POPULATION HEALTH INITIATIVE
UNIVERSITY of WASHINGTON

Tier 3 Pilot Grant Letter of Intent: Scaling for Greater Impact
Spring 2026

Project Information

Please provide the following information.

Proposed Project Title	*Nature exposure, the nasal microbiome, and human well-being in the Puget Sound region.*
Approximate Budget Request	$150,000

Applicant Information

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Urbanization is linked to elevated risk for some anxiety and mood disorders (1) and to declining contact with nature (2)—trends that are likely related, given evidence that nature exposure benefits mental health (2-6). The biological mechanisms underlying these benefits, however, remain unclear. Recent work suggests that the olfactory system may play a key role, including via 1) inhalation of biogenic volatile organic compounds (BVOCs); and 2) the microbial nose-brain axis (7)—a pathway by which local microbiota, their metabolites, and host inflammatory mediators respond to inhaled exposures and influence the brain through nasal mucosal vasculature and olfactory structures (8-10).

Our recent pilot studies found that BVOC exposures in forest air may have produced limited trend-level anti-inflammatory effects after one hour (11); and that an 8-week forest (vs. urban) immersion was associated with significant improvements in affect and rumination alongside key changes in nasal microbiome composition (12). These included increased abundance of well-being-associated bacteria (e.g., *Akkermansia*, *Bifidobacterium*) and greater bacterial richness, changes that were significantly associated with well-being improvements. This project scales up this preliminary work.

We will recruit 60 healthy adults across the Puget Sound region for a comparison of nasal microbiome composition and function, olfactory sensitivity, and mental well-being across a built-to-natural residential environmental gradient. Participants will complete 7 days of daily REDCap surveys reporting nature contact prior to a single in-person data-collection visit. Nasal swabs will be collected for metagenomic sequencing and targeted metabolomic profiling using liquid chromatography-mass spectrometry. Olfactory sensitivity will be assessed using a validated odor threshold test, and mental well-being via validated self-report surveys. We aim to include dried blood spot assessments of inflammatory biomarkers as well. Environmental exposures within 500m of participants' residences will be characterized in detail using multiple approaches: satellite imagery to capture surrounding greenness, state-of-the-art mobile GC-MS instrumentation to measure BVOC mixtures, aerobiome sampling using a Coriolis Compact air sampler, and air pollution monitoring using PurpleAir sensors. This novel, integrated design represents a new area of collaboration for the UW PIs who have not yet had the opportunity to work together.

This project expands on our pilot studies in three key ways. First, we move from a binary natural vs. urban comparison to a continuous environmental gradient with multiple exposure measures, incorporating diverse residential environments within the Puget Sound region. Second, we expand BVOC assessments to include real-time measures that allow for high temporal and spatial resolution. Third, we move from amplicon to metagenomic sequencing, enabling compositional and functional microbiome characterization, and add metabolomics to directly quantify nasal microbial functional output—specifically neuroactive and immunomodulatory compounds relevant to mental well-being.

This study aligns with two pillars of population health that we believe are fundamentally intertwined: human health and environmental resilience. By examining how environmental variation across a built-to-natural gradient is reflected in airborne chemical, microbial, and pollutant exposures—and how these exposures in turn relate to the human nasal microbiome, olfactory function, and mental well-being—this project increases knowledge about critical and specific links between the environment and human health.

References

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