July 1, 2020

Erin Uloth, Mt. Baker District Ranger
Mt. Baker Ranger District, Mt. Baker-Snoqualmie National Forest
810 State Route 20
Sedro-Woolley, WA 98284

Re: NF Nooksack Vegetation Management Project – Evergreen Land Trust Comments

Dear District Ranger Uloth,

On behalf of the Evergreen Land Trust, we respectfully submit these technical comments for the proposed restoration and logging project in the Mt Baker-Snoqualmie National Forest (MBS), known as the North Fork Nooksack Vegetation Management Project (NFN VMP, or "the Project").

While detailed information about site-specific prescriptions and current stand condition was lacking in the June 1 Public Scoping Letter and associated materials, we would like to articulate to you and your staff the numerous significant ecological and hydrological impacts that would likely result from the NFN VMP as currently proposed, and present alternative approaches to mitigate these impacts. Below we have developed a review of the relevant scientific literature as it pertains to the proposed management activities, as well as key take-aways from the Canyon Creek Watershed Analysis (CCWA USFS 1995). We hope this scientific review will prove useful as MBS develops alternative approaches to the NFN VMP later this year.

The Evergreen Land Trust Association (ELT) is a 501(c)(3) non-profit organization established in 1974 to encourage the development of sustainable land use practices in the Puget Sound area, and to create working, cooperative models of active stewardship. Through its Evergreen Ecoforestry program, the trust manages forestlands and provides technical assistance on selective silviculture techniques and low impact forestry.

SUMMARY OF TECHNICAL COMMENTS BELOW

1. **Summer Streamflow** – According to recent research conducted throughout the Pacific Northwest, the prescriptions advanced by the NFN VMP will likely result in increased evapotranspiration rates, thereby contributing to diminished summer streamflow levels. This will adversely impact the Nooksack Indian Tribe, the Lummi Nation, downstream communities, agricultural interests, salmon populations, and other aquatic species.

2. **Peak Flow** – The stand regeneration prescriptions advanced by the NFN VMP will likely lead to decreased soil moisture retention rates and increased runoff during the winter months, thereby contributing to elevated peak flow levels in Canyon Creek (CC) and the North Fork Nooksack River (NFNR). High peak flows are associated with a wide variety of hydrologic and ecological impacts, and may increase flood risks for communities along the NFNR and the mainstem Nooksack River.

3. **Mass Wasting, Landslides, and Turbidity** – The NFN VMP would likely increase incidences of mass wasting, increase surface erosion, and increase sedimentation inputs – thereby reversing the trend towards recovery of water quality and quantity in the CC basin and the greater NFNR watershed.

4. **Salmon Habitat** – The June 1 Public Scoping Letter erroneously describes industrial logging activities as "restoration," and inappropriately advances extractive silvicultural prescriptions in current and potential habitat for ESA listed species. These prescriptions will likely impact listed populations of spring Chinook, steelhead, and bull trout by increasing peak flows and turbidity – thereby altering stream-channel morphology and contributing to a further increase in stream temperatures. Canyon Creek is already listed as a category 5 impaired waterway for excessive temperature under section 303d of the Clean Water Act (Washington Department of Ecology).

5. **Forest-Carbon** – The NFN VMP would transfer large amounts of carbon into the atmosphere, and undermine the forest's capacity to capture and store carbon in the decades to come. Forests can play a major role in mitigating excessive carbon levels in the atmosphere; however, the Project's harvest prescriptions would negate these benefits.

6. **Summary and Recommendations** – Due to the numerous significant impacts that would likely result if the NFN VMP were implemented, we recommend that MBS:
    a. Pursue an Environmental Impact Statement (EIS) that fully considers the Project's likely adverse impacts, identifies appropriate mitigative measures, and provides robust opportunities for various stakeholders and the general public to provide input;
    b. Eliminate all stand regeneration prescriptions;
    c. Pursue thinning prescriptions in Late Successional Reserves (LSRs) that prioritize ecological restoration – not timber production (i.e. "commercial thinning");
    d. Ensure that any closed roads that are reopened for project implementation are repaired and appropriately maintained to avoid further exacerbating peak flows and turbidity;
    e. Avoid reopening decommissioned roads under all circumstances.

Before detailing our concerns about the commercial prescriptions in this project, we would like to applaud MBS for advancing non-commercial prescriptions intended to increase age and species diversity in stands previously degraded by industrial logging activities (i.e. even-aged harvest or "clearcut logging"). We recommend MBS pursue these restoration prescriptions in other degraded plantations within the National Forest.

We are also encouraged to see MBS prescribe selective harvest practices to meet its commercial goals; although, we do not support commercial activity in LSRs. We believe the USFS can help pave the way for the timber industry to shift away from even-aged management and towards uneven-aged management that encourages diverse stand ages and species composition. The USFS should demonstrate how "ecological forest management" can produce wood products while simultaneously supporting ecosystem services, so other land managers on state, private, and tribal timberlands will be encouraged to do the same in coming years.

1. SUMMER STREAMFLOW

The NFN VMP currently prescribes over 1,800 acres of clearcut logging, which will likely alter hydrologic function in the CC basin as well as the greater NFNR watershed by increasing winter peak flow events and decreasing streamflow and water availability during summer months. MBS should conduct a careful assessment of the ecological and hydrological impacts that this process would pose to the watershed by pursuing an Environmental Impact Statement (EIS).

The Nooksack River Watershed currently faces numerous water quality and quantity impairments – most of which are actively being exacerbated by the onset of climate change. Water quantity concerns are perhaps most pressing for in-stream flow users such as the Nooksack Indian Tribe and Lummi Nation, as well as downstream users, such as the Whatcom County PUD, agricultural interests, and residents of rural Whatcom County.

Streamflow levels in the Nooksack Watershed have continually declined over the recent decades, largely due to the legacy impacts of industrial forest practices – although it remains unclear to what extent forestry has contributed to this trend. Over the past 50 years, the stream gauge at Ferndale has seen an average decline of about 0.5% annually. Concerningly, the rate of decline over the past decade has increased dramatically, with streamflow levels dropping by an average of 5% annually (Hirst 2020), which suggests that we are seeing the results of cumulative effects.

Decreased streamflow levels impact human uses, but also have a significant impact on dozens of plant and animal species – including numerous ESA-listed species – that depend on functioning aquatic and riparian ecosystems. A brief overview of those impacts is described below in Section 4 ("Fish and Wildlife Habitat").

Numerous scientific studies have documented a sharp decline in summer streamflow in basins subjected to industrial forest practices (even-age harvest, plantation regeneration, etc). Analysis of six decades of data from paired watersheds in the HJ Andrews Experimental Forest showed that basins that had been clearcut and replanted produced 50% less water during summer months than adjacent paired basins with mature forest cover (Perry & Jones 2016). While the study was conducted in western Oregon, one analysis found, "The watersheds in this study are considered representative of a vast population of watersheds across western Oregon and the Pacific Northwest where Douglas-fir is the dominant tree species" (Frissell Memo 2017).

Another multi-decade analysis in the Oregon Coast Range found that 40-50 year rotations of Douglas-fir plantations can produce persistent summer low-flow deficits of up to 50% when compared to adjacent basins with older trees (Segura et al. 2020). The scientists on the Segura et al. 2020 paper theorized that clearcut-plantation forestry leads to these persistent streamflow impacts due to high evapotranspiration rates from rapidly regenerating plantations. Segura et al. found that these reductions in water quantity were not short lived, but rather persisted for many decades.

This has serious implications for industrial forest management in the age of global climatic change. If the USFS were to apply stand regeneration prescriptions to the Canyon Creek basin in the coming years, the diminished summer streamflow that would likely result would persist well into the late 21st century. Notably, this time frame overlaps with the onset of systematic climate change that will only continue to bring hotter temperatures to the Pacific Northwest.

Scientists predict that more precipitation will fall as rain instead of snow in the decades to come, and that this trend will persist into the 21st century and beyond. Combined with the retreat of the glaciers of the North Cascades, the Nooksack River watershed will likely produce greatly diminished summer streamflow levels in future decades (Murphy 2016). Forest management decisions made now must consider these projections when determining the best use of our publicly owned natural resources. The USFS should actively pursue management strategies that attempt to mitigate climate impacts to streamflow – not outdated strategies that are proven to lower water quantity.

By promoting hydrologic maturity on our federally-managed public forestlands, MBS can help make our communities and imperilled ecosystems more resilient to the impacts of climate change. Climate change driven water shortages are already impacting hundreds of communities across the American West. Whatcom County will not be immune from these challenges and prudent forest management decisions made today can mitigate the severity of climate impacts in the future.

In summary, we are concerned that the stand regeneration prescriptions proposed in the NFN VMP are likely to contribute to diminished summer streamflow within the Canyon Creek basin, and moreover, that it would be inappropriate to simply evaluate the potential impacts at the stand level.

The Northwest Forest Plan Standards & Guidelines require the USFS to consider impacts of management activities at a watershed-scale, with specific emphasis on maintaining ecological functions over long periods of time (Spies et al. 2018; NWFP Standards & Guidelines, USDA & USDOI 1994). Therefore, in order for the USFS to accurately assess the NEPA-related significance, ***MBS must consider the cumulative hydrologic impacts of logging prescriptions at a watershed-scale***. This approach is absolutely critical, especially as climate change adds to the cumulative legacy impacts that already exist in the NFNR watershed.

2. PEAK FLOW

The stand regeneration prescriptions advanced by the NFN VMP will likely contribute to elevated peak flow levels in the NFNR, which could lead to a wide variety of hydrologic and ecological impacts. Scientific research spanning the last five decades emphatically correlates increased harvest area with sharp increases in peak flow levels. The greatest increases have been correlated to even-aged harvest (clearcutting) in the transient snow zone (TSZ) (Grant et al. 2008) – which is precisely what the NFN VMP proposes in its stand regeneration units.

Peak flow events in the Canyon Creek basin have a major impact on the NFNR. In fact, a USFS analysis estimates that "Canyon Creek may contribute 30 to 40 percent of peak discharge (in the NFNR) from rain-on-snow storms" (CCWA USFS 1995). Therefore, mitigating peak flows in the Canyon Creek basin is integral to any general strategy to mitigate flood risks in the NFNR and the mainstem NR.

Below is a brief survey of the relevant scientific literature on this topic:

- ***Across all three zones (rain zone, transient snow zone, and snow zone) there exists a general trend of larger changes in peak flows with higher levels of harvest*** (Grant et al. 2008).

- Presence of trees, roots, and woody debris on flood plains increases hydrologic resistance, and may thereby decrease velocities of both water flows and flood waves (i.e., hydrograph peaks) (Darby 1999).

- Partial cutting and thinning result in peak flow changes that are lower than those that result from stand regeneration harvest (Grant et al. 2008). Therefore, increased tree retention through the use of selective harvest techniques will likely help mitigate risks of increased peak flows.

- Percentage change in peak flow generally decreases with time after harvest (Jones 2000; (Jones & Grant 1996). Therefore, staggering commercial harvest over the course of several years may help moderate peak flows.

- Forest harvesting has increased peak discharges by as much as 50% in small basins and 100% in large basins over the past 50 years (Jones & Grant 1996). It is likely that the NFNR already experiences elevated peak flows due to industrial forest practices in the watershed, especially given that the vast majority of non-federal forestland in the NFNR basin is managed on short harvest rotations.

Here is a brief synopsis of peak flows in the Canyon Creek basin:

- ***Logging activity in the Canyon Creek basin increased peak flows and mass wasting*** – especially in the 1970's and 1980's – causing detrimental impacts to stream channel morphology, salmon habitat, riparian areas, road networks, and more (CCWA USFS 1995).

- The Canyon Creek basin is particularly susceptible to peak flow events, given its elevation (rain-on-snow events being common) and steep topography (CCWA USFS 1995).

- Rain on snow events will continue to produce destabilizing floods in the basin; however, the magnitude of flood events will diminish as the harvested areas continue to mature. (CCWA USFS 1995). Additional harvest activity and road construction in the basin will likely contribute to increased peak flows.

The impacts of elevated peak flows are numerous. Perhaps chief among these is the risks posed to life and property by flood events downstream. In 1989 and 1990, three floods carried large amounts of water and debris down Canyon Creek, destroying four homes, a county road, and a private resort (a longer review of this flood and subsequent restoration work appears below in Section 4: "Fish and Wildlife Habitat"). Earlier this year, the mainstem Nooksack River flooded over 100 homes in Nooksack, Everson, Sumas, and Lynden – causing damages that totaled over $4 million (final costs of this flood event have yet to be determined).

In summary, industrial logging practices – such as stand regeneration harvest, reopening abandoned roads, construction of new roads – are likely to contribute to an increase in peak flows in Canyon Creek as well as the NFNR. Canyon Creek is a significant tributary to the NFNR in terms of streamflow (CCWA USFS 1995), and therefore increasing peak flows in the Canyon Creek basin will have significant impacts on flow levels in the NFNR. Once again, we ask that the USFS acknowledge the cumulative nature of forest hydrology by considering the Project in context of surrounding forestland – much of which is subjected to stand regeneration on short rotation intervals. We strongly recommend avoiding these adverse impacts by dropping the stand regeneration harvests proposed in the current plan.

Chart from Grant et al. 2008:

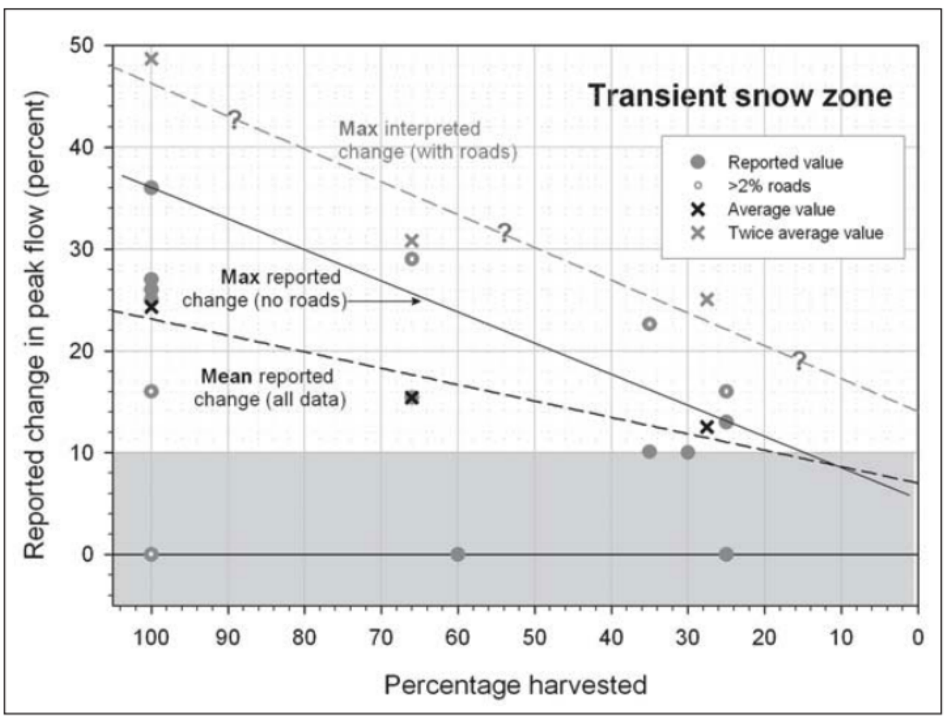

Figure 10—Peak flow response to harvest in the transient snow hydrologic zone. Solid line represents maximum values reported for basins without roads. Dashed black line is a linear fit through the average values from figure 8d, and represents the mean reported change for all data. Dashed gray line represents interpreted change with roads, and is a linear fit through a doubling of the average values. Gray shading around zero indicates limit of detection (±10 percent).

3. MASS WASTING, LANDSLIDES, SOIL EROSION AND TURBIDITY

The NFN VMP would likely increase incidences of mass wasting, and increase surface erosion inputs, reversing the trend towards recovery of water quality and quantity in the Canyon Creek basin and the NFNR watershed. MBS should conduct a careful assessment of the mass wasting, surface erosion, and the associated habitat and hydrological impacts that this process would pose to the watershed by pursuing an Environmental Impact Statement (EIS).

A strong correlation exists between mass wasting and management activities – most events (84%) occurred within clearcut associated areas or road cuts and fills (CCWA USFS 1995).

The NFN VMP currently calls for stand regeneration harvest on over 1,800 acres of matrix lands in the MBS National Forest. Stand regeneration harvest – also known as clearcut logging – leads to increased erosion and mass wasting through the cumulative impacts of:

1. Loss of root strength;
2. Loss in canopy interception and associated reduction in evapotranspiration, and evaporation of precipitation;
3. Increased and more frequent saturation of soils during precipitation events (both rain and snow events) – leading to mass failures;
4. Compaction and associated loss of pore space in soils;
5. Increased peak flows during storm events;
6. Increased wind throw of trees within harvest boundaries triggering mass wasting events;
7. Mass wasting events triggered by road failures, road fill failures, increased saturation of soils through groundwater capture in ditches without sufficient drainage relief.

Nearly all of the Project's harvest prescriptions are proposed in areas with hazardous landforms classified by scientists as high risk for landslides and erosion (e.g. steep inner gorges, bedrock hollows, and steep planar slopes).

1. Significant portions of proposed logging within matrix lands – including the majority of the stand regeneration units – overlay land forms identified as having high mass wasting potential (082,083,084,90) (Table: 2B-12, CCWA USFS 1995).

2. The Project area contains steep planar slopes over 64% including convergent topography over 70% (inner gorges and bedrock hollows) throughout proposed stand regeneration units and stand improvement units.

3. Currently, the Project lacks any level of detail that identifies hazardous landforms and protective measures (leave areas/mass wasting buffers) or mitigation measures (slope stability analysis) to ensure there is no increased risk of mass wasting through timber harvest activities.

4. At this point, the prescriptions laid out in the NFN VMP do not meet standards required by current Forest Practices rules – as defined by the Washington State Department of Natural Resources (DNR) – in regards to reduction of mass wasting hazards and mitigation of road-related impacts on hazardous landforms.

5. The Project must evaluate slope stability issues as a part of an EIS.

Mass wasting impacts on in-stream flow, peak flows, and rain-on-snow flooding will increase if clearcutting is allowed under this proposal.

1. Logging in the watershed increased peak flows and mass wasting in the Canyon Creek watershed, especially in the 1970's and 1980's, causing detrimental changes to stream channels, aquatic habitats, and riparian areas. Damage to road infrastructure has been widespread and extensive (CCWA USFS 1995).

2. Mass wasting is a significant contributor to peak flows, and channel incision, resulting in channel scour, migration, and disconnection from the floodplain.

3. Mass wasting – especially debris torrents and dam debris break floods – leads to extreme channel scour, channel incision, and destruction of pools and loss of woody debris. Risk of management related debris flows will be increased by proposed clearcutting within the matrix lands.

4. Other key stream reaches will continue to experience destabilizing floods from rain on snow storms, but the magnitude of increase will diminish as the harvested areas regrow (CCWA USFS 1995).

Mass wasting is the largest contributor to increased soil erosion and associated turbidity, sediment load, and causal impacts to water quality, water quantity and wildlife habitat.

1. The CCWA says, "The majority of soils within Canyon Creek are highly susceptible to erosion" and "Timber harvest activities have resulted in surface soil erosion" (CCWA USFS 1995).

2. Surface erosion impacts are decreasing as the forest recovers from previous harvest. Clearcutting will in the CC basin likely increase erosion inputs, reversing the current trend of water quality recovery in the CC basin.

3. Surface soil erosion and erosion via mass wasting will lead to increased turbidity levels. High levels of suspended solids may be fatal to salmonids, while lower levels of suspended solids and turbidity may cause chronic sub lethal effects such as loss or reduction of forage capability, reduced growth, resistance to disease, increased stress, and interference with cues necessary for orientation in homing and migration (Lloyd 1987).

4. Increased turbidity can lead to elevated water temperature. Suspended particles absorb heat and conduct that heat to the surrounding water raising the water temperature.

5. Increased peak flows and increased turbidity often cause active channels to widen, thus reducing shade provided by riparian vegetation. This exposes waterways to increased solar radiation, resulting in increased stream temperatures.

6. Canyon Creek is listed as an impaired waterbody under section 303d of the Clean Water Act (CWA) for excessive temperature. Impaired rivers and streams in this category require the Washington State Department of Ecology to develop a water cleanup plan – a Total Maximum Daily Load or TMDL – to reduce pollution sources throughout the surrounding watershed. Given that forestry and road building are the only land uses in the basin, it is readily apparent these uses are the driving causes of excessive temperature. Further degrading this watershed through stand regeneration harvest will only exacerbate temperature conditions, thereby complicating efforts to restore this impaired waterway to a condition that can support salmonids.

Surface soil erosion is expected to decrease through the next decade. The last clearcut harvest on NF lands occurred in 1988. Revegetation of those sites is expected to restore natural erosion rates. The majority of lands in other ownership have been harvested and are in various stages of recovery. The trend appears to be less timber harvest occurring within the next several decades which will reduce soil erosion from that source (CCWA USFS 1995).

The Project is likely to increase road-related impacts.

1. The impacts of road locations, construction, design, drainage, surface erosion, and road failure related mass wasting has been exhaustively detailed in the scientific literature over the last 40 years. MBS must comprehensively evaluate the impacts of the heavy traffic associated with logging on the current road network, and the maintenance required in the long term to maintain this road system.

2. There should be no new road construction, and the existing crossing of and impacts to hazardous landforms should be thoroughly evaluated. Given the history of MBS lacking adequate funding for road maintenance and reconstruction, there should be a dedicated and guaranteed fund for roads associated with any revenue and derived from commercial harvest in the Canyon Creek basin.

The CCWA contains many valuable findings related to roads:

1. Roads only comprise 2.3 percent of the Canyon Creek watershed, but they have a higher potential to increase peak discharge because they: 1. Are generally located on mid to lower slope positions that increase the contributing area for subsurface flow interception; 2. Include large road cuts that generally intercept the soil water impeding layer; and 3. Are paved and distances between culverts are long (CCWA USFS 1995).

2. The impacts of roads on terrestrial ecosystem components has been to interrupt and redirect the flow of ground and surface water away from their natural gravitational flow through the soil to ditches and channels paralleling or crossing roads. This has the effect of accelerating the release of water from the hillslopes and into the streams and lakes. It also has the effect of removing water from the soil faster, perhaps affecting the growth of residual trees and other plants.

3. In subwatershed "G", roads comprise 4.6 percent of the area. It is highly likely that this subwatershed exhibits increased peak discharges that have localized effects on the channels and possibly on the Jim Creek landslide (CCWA USFS 1995).

4. The possible effects of roads on runoff and mass wasting in Canyon Creek was recognized in the early 1980's. Remedial road work began in Kidney Creek in 1984. Road work consisted of three general types: 1. Water barring and insloping; 2. Decommissioning; and 3. Reconstruction.

5. Nearly 15 miles of water barring and 5.9 miles of decommissioning, including 3.7 mi of system roads and 2.2 mi of other routes, has been completed. Most of this work is in the Kidney Creek and Jim Creek areas. Less than a mile of reconstruction has been completed. Treated roads contributed only on mass failure during the 1989 rain-on-snow storm, while numerous failures occurred on the rest of the road system.

6. The potential also exists for roads to de-synchronize runoff from different portions of the watershed. Roads may accelerate or slow the transfer of water to stream channels and therefore change the timing of runoff. Depending on whether the runoff is accelerated or slowed in a subwatershed, runoff from several subwatersheds may be synchronized or de-synchronized by the road effects, and peak discharges may be increased or decreased.

7. Management induced increases in peak flows and erosion processes are somewhat reduced from what they were in the 1960's through 1980's. Hillslope erosion processes and changes to peak flows are returning to "non-management" levels. Except for effects of the roads on hillslope processes (mass wasting and re-routing of runoff) management effects have been within the range of natural variability for these processes in the watershed.

8. Some road related mass failures may persist, but road stabilization and decommissioning work will reduce the significance of these processes. The size and travel distances of failures should diminish as forest stands grow and stream channel structure increases. This will contribute to channel stability and Improved aquatic habitat complexity In Canyon Creek (CCWA USFS 1995).

To summarize, the NFN VMP would likely increase incidences of mass wasting, increase surface erosion, and increase sedimentation inputs – thereby reversing the trend towards recovery of water quality and quantity in the CC basin and the greater NFNR watershed. MBS should conduct a careful assessment of these impacts by pursuing an EIS.

4. SALMON HABITAT

The NFN VMP is also likely to have significant impacts on numerous animal species and the habitat they depend on to survive. Perhaps most notable of these species are the nine species of native salmonids that have run throughout the NFNR for millennia. The NFNR supports the following salmonids: chinook, coho, chum, pink, sockeye, steelhead, cutthroat, dolly varden, and bull trout (NF Nooksack River Watershed Analysis, USFS 1995). Most of these populations have plummeted in recent decades – including a population of spring chinook that is of critical cultural importance to the Nooksack and Lummi peoples.

Canyon Creek in particular provides spawning habitat for spring Chinook, steelhead, and bull trout – all of which are listed under the Endangered Species Act (ES) – as well as other native salmonids including pink salmon, sockeye salmon, coho salmon, and cutthroat trout.

Today, Pacific salmon runs in the greater Puget Sound system are estimated to be less than 10% of the runs in the late 19th century (Lackey 2000). Needless to say, successfully recovering these species demands bold, science-based approaches that apply restoration and conservation techniques at a large spatial and temporal scale. Each year, millions of dollars are spent on salmon habitat restoration in the Nooksack River watershed primarily to address legacy impacts – and yet, salmon populations continue to decline. This suggests that declines may not be solely related to instream habitat, but also to upper watershed processes that are affected by forestry. Since forests are the chief land cover within the NFNR watershed, recovering salmon in the watershed will demand novel approaches to forestry that move beyond outdated silvicultural practices such as clearcut logging.

The impacts of stand regeneration harvest on salmon habitat have been extensively documented by hundreds of peer-reviewed studies. Some of the common impacts that industrial logging practices have on salmon habitat are:

- Increased peak flows and associated scour can destroy reds, remove log jams, displace gravels, and contribute to juvenile mortality;
- Increased mass wasting and landslide events, which alter stream channel morphology and remove riparian vegetation – resulting in elevated temperatures;
- Increased mass wasting can also disconnect waterways from their historic floodplain, thereby diminishing hyporheic exchange and increasing stream temperatures;
- Decreased summer streamflow – as a result of even-aged plantations replanted after stand regeneration harvest – can also contribute to increased stream temperatures;
- These impacts result in decreased quality and quantity of salmon habitat, a critical impediment to salmon recovery.

Millions of dollars have already been spent on restoring the tributaries of the NFNR, including $5.6 million spent in recent years to complete restoration efforts in lower Canyon Creek. In 1989 and 1990, three floods carried large amounts of water and debris down Canyon Creek, destroying four homes, a county road, and a private resort. The floods also destroyed important salmon habitat in the lower reach of Canyon Creek that was used by a variety of salmonids. Since lower Canyon Creek was identified as a priority area in the WRIA 1 Salmonid Recovery Plan, a diverse group of stakeholders worked together to conduct a 15-year construction and restoration project to restore the reach and mitigate flood risks to nearby homeowners (Lower Canyon Creek Fish and Flood Project, Whatcom County). This important restoration work could be undermined by stand regeneration harvest within the Canyon Creek basin.

To avoid the extirpation of these endangered salmon populations, the USFS must proactively promote forest and aquatic resilience in the face of continued climate change. Currently, the NFN VMP does not adequately advance climate resilience objectives, and may even exacerbate climate impacts – unless modified.

5. FOREST-CARBON

This project involves commercial thinning and regeneration harvest – both of which will come with significant carbon consequences. We ask that MBS consider these impacts when conducting an EIS or EA for this project. No single source of carbon emissions causes the planet to warm – but rather, an accumulation of numerous non-point sources over time are responsible for global climate change. Please consider the carbon consequences of this project in that context.

The Intergovernmental Panel on Climate Change (IPCC) has repeatedly made clear that in order to avoid catastrophic climate change, it is essential that we rapidly reduce fossil fuel emissions while simultaneously growing carbon pools in the world's forested ecosystems and other plant-based ecosystems (IPCC 2019). One analysis found that natural carbon solutions can provide roughly one-third of the carbon reduction the world needs to meet the goals laid out in the 2015 Paris Climate Accord (Griscom et al. 2017).

Scientists around the world have come to the same conclusion – ***the most effective strategy to remove carbon from the atmosphere at a scale that can meaningfully contribute to climate stability is to better preserve the world's forests***.

Forests are the largest living stores of carbon on the planet. In fact, the forests of western Washington are especially relevant to global carbon cycles because our forests have the capacity to store carbon at a higher density per hectare than almost any other ecosystem in the world. Our sprawling forestlands are globally significant for their ability to capture and store vast amounts of carbon for long periods of time, and scientists have found that there is no marked decline in carbon sequestration as forests mature (Hudiburg et al. 2009).

However, the carbon benefits of our forests are negated when subjected to industrial logging practices, such as stand regeneration harvest. Countless studies spanning numerous decades have found that the best way to keep forest-carbon out of the atmosphere is to keep it stored in mature forest ecosystems – not wood products (Hudiburg et al. 2013; Law et al. 2011; Harmon et al. 1990).

Here is a brief review of the scientific literature demonstrating the carbon consequences of industrial logging practices:

- Half of harvested carbon is emitted to the atmosphere almost immediately after logging (Harmon 2019).
- Significant amounts of carbon are lost at each stage of timber harvest and manufacturing (Hudiburg et al. 2011).

- Only 19% of the forest-carbon removed by logging Oregon's forests in the past 115 years remains stored in long-lived products (Hudiburg et al. 2019).
- During the first 10 to 20 years after harvest or stand-replacing disturbance, young forests are net sources of carbon (Amiro et al 2010; Law et al 2001).

Rampant clearcut logging in the post-war period replaced mature, native forests with mono-culture tree plantations, transferring massive amounts of carbon from forested ecosystems into the atmosphere. Prior to the 1994 Northwest Forest Plan (NWFP), our National Forests were a net source of carbon emissions, due to management decisions that prioritized timber production over other values; however, the reforms under the NWFP converted National Forests in Oregon and Washington into a carbon sink – meaning they began to absorb more carbon than they emitted (Watts et al. 2017).

In fact, according to the researchers at the USFS Pacific Northwest Research Station, the National Forests of Oregon and Washington accumulate 7 million metric tons of carbon per year, the equivalent of 24% of all fossil fuel emissions in both states. Despite these gains, our National Forests still only store 63% of their maximum carbon storage capacity, which means there are significant opportunities for growth (Watts et al. 2017).

Given the current climate crisis we now face, the USFS should actively identify opportunities to grow carbon pools on public lands – while proactively promoting forest resilience to climate impacts. Scientists are beginning to coalesce around a new term to describe this approach: "Proforestation" – or growing forests to their greatest ecological potential. Research has found that this strategy can help us draw down carbon levels, buffer imperiled wildlife against warming temperatures, and make our communities more resilient to drought, floods, landslides, wildfires, and other impacts of climate change (Moomaw et al. 2019).

6. SUMMARY AND RECOMMENDATIONS

Due to the numerous significant impacts that would likely result if the Project were implemented, we recommend that MBS pursue an Environmental Impact Statement (EIS) to arrive at a well-informed decision. Conducting an EIS is the only way that the USFS can fully consider the Project's likely adverse impacts – especially those impacts that are cumulative in nature. It is also critical the MBS provide stakeholders and community members numerous opportunities to provide input and feedback.

We also ask that MBS strictly adhere to the guidelines outlined in the NWFP throughout this process. The Aquatic Conservation Strategy (ACS) was developed in 1993 to restore and maintain the ecological health of watersheds and aquatic ecosystems located within the region covered by the NWFP. To achieve its goal of "maintaining a watershed's natural disturbance regime," **the ACS requires the USFS to limit or exclude logging activities in areas prone to instability (NWFP Standards & Guidelines, USDA & USDOI 1994)**. Clearly, the Canyon Creek basin is such an area.

The Canyon Creek Watershed Analysis (cited heavily in the sections above) draws a strong correlation between past logging activities and subsequent mass wasting, landslides, and other hydrologic impacts. As forest stands mature in the CC basin, the watershed analysis projects that waterways within the basin will continue to recover from legacy impacts and approach the watershed's natural disturbance regime; however, such recovery will be stifled by future industrial logging practices in the basin.

The NWFP Standards & Guidelines of the NWFP state:

> *"Management actions that do not maintain the existing condition or lead to improved conditions in the long term would not "meet" the intent of the Aquatic Conservation Strategy and thus, should not be implemented" (B-10, NWFP Standards & Guidelines, USDA & USDOI 1994).*

In other words, the NWFP and the ACS make it incumbent upon forest managers to demonstrate that proposed harvest prescriptions will not compromise established objectives for improved water quality and salmonid recovery. This is a departure from the management protocols prior to 1994, because it requires federal land managers to use the precautionary principle when making management decisions. The ACS acknowledges the cumulative nature of forest hydrology and requires the USFS to consider impacts of management activities at a watershed-scale, with specific emphasis on maintaining ecological functions over long periods of time (Spies et al., USFS, 2018).

The ACS classifies the NFNR as a "Tier 1 Key Watershed" – a designation reserved for fish-bearing waterways intended to serve as refugia for aquatic species, particularly in the short term for at-risk fish populations (FEMAT 1993; USDA & USDOI 1994). In the coming decades, the NFNR watershed will play a critical role in the continued survival of Puget Sound salmonid populations, especially as other waterways experience elevated temperatures due to climate change. Protecting this magnificent river, and its major tributaries, must be a chief priority of the Mt Baker Ranger District.

In conclusion, we appreciate this opportunity to comment on the NF Nooksack Vegetation Management Project. We believe that the Project poses significant impacts including direct, indirect, and cumulative impacts that warrant an EIS. We applaud MBS for advancing non-commercial prescriptions intended to restore stands previously degraded by industrial logging activities. We hope to see these prescriptions extended to all LSR units within the project area to help expedite the onset of old-growth characteristics in these stands.

We recommend that any closed roads that are reopened for project implementation are repaired and appropriately maintained to avoid further exacerbating peak flows and turbidity, and we strongly recommend avoiding the reopening of decommissioned roads.

We remain opposed to stand regeneration harvest in the matrix, as it clearly compromises many of the objectives and mandates of the USFS. We believe the USFS has the scientific expertise necessary to advance 21st century prescriptions on our public lands. By adopting the principles of "ecological forest management," the agency can continue to produce wood products while simultaneously recovering salmon populations, restoring hydrologic function, and supporting other ecosystem services.

We are interested in being directly involved in the development of the NFN VMP, especially as MBS considers various alternatives this fall and winter. Please feel free to reach out if you would like any additional information or clarification about any of the points above.

Sincerely,

Alexander Harris, Ian Smith, and Holly O'Neil

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