, with some over 160 years old. In addition, these are not dying forests with a single monolithic canopy and no understory. Total stems per acre is a measure of natural regeneration, and some midwestern data indicates northern hardwoods under natural regeneration have total stem counts of about 2000-5000 per acre; here the average stems per acre is 1,923 (with a few stands at 3000 +) which is a clear indication an even-aged forest, initiated as pastures regrew, is starting to naturally create regeneration gaps. This is a happy accident (in a data-rich environment of approximately 236,600 trees sampled) that allows a chance to think differently about how to produce larger, sustainable timber flows over the long-term while simultaneously also maintaining a much more intact forest ecology. This is not normally possible because it requires several generations of focus just to get an eastern hardwood forest to the starting point of that exploration. This forest is there now.

While I have not walked these stands, the data indicate that it would be an unimaginably huge lost opportunity if GMNF chose to intensively manage TGPS in the next few years in a manner that essentially reduces it to a forest similar to what is found throughout Vermont, just in the pursuit of "correcting" 5,000 acres of economically "overstocked" stands and reduced growth by "recovering potential mortality" to use the words of the proposed action. These forests are still adding and storing increasing amounts of biomass as they age – that is the recent advance in understanding forest ecology. Harvesting TGPS prematurely, and using intensive management on the remaining stands, does nothing to advance forestry knowledge and definitely does not help mitigate climate change. If left to grow, or very lightly managed for timber through Natural Dynamics Silviculture techniques, there will still be increasing amounts of timber available to sustainably harvest in the future, using techniques far less intensive and ecologically destructive than those proposed by the TGPS actions.

10) **Climate Mitigation:** The TGPS proposed action argues that the timber harvested will offset fossil fuels and provide timber that will store carbon in long lasting timber projects or offset the use of steel and concrete. It is not totally clear as to whether TGIRP forests will provide a 40:60 or 60:40 pulp to sawtimber split as both ratios have been presented, but based on the Proposed Action document this harvest will probably be 40:60. Pulp does not represent any climate mitigation as these products (paper and biomass fuel) are short-lived and move the carbon stored in the tree rapidly into the atmosphere. A strict carbon accounting would probably show best climate results, second to just letting the tree grow, by simply felling and leaving the pulp component in the harvest.

Long lived timber products as storage is a great concept, but rarely or at best weakly supported by the data. The amount of wood that moves into furniture that lasts longer than 25 years is miniscule. And based on antique furniture, how much of the all-wood, fine furniture made actually lasts multiple generations. Even wood buildings are relatively short lived. I've never seen it quantified, but the number of buildings whose original wood survives more than a hundred years, compared to those extensively remodeled or torn down and replaced, is probably relatively small. It is clearly miniscule when taken to 200 years, which is mid-life for the maple, spruce, yellow birch found in these forests, and young for hemlock.

Having wood replace concrete and steel construction is potentially a meaningful contribution to climate mitigation, but only if those markets were robust and the wood from the TGPS actions was explicitly targeted for that. The next 30 years are most important from a climate mitigation perspective, and those markets will simply not be robust enough in that time frame to think that wood harvested in TGIRP will move toward that use. Many studies have tried to quantify whether timber harvest versus timber growth help in climate mitigation. To date, when one incorporates the carbon equivalents embedded in the wood processing, the hardwood forests' storage of carbon provides the most mitigation. Over the 30-year time frame and the old forests in TGIRP it would not even be a close comparison; letting the trees grow to store and sequester carbon is clearly better from a climate mitigation strategy.

However, while not explicitly stated, one can read the proposed harvest methods and post-harvest activities and think that the focus on tree growth is a climate mitigation goal. Many people have recently argued that carbon storage is related to growth rate, and thus younger trees are more important for climate mitigation. This is simply not true. Growth rate in forestry is based on the incremental gain in width of the growth rings because it was critical to determining the rate of gain of the product – the timber in the bole of the tree. It is a two-dimensional measurement and mathematically it increases as a square function. Carbon sequestration, the accumulation of biomass, is a volume measurement, which mathematically is a cube function and so its rate of increase is faster than the forestry defined growth rate as the tree grows. In addition to simply the bole increasing as a tree ages, biomass is being added to limbs of increasing diameter. The key to carbon sequestration as a climate mitigation strategy is large old trees, not planting seedlings or harvesting trees to increase growth rates of crop trees (Keeton et.al. 2011, For. Sci 57:489 and Anderson, M.G. 2019 & 2021 Wild Carbon publications by NE Wilderness Trust for lay summary of the science).

11) **Climate Resilience:** The TGPS discusses climate resilience as a key aspect of the proposed actions, with an intense focus on rapidly increasing the forest diversity. One could argue that is counterproductive to actual climate resilience because many of the proposed harvests are creating less resilience to wind, which will be increasing in intensity, because of proposed openings or thinnings. A forest, particularly a northern hardwood forest whose major natural disturbance regime is wind based, develops wind resiliency by creating a full canopy such that wind goes over the forest, rather into the forest where it can get leverage to topple trees. The small gaps are naturally created by strong vortex or downdraft wind currents. The openings of an acre or more, and any heavy thinnings, are likely to increase the friction on the wind and thus draw wind into the forests. This will increase windfall as well as soil desiccation.

Invasive species, including pests, are projected to increase with climate change. Often along trails and roads, as shown by the mapped invasive locations and strongly supported by scientific literature, but openings and edge habitat can also serve as invasion point by providing habitat that attracts birds and mammals normally found outside the interior forest, and thus they spread invasive seeds found in the wider landscapes. These edge habitats can also provide insects pest attractive conditions. These habitats also attract egg predators, or ground nest predators that are not normally found within interior forests. One of the strongest strategies for climate resilience will be to keep interior conditions of the forest intact.

Finally, large diameter downed material goals, by size class, should be created specifically to improve climate resilience. Rotting large logs hold immense amounts of water that moderate drought conditions for many species, and for some, particularly fungi, they become critical refugia as other soil organic matter dries out.

12) **Emerald Ash Borer:** Proactive removal of potentially hazardous white ash trees is badly misplaced in this setting for several reasons. First, in most locations the intensity of use is relatively low so one has to question the level of hazard and the need for speed. There is clearly plenty of time post infection before limbs endanger people. More importantly, proactive harvest removes the potential to save beetle resistant trees. If anything was learned from the rapid, proactive massive harvest of American chestnut it should be that we eliminated the potential for natural resistance. Almost always at least 1% of a tree's population has resistance to a disease or pest, but that is only useful if the trees remain in the forest. Beach bark disease is the most recent example, and one that many people have seen because the disease-free trees stand out so well.

    The proposed harvests of ash along roads and trails may provide valuable timber, but the action is most likely the opposite of providing climate resilience for the forest. Such harvest will simply open up forest roads and provide corridors with the ideal conditions for movement of invasives and edge predators into the interior of the forest, simply because somewhere within 5 miles of the TGIRP in the developed landscape EAB has been found. Far more importantly, it creates the condition to attract EAB beetles. The experience in NH (personal communication) has been that large, exposed ash are the first to attract beetles. While far from an iron clad rule, interior forest trees get infected much later. No one knows why, but it doesn't seem to be that beetles are found first on travelled roads just because that is where people are more often. The thinking is it is some combination of chemical cues and exposure to warm sunlit conditions attracts the beetles there first. My opinion is that no cutting should be done prior to beetles being found adjacent to TGIRP, and even then I would only cut in an attempt to isolate and control an infection. Hazard reduction should only occur on an individual tree basis when a tree actually becomes infected.

13) **Extended Rotations:** A very large proportion of the TGIRP is made up of the management area known as Diverse Backcountry. According to the 2006 Forest Plan the area will be predominantly forest of 150 years old or more. According to the proposed actions that could not be further from the truth. In the age class 60-119 years old there are 142 stands planned for harvest and 53% (75) of those are in the Diverse Backcountry areas. In addition, there are a quite a few stands near the Long Trail that were harvested in the 1980s that are now being slated for growth enhancement stand improvement (non-commercial thinning) – stand 145-20 for example. Commercial thinning of a variety of ages are planned for many stands in in the Diverse Backcountry. A stand 126 years old is proposed to be clearcut.

Commercial thinning is antithetical to developing a forest predominantly 150 years or more in age. One of the defining characteristics of second growth forests managed on more normal 80-100 year rotations is the lack of downed woody material and snags, particularly the larger diameter boles that thinning removes. If there is a need for early succession openings then one should cut a younger forest, rather than one of the oldest stands, assuming one's target is gradually getting to a forest that is predominantly over 150 years old. The current action is cutting a stand that is at the threshold of reaching the desired condition; it should be allowed to be one of the stands that exceeds 150 years of age. Based on the Stand Age map, the Diverse Backcountry received much of the harvesting that has occurred on the GMNF's ownership within TGIRP over the past 100 years. If it is ever going to become a part of the GMNF that is predominantly 150 or more years old no harvesting should be proposed with the Diverse Backcountry as part of the TGPS.

14) Context: Before discussing what is missing let me applaud again the amazing amount of work and detail that has gone into giving the public the ability to understand and respond to this TGPS with lots of data. The interactive stand map (the GIS story map work) is probably the best way of allowing the public to enter the data rich forestry environment that I have ever seen. As planning for this area goes forward, I hope this interactive map is expanded and improved up. One must still dig to put all the parts together in this very complex landscape with high resource values attached to it. Ideally, the base map would show the compartments and dividing lines between management areas. The pop-up details included for each stand should include some of the information that is now just on pdf maps as well as some easy access to slope and soil information. Probably the most important information would be why the management action was chosen, as well as some information on actual species composition. I asked for and received the stand species information and some other detail, but in most cases I still could not parse apart why different management approaches or stand divisions were made. Below I go through a couple of area analysis that illustrate some of those fine scale context issues.

Context occurs at many scales. The two that I constantly felt the need for so that I understood the proposed actions were: 1) the forest condition of the TGIRP that is not owned by the GMNF at some level of coarse analysis and a few maps; and 2) the history of the land owned by the GMNF but not within the TGPS actions. There is no reason to have this area called the TGIRP acre with bounds outside of federal ownership unless it informs decisions within the GMNF. This clearly happens in the recreational arena. However, in the ecological/forestry context I found myself constantly questioning the assertion that aspen and birch openings were needed. This is because a look at the canopy height maps quickly show that private lands, some intimately connected to the TGPS lands, have many acres recently clearcut and in young forest. Knowing what land is developed or in small parcels also would be useful for understanding the trajectory of this landscape. The forest type, condition and history of all the GMNF land within TGIRP would allow one to visualize and assess the proposed actions, some at incredibly fine scale, within the context of what happened previously. This is particularly true where the forest type is different since so much of the current actions were predicated on trying to shift to a mixed wood forest. It would be interesting to know if that actually happened on a previously harvested parcel, particularly comparing the 60s, 80s and 90s to get a span that covers early to young forest conditions. Some easy way of seeing what stands are not suitable for harvest because of topography would be useful so context is more readily visualized.

15) **The Cape Area – context analysis:** The Cape Research Natural area is represented as the only old growth within the TGIRP. Normally conservation biology landscape planning would make sure that any resource of that rarity did not sit as an island surrounded by land that is intensely managed. In many contexts it is actually hard to create a more mature forest around such an area. In The Cape situation it would be actually quite easy. The Cape sits just below a Remote Backcountry Forest where management is through natural processes except in some rare, limited situations. The thin strip between the two areas includes two more recently cut stands and two stands totaling 125 acres that are 120 years old. All of these are the same natural community as The Cape, and yet the proposed action is to thin these forests. They should simply be left to grow and become part of the Natural Area.

    In addition, The Cape is surrounded by Diverse Backcountry where the largest extent of the oldest forest in TGPS is found. Basically a coming together of old montane spruce fir and northern hardwood/yellow birch, some probably enriched, located on steep enough slopes that they were largely not harvested, some since 1865. Unfortunately, in the 1990s the GMNF put a series of 2-acre group selection openings and 10-acre patch cuts into some of the oldest stands. Four stands from 1865, totaling 147 adjacent acres (Stands 142 – 2,13,14,15), and one adjacent one from 1904 totaling (Stand 142-7), are all extremely similar and sit below very old spruce fir on the ridge, are at the southern end of this Cape landscape area.

    After intensive investigation of all the information on stands from this Cape landscape area I find no silvicultural reason that could possibly outweigh the loss of these extremely rare forests, some completely through clearcut or shelterwood cuts, that compliment, enhance and enlarge the Cape landscape area of old forests. Based on stocking levels, volumes and diameter there is valuable maple that could be harvested, but this seems inappropriate given this setting within the Diverse Backcountry. I propose that all harvesting, stand improvement management and tree planting north of the 5 stands listed in the paragraph above be removed from the proposed actions and the area become a natural area, with the existing road above The Cape decommissioned.

16) **The Blue Ridge Area – context analysis:** The stand age map shows an old forest at the top of this Ridge, presumably montane spruce-fir and possibly hardwood seepage communities based on the botanical map. This ridge also includes the Blue Ridge Fen candidate Research Natural Area. The scoping action propose some fairly intense management in forests that are old, including a clearcut of one. Given that this entire area is within the Diverse Backcountry, where forests of 150 years old and more are supposed to predominate, this entire area needs for more justification for the proposed management.

17) **Townsend Brook Road – context analysis:** The discussion looks at four stands (137 – 22,23,24 and 38) found at the eastern edge of the TGPS with the Townsend Brook Road running through them. All four are in the Diverse Backcountry management area. Based on the detailed stand information these seem to represent the TGPS goal of mixed wood forests. A stream valley probably accounts for much of the hemlock. Red spruce is found on the two stands slated for clearcutting (137-22&24). Maples are dominant in stand 137-23 and the stand height map indicates they are quite tall. The three stands 22,23,and 24 are adjacent at the entrance to the federal ownership and all have significant levels of white ash, though little in the bole stage. It should be noted that invasive species are located in this area.

    Ignoring the fact that the oldest of these stands, 137-38, at 118 years of age sits within the Diverse Backcountry where extended rotations ages should guide harvest, a thinning may be appropriate for this stand as it is barely at the B line and not very tall on average. It is diverse in that it includes red maple and hemlock, and a little white ash. This stand is so different from those near it that further context might be important.

    The management for the other three stands seems aggressive given the signs of richness. It seems small openings might be more appropriate and in keeping with the fact they sit near invasive species, both within and outside of the national forest. This should also help bring in more red spruce than clearcuts or even a shelterwood cut. Stand 24 does include birch and aspen, and some white pine, but it seems small patches might be more appropriate if this is a place to increase their presence. It would be interesting to know the regenerating status of some openings adjacent, but outside of federal ownership to determine how important it would be to encourage these species on this particular stand. I don't have a particular recommendation for these 3 mixed wood stands, but all of them are still below the A line so given their richness significant growth might still occur. The lack of stem diversity and large diameters, particularly for stand 137-23, may simply be a reflection that they have not started their gap formation yet, and that could be appropriate management action without starting the forest over by a clearcut. Again, this is a balance between economics and ecological benefits that currently is heavily tipped toward economics.

18) **Are the Different Harvest Just Different Ways to Reach the Same Endpoint?** At many points in my analysis of what the proposed actions will accomplish I am left with an imprecise muddle. It seems highly unlikely that significant amounts of red spruce will be present 80 years into the future, and that is not a hidden understanding. But one could say that matching the goals of an outdated plan does provide a way to justify management that would not necessarily be the optimum if trying to maintain what is currently largely a healthy mature and old northern hardwood forest. The two intermediate treatments are differing descriptions without much distinction in practice, particularly when thinning includes "recovering potential mortality." There are indications of enrichment throughout much of this forest area, and yet the actions lean heavily on even-age management, not something normally indicated for enriched areas under nearly any circumstance.

The place I really stumbled is trying to reconcile the footnote 2 on Table 8 saying that uneven-aged harvest will result in "either 100 percent of a stand receiving individual tree harvest or 20% through group selection" with the statement in Table 9 saying that single tree harvest and group selection could be combined within the same stand. Normally, group selection and single tree selection have distinctly different goals, particularly in this case where the size of groups focuses exclusively on larger openings. Single tree selection is not normally a harvest that covers 100% of a stand, particularly when the description of it is simply to promote growth of remaining trees and provide space for regeneration. That fits more closely with a definition of thinning. Regeneration in quality northern hardwoods would normally be accomplished, in a silvicultural setting driven by economics, by creating the small gaps that mimic windfall earlier in the maturation of the forest than would normally happen, usually with complete removal of all stems so that one is cutting all age classes present. Adding in the proposed post-harvest reduction in competition and planting of trees just completed the feeling that the actions result in a muddle.

What jumps out at me from all this data is how extraordinarily large the quadratic mean diameters are for most of these stands, how the stand age is different from any landscape analysis I have seen, and how different the stand heights are from the surrounding landscape. The result is a visualization of a second growth forest that I have only seen in very small patches on private land, with one forest exception in Fairlee formerly managed by Richard Mallory. I have also seen it in a few other places on the GMNF where soils were very rich. I can't escape that what is driving this TGPS is the goal of capturing this mature and old forest as high value timber. If realized, this would help a few, but at both a huge ecological and climate cost. In addition, and as explained in a prior section above, capturing the high value timber now results in the loss of a unique opportunity to learn how to actually realize large amounts of timber while also getting the benefits of a forest that more closely approximates the ecological health of an old growth forest. That would be true sustainability.

19) **Conclusion:** There are enough problems and questions as detailed above that this Telephone Gap Project and the proposed actions should go through a full EIS with various alternative scenarios if the TGPS is not modified to eliminate harvests. My recommended action would be to enlarge The Cape natural area and set the remaining TGIRP area aside from harvesting for the next 50 to 80 years, when maximizing carbon storage and uptake is so important from a climate perspective. Make it a research site, and use the detailed data as a base, to start formulating new silvicultural ideas that work in very old forests that are not constrained by economics and are subject to the new reality that climate change will bring. At the end of that period the Forest Service could propose limited research harvests that explore a new set of silvicultural guidelines that could be practiced on public lands or permanently conserved private lands. It is time that forest management move away from the time value of money and economic maturity concepts, and truly figure out sustainable harvest incorporating the new knowledge of how forest communities are networks of trees. This can result in true ecological health and resiliency and substantial long term timber flow.