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Comments: I am against most of the proposed project activities in the WMNF Lake Tarleton Integrated Resource Project (IRP) for the following reasons which will be detailed in the comment further below:

-The plan is based on the 2005 WMNF Plan which is 17 years old and is based on outdated science about forest ecology and sustainability. It does not cover recent climate change or mycorrhizal fungi research studies and data on the impacts of timber harvesting. It does not include recent EPA findings on the impacts of forestry on water quality and the effects of applying or spraying herbicides on mycorrhizal fungi and soil integrity and general effects on forest ecosystems (see https://www.srs.fs.usda.gov/sustain/report/pdf/chapter_21e.pdf and https://www.sciencedirect.com/science/article/pii/S0048969718320345). Specifically impacts on soil microorganisms, nutrient cycling, and mycorrhizal fungi networks which are critical to forest health and regeneration.

-Limited information and no specific data on the existing forest types in the Harvest Unit Treatment areas targeted for different proposed silviculture treatments and the goals in the Lake Tarleton IRP for vegetation and wildlife habitat management to achieve the following: increase spruce-fir habitat, increase or maintain aspen-birch habitat and maintain current levels of hemlock. There is no data on % of these forest types in each Harvest Unit Treatment area. What is the percentage to be achieved for the vegetation and wildlife habitat goals? The goals are very general no details on how that will be done. How will the current forest species be changed to the forest types in the goals for this project ? Spruce-fir and aspen-birch ? Why change from Ecological Land Types to forest types with land capability ? What does that mean?

-Limited information or no data on the amount of non-native species (NNS) in the forest understory in order to determine the amount of herbicides that might be used across the project area. What is percentage of NNS in each Harvest Unit Treatment ? How much herbicides will have to be used as a result ? How many of these NNS have to be treated since they spread easily by birds? How will they increase once the forest canopy is removed ?

-No data provided on Canada Warbler in the Biological Evaluation, but sites are identified in the Lake Tarleton IRP Known Wildlife and Habitat Features map. The listing of Canada Warbler as a species at risk of continental concern in the 2021 U.S. Fish and Wildlife (https://www.fws.gov/media/birds-conservation-concern-2021pdf) and no specific actions taken to preserve forest around the identified habitat in the northwest area of Lake Tarleton IRC project and the impact of timber harvesting roads, equipment and treatments on vernal pool species identified on map -a total of 6 vernal pools.

-Cumulative impacts of different silviculture methods and logging equipment and roads on the water quality of vernal pools, Eastman Brook and its wetland systems, and Lake Tarleton.

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1.Plan Based on Outdated Forest Ecological Science and Sustainability in 2005 WMNF Plan
The Lake Tarleton IRC plan is based on the 2005 WMNF Plan which is 17 years old and does not include even remotely recent research and data conducted in the following areas of forest ecology: climate change science impacts; mycorrhizal fungi networks and forest ecosystems; impacts of herbicides on mycorrhizal fungi and soil micro-organisms; or the effects of releasing carbon from disturbed forest soils. In fact, the 2005 WMNF Plan under the Purpose and Need section states that the Forest Plans should be revised every 10-15 years, this plan

is 17 years old and is based on old forest ecosystem science.
(https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5199874.pdf)

There has been lots of research on the ecological benefits of forest soils-fungi networks-and the nutrient interconnections between diverse species of trees in the Northern Forest in the past 17 years. Dr. Suzanne Simard at the University of British Columbia has done extensive research on the importance of older trees in providing important nutrients to younger trees in the forest -this data has not been considered in the Lake Tarleton IRP. Simard's research shows the importance of preserving older trees in forest ecosystems to provide critical nutrients and help reduce tree diseases.
"In connecting with all the trees of different ages, [the mother trees] can actually facilitate the growth of these understory seedlings," she says. "The seedlings will link into the network of the old trees and benefit from that huge uptake resource capacity. And the old trees would also pass a little bit of carbon and nutrients and water to the little seedlings, at crucial times in their lives, that actually help them survive."
Keep in mind that all trees and all plants - except for a very small handful of plant families - have obligate relationships with these fungi. That means that they need them in order to survive and grow and produce cones and have fitness - in other words, to carry their genes to the next generations. And the fungi are dependent on the plant or the trees ... because they don't have leaves themselves [for photosynthesis]. And so they enter into this symbiosis in that they live together in the root, and they exchange these essential resources: carbohydrates from the plant for nutrients from the fungus, in this two-way exchange which is very tight, almost like a market exchange. If you give me five bucks, I'll give you five bucks back. It's very, very tightly regulated between those two partners in the symbiosis. But, yes, all trees and all plants in all of our forests around the world are dependent on this relationship…..
I had learned about these mycorrhizal fungi and how they could actually protect trees against diseases. And I'd also heard about David Reed's work in the U.K., where he had shown that in the laboratory that trees could be linked together by mycorrhizal fungi and pass carbon between them.
(https://www.npr.org/sections/health-shots/2021/05/04/993430007/trees-talk-to-each-other-mother-tree-ecologist-hears-lessons-for-people-too)

Her book "Mother Tree-Finding the Mother Tree: Discovering the Wisdom of the Forest" details her research and findings about fungi networks and their symbiotic relationships with trees. Her research shows that all plants in all of our forests are dependent on these fungi networks. The WMNF Lake Tarleton Integrated Resource Project harvest plan does not include any of these potential impacts nor mitigation to reduce them. In fact, the plan focuses on applying herbicides to beeches and invasives in the forest which will permeate the soils disrupted by all the heavy equipment and kill the microorganisms and fungi in the soils of the forest around Lake Tarleton. Dr. Rick Van de Poll highlighted the benefit of old growth soils, carbon storage in soil and the importance of maintaining soil integrity in a recent article in the Quincy Bog newsletter (see attached).

The disturbance of the soil integrity will occur from the heavy logging machinery and removal of large trees in the forest particularly the northeast side of Lake Tarleton. The 2005 WMNF plan does not include any of this new mycorrhizal fungi in forest ecosystems research nor the potential impacts of disturbing these networks.
I have attached research articles on the importance of preserving mycorrhizal networks and microorganisms which discuss the critical importance of the rhizosphere in forest ecosystems (see "The foundational role of mycorrhizal networks in self-organization of interior Douglas-fir forests", 2009, Suzanne Simard and "Forestry and fungi - a neglected relationship",Nordic Forest Research.org blog-5-30-2018)
None of this forest mycorrhizal science is considered in the 2005 WMNF Plan demonstrating it is an outdated and not a credible scientific source for developing a harvest plan for the WMNF- Lake Tarleton IRP. There are many other research papers which identify the importance of preserving mycorrhizal networks and soil integrity for forest health and management. How will this be done ? This is not explained in the Environmental Assessment.

The latest climate science data has not been included to truly evaluate impacts of timber harvesting within a

pristine watershed like Lake Tarleton. What will happen with extreme weather events like heavy rains or extensive droughts ? How is that considered when looking at regeneration of specific trees or types of silviculture treatments used ? Will trees in selective group cutting be affected or on the edge of clearcuts due to extreme evapotranspiration or heavy rain events ? Digging up the soil with miles of roads and heavy equipment will cause a release of more carbon. This is not accounted for in the EA. How will the removal of trees effect evapotranspiration from Lake Tarleton, Eastman Brook and wetlands especially due to droughts or heavy rainfalls ? Either of these conditions will have significant impacts on all of these wetlands-see attached-(Carl C. Trettina, *, Martin F. Jurgensenb , Zhaohua Daia-Effects of Climate Change on Forested Wetland Soils-2019)

Further, there is no recent scientific data and research on the impacts of silvicultural methods and infrastructure on mycorrhizal fungi and soil micro-organisms and forest health. Research on these impacts was described in the following 2012 study: Hartman,et al The ISME Journal," Significant and persistent impact of timber harvesting on soil microbial communities in Northern coniferous forests"

Based on their research, they found that:
"Plant symbionts, like ectomycorrhizal fungi, and saprobic taxa, such as ascomycetes and actinomycetes, were among the most sensitive to harvesting disturbances. Given their significant ecological roles in forest development, the fate of these taxa might be critical for sustainability of forest ecosystems. "
see attached for details on their research (https://www.nature.com/articles/ismej201284).
The release of additional carbon from soil disturbance due to tree removal and forestry work infrastructure and machinery is also not included in the climate change section of the Lake Tarleton-IRP Environmental Assessment. There has been a lot more research in this area over the past 15 years as detailed in this 2016 Meta Analysis: "The Effect of Harvest on Forest Soil Carbon: A Meta-Analysis" Jason James and Rob Harrison from the University of Washington and according to their analysis:
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"To quantify the effect of harvesting on soil C, we used meta-analysis to examine a database of 945 responses to harvesting collected from 112 publications from around the world. Harvesting reduced soil C, on average, by 11.2% with 95% CI [14.1%, 8.5%]. There was substantial variation between responses in different soil depths, with greatest losses occurring in the O horizon (-30.2%). Much smaller but still significant losses (-3.3%) occurred in top soil C pools (0-15 cm depth). In very deep soil (60-100+ cm), a significant loss of 17.7% of soil C in was observed after harvest. However, only 21 of the 945 total responses examined this depth, indicating a substantial need for more research in this area. The response of soil C to harvesting varies substantially between soil orders, with greater losses in Spodosol and Ultisol orders and less substantial losses in Alfisols and Andisols. Soil C takes several decades to recover following harvest, with Spodosol and Ultisol C recovering only after at least 75 years."

2. Limited information and no specific data on the existing forest types in the Harvest Unit Treatment areas targeted and the goals of vegetation and wildlife habitat management to increase spruce-fir habitat, increase or maintain aspen-birch habitat and maintain current levels of hemlock.

The Lake Tarleton IRP plan does not include any details on the percentage of forest type in any of the Harvest Treatment Units nor does it include percentage goals for attaining more spruce-fir and birch-aspen forest types in specific HTUs nor the maintenance of hemlock forest. As a result, it is impossible to determine how these goals will be achieved and whether they are reasonable, credible and scientifically achievable. Further questions arise about the need to change from Ecological Land Types to forest types with land capability ? What does that mean? Why is it necessary ? Does it make ecological sense for the whole forest ecosystem around Lake Tarleton to be managed in this way ?

Is the goal truly just an economic one and not a wildlife habitat enchancement goal ? Birch and red spruce bring more money than beech. Also, the Environmental Assessment states that one of the project goals is to keep the

wood local or regional to help the local economy. This is national forest land paid for by taxpayers, it should not be exported to China or Canada it should remain for use in the U.S. Yet, in a recent search on wood prices in NH, it states that the market prices of oak are being depressed due to lack of demand in China and that Hemlock prices are stable due to demand in Canada. Where is the wood being exported to ? I have concerns that this wood is going to be exported and not sold locally or regionally (https://www.stillwaterforestry.com/forestry/timber-prices-winter-2020.php) Also, an article in the Concord Monitor in April 2021:

Hardwood has been a different story," said Stock, concerning lumber demand. "China is hands-down the No. 1 consumer of northern red oak, the most significant hardwood product grown in New Hampshire. The trade war with China has been a problem. … We have started to see kind of a steady recovery and a modest increase in hardwood lumber markets, but nothing great." (https://www.concordmonitor.com/lumber-wood-logging-nh-covid-coronavirus-nh-new-hampshire-39555106)

3.Limited information or no data on the amount of non-native species (NNS) in the forest understory in order to determine the amount of herbicides that might be used across the project area.

There is no information in the Environmental Assessment about the extent of non-native species (NNS) in each of the Harvest Unit Treatments and type of invasives to be able to determine what treatments may be used for particularly difficult invasive species as many do not become eradicated by mechanical treatment and early detection is difficult to do without more labor. For Glossy Buckthorn treatment, the recommendation is usually chemical. There is no information on what invasives are where in the Harvest Unit Treatment areas and many of the forest invasives are spread by birds who eat the fruits of oriental bittersweet, multi-flora rose, glossy buckthorn and autumn olive. Opening up the forest with a timber harvest is completely counterproductive to reducing NNS because of the way they spread. How much chemical treatment will be needed ? How can you have as a goal to remove NNS and yet create conditions for increasing NNS which will have to be continually monitored ? The U.S. Forest Service does not have sufficient staff to do this type of monitoring. So there is no way to evaluate the environmental impact of this project activity.

There is no way to know and how will the chemical treatments affect soil integrity and mycorrhizal networks when they are spread by heavy rain. Water quality impacts are not able to be assessed when you do not know how many invasives are in an area. What will be the results of herbicide runoff a on the water quality of Lake Tarleton, Eastman Brook, vernal pools and other associated wetlands ?
The following recommendations from UNH Extension's Good Forestry in the Granite State describe the problem with tree removal and site disturbance creating conditions for invasives to propagate. This is of serious concern particularly in such an environmentally sensitive and pristine watershed area.

Healthy forest ecosystems are less susceptible to infestation by invasive plants. Though careful silvicultural planning and practices can reduce or prevent invasive plant infestations, forestry practices can also create conditions suitable for invasive plants. These conditions occur when site disturbance exposes soil creating a seedbed, or tree removal releases invasives already present.
*Map infestations and use the mapped locations in planning harvest areas and skid trails, truck roads, and landing locations. Avoid placing transportation infrastructure and landings in infested areas.
*Invasive plants thrive on disturbance, often requiring the combination of seed sources or vegetative propagule (plant pieces that root and sprout) and disturbance. Once established they can spread beyond the introduction site even in the absence of continued disturbance.
(https://extension.unh.edu/goodforestry/html/5-2.htm)

There are no maps of infestations in this EA and there is no way to tell the extent of the NNS and treatments needed to truly determine the environmental impact on the forest and the Lake Tarleton watershed harvest area.

4.No data provided on Canada Warbler in the Biological Evaluation, but sites are identified in the Lake Tarleton IRP Known Wildlife and Habitat Features map and protection of upland habitat for vernal pool species impacted by forestry work.

There are two locations for Canada Warblers on the Lake Tarleton IRP Known Wildlife and Habitat Features map, but no information on how the warbler will be affected by proposed tree cutting surrounding its breeding habitat. The Lake Tarleton IRC Biological Evaluation does not even mention Canada Warbler and yet they are listed as a species at risk of continental concern on the 2021 U.S. Fish and Wildlife Birds of Conservation Concern list (https://www.fws.gov/media/birds-conservation-concern-2021pdf). Partners of Flight list the Canada Warbler as a Yellow-Watch List species and explains why their population has dropped by 72% along the Atlantic Coast Joint Venture region:

"The Canada Warbler inhabits shady forest undergrowth year round, making this species vulnerable to forest loss….. On the breeding grounds, dense deer (Odocoileus virginianus) populations have resulted in over-browsing of the shrubby layer that Canada Warblers prefer. Additional potential threats include habitat fragmentation from energy development and habitat desiccation from land draining and climate change." (https://partnersinflight.org/species/canada-warbler)
Yet, there is no mention of impacts on the breeding habitat of Canada Warblers in the Biological Evaluation. This is a serious oversight and should be corrected by working with U.S. Fish and Wildlife to determine best practices for preserving this species which means preserving forest surrounding their understory/wetland habitats.
There are six vernal pools identified on the Lake Tarleton IRP Known Wildlife and Habitat Features map. Yet no mention of species that use these pools for breeding and their dependence on upland habitat surrounding the pools. The Biological Evaluation does not provide any information on how these vernal pool species and their forest habitats will be preserved or protected when heavy logging equipment and roads will fragment and crush areas of their upland habitat.

I was trained in the certification of vernal pools in Massachusetts by Massachusetts Audubon and have certified 12 vernal pools in Pepperell, Mass through Natural Heritage Program and documented several vernal pools in Hollis,NH for the Conservation Commission which were submitted to the state. I know a lot about the obligate species -Wood Frogs, Spotted Salamanders, Jefferson and Blue-Spotted Salamanders that use these pools for breeding. Based on recent research, most of these species live in upland habitat within 300-900' of vernal pools during the non-breeding season. See UNH Extension Service-Good Forestry in the Granite State considerations for vernal pools:

"The vernal pool and the surrounding forest make up the functional vernal pool system, but each serves different functions. Breeding habitat includes the vernal pool basin and a forested buffer extending 200 feet from the pool edge. The pool basin is the physical breeding location for vernal-pool-dependent species and a nursery for their eggs and larvae. The buffer helps protect the pool's water quality by filtering sediment and pollutants, providing shade, and slowing surface run-off. The buffer also provides leaf litter, which serves as the foundation of the vernal pool food chain and as elter for adult and metamorphic amphibians immediately after they emerge from the pool. Core habitat extends from the breeding habitat out 950 feet from the pool edge. It provides habitat for amphibians of all ages during the nonbreeding season and provides aestivating and basking habitat for spotted and Blanding's turtles."
"Recommendation: Locate openings such as landings, main skid trails, roads, wildlife food plots, pastures, and fields as far as reasonably possible from vernal pools. Avoid locating permanent, nonforest openings directly between two adjacent vernal pools." https://extension.unh.edu/goodforestry/html/7-3.htm
There is no description or plan in the Lake Tarleton IRP EA to explain how the habitat around these pools will be preserved for these species. I am completely against harvesting in this area where there are so many pools, wetlands and sensitive species. I recommend not doing any timber harvesting,or using heavy equipment or road expansion in this area of the project. The effects of evapotranspiration on vernal pools and wetlands is another reason to not cut trees that shade these pools.

5.Cumulative impacts of different silviculture methods and logging equipment and roads on the water quality of vernal pools, Eastman Brook and its wetland systems, and Lake Tarleton.

This is a highly sensitive lake watershed and wetland area that will be affected by logging on 700+acres of surrounding forest. The cumulative impacts of 4 miles of logging roads, 9 acres of landing areas, heavy equipment and infrastructure, and timber harvesting will be significant. 100 foot buffers will not sufficiently protect the lake, vernal pools and Eastman Brook and its wetland systems from runoff, siltation, and herbicides during heavy rainstorms more frequently occurring due to climate change effects. The impact of opening the tree canopy on the northeast and northwest sides of Lake Tarleton will increase evapotranspiration of the vernal pools and wetlands particularly during longer drought periods occurring as a result of climate change conditions. I see no need to overmanage this forest to bring it to an age and forest type condition determined as appropriate by an outdated 2005 WMNF Forestry Plan.
The primary objective seems to be to transform the forest to age conditions and species that have more economic benefit than any environmental benefit as early successional habitat is available to the north and east of Lake Tarleton in the Oliverian area, Benton, and the powerline that runs along the eastside of the project. This project will create a management nightmare for the USDA Forest Service if you intend on monitoring and managing NNS, water quality protection, and habitat preservation afterwards.

Lake Katherine Forestry Plan
The only part of this project that I support is the plans for work around Lake Katherine to improve the wildlife habitat and non-motorboat recreational access to the lake as it is currently torn up and difficult to put in a kayak or canoe.

Thank you.

Gail Coffey
Wentworth and Wilton, NH