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Comments: To: Gifford Pinchot Forest Supervisor

Re: ALTB, Spirit Lake Road

I wish to express my concern regarding Alternative B regarding the proposed activity in the Spirit Lake Basin of Mount St. Helens. The act that created the Monument recognized that truly long-term research is essential for understanding ecosystems, and for managing both existing sites and mitigating disturbances that occur naturally and are human-induced. In looking at other alternatives, better outcomes have been identified that would not cause the loss of critical on-going research.

ALT B runs directly through research plots that were set up expressly for long-term research on the recovery patterns and mechanisms from the 1980 eruption. Plots were specifically designed with the long term in mind. I am especially concerned about the original Lupine plot, which would be destroyed, and the Willow Spring multi-taxa studies. I also am concerned with the loss of the other on-going research study plots, transects, and studies that are at risk under these proposed activities.

The original Lupine plot was designed around the first plant, an individual of *Lupinus lepidus* Lindl., on the Pumice Plain. This location was sampled for microorganisms in the fall of 1980. By the spring of 1982, the original individual was alive (2 years old), and surrounded by its offspring, in their first year of growth. This patch has undergone yearly changes in vegetation, microbial activity, and ecosystem processes since. A second set of similar observations were initiated at the Willow Spring site- a very different microsite, with very different plant species, but requiring the same sets of ecosystem players. Studies on the role of three crucial processes were initiated at these locations, and are still on-going. These three processes were the genetic responses of individual organisms subject to the stresses of the volcanic disturbance, the separate invasions of symbiotic mutualistic microorganisms and how they alter plant growth and establishment, and the role of animals compared with abiotic agents such as wind and water in the immigration and establishment of microbial symbionts. These studies were and remain unique in all of ecology. Where other research studies depend upon space for time substitutions, a widely used but suspect approach, the ability of studies in the Mount St. Helens were designed to continually measure and monitor a specific site through time, and has already demonstrated that the assumption that space for time is inadequate for providing the critical information (see Allen et al. 2018 and references therein, in Crisafulli and Dale, editors, *Ecological Responses at Mount St. Helens: Revisited 35 years after the 1980 eruption*, Springer). It was demonstrated that the genetic expression of these plant species changed as a function of invading this disturbed site, and then changed back to resembling one found in the surrounding meadows as the site matured and the soils became more suitable to plants. Plants, symbiotic bacteria, and symbiotic fungi all immigrated separately, even though each was essential to the long-term survival of plants and the reformation of this ecosystem. Finally, both animal reinvasion and wind-blown dispersal were independently crucial to different elements of the recovery of this ecosystem. If any of these characteristics were been missing, this plot would not have recovered. Research by many different investigators, using approaches from microbiology, to physiology, to animal movement, to biochemistry, to soil science has all demonstrated the interconnectedness of the processes studied in detail. Further, because multiple locations were observed, but without the detailed information, without disturbance across the Pumice Plain, we can clearly assess the relative importance of each process. Also important, we know that these interrelationships are critical because other locations, missing one or two of these processes, have failed to recover. This failure can be seen not only on Mount St. Helens, but also in places like Mount Lassen in California, on roadside and strip mine restoration, reforestation, and even on Crater Lake, thousands of years later.

Why is this important? We have already applied many of the lessons learned to restoration and reforestation worldwide. The critical interactions of many species, ranging from microorganisms to elk, are all essential to restoring a new, viable ecosystem from a destroyed remnant past. Now, standard restoration practices encourage animal migrations, and when not possible, artificial replacement for inoculating plants and carefully selecting genotypes of plants and microbial symbionts. This is crucial to the recovery of a functioning ecosystem.

Why is it critical to continue these studies? In observing other severe disturbances, including Mount Lassen, volcanoes in South America and Europe, the same both positive recoveries, and long-term desolation, can be seen. Our research technologies have changed dramatically over the past 40 years. In 1980, we plated out a subset of culturable microorganisms to identify, measured biochemical changes in the lab, and needed cores and expensive laboratories to undertake these analyses. Today, we are in the process of completing genome-wide sequencing that tell us exactly who the players are and their genetic abilities, along with new in situ microscope and chemical sensor technologies that exactly describe who, when, and where critical processes are occurring. Development of new technologies is currently underway, and the loss of the critical research sites will compromise both the ecological information and future technological developments.

Impacts on Global Change Assessments. We are in the middle of research on the impacts of and mitigation for climate change. The plots on the Pumice Plain provide a unique window into both. In 1980, when Mount St. Helens blew, global CO₂ was 339ppm. Today CO₂ peaked at 411 in May. The same group of organisms responsible for the recovery of ecosystems on Mount St. Helens were involved in bringing down atmospheric CO₂ between 30 and 40 million years ago. By undertaking these studies through this critical time period, are able to, in part, also study how the rapidly changing globe is affecting forest ecosystems and succession. How, how fast? Under what conditions?- These are critical topics in both addressing the causes and potential ways in which ecosystems can adapt to our changing world.

Research on the Lupine Plots and Willow Springs, among other locations, is undergoing a generational shift among the scientists. Most of us who initially designed these plots and studies, are retiring. We are working closely with a new generation of young scientists, microbiologists, molecular biologists, foresters, and ecosystem scientists who are taking over these studies, bringing new theories and techniques and approaches to the study of the processes and patterns on-going at these sites. They are also seeing new concepts and new applications of the information that is being generated.

Please do not end these on-going research programs, just when we are truly beginning to understand the tremendous impacts of this research.