Aeolian Transport of Microplastics in Alpine Environments of North American West Coast Ranges

Aleksandra Karapetrova and Professor Jay Gan

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About Myself

- Molecular biology background
  - Enzyme structure/function
  - Cytotoxicity of nanoscale metals
  - Argonne National Laboratory and Pomona College
- Ecology
  - Population structure and age in Mono Lake
  - Benthic invertebrate diversity acid mine drainage and saline lakes
  - UC Santa Barbara and SNARL
- Environmental Toxicology
  - Neonicotinoids and mosquito resistance to pesticides
  - Microfibers in alpine environments
  - UC Riverside, Distinguished Professor Jay Gan and Professor Andrew Gray

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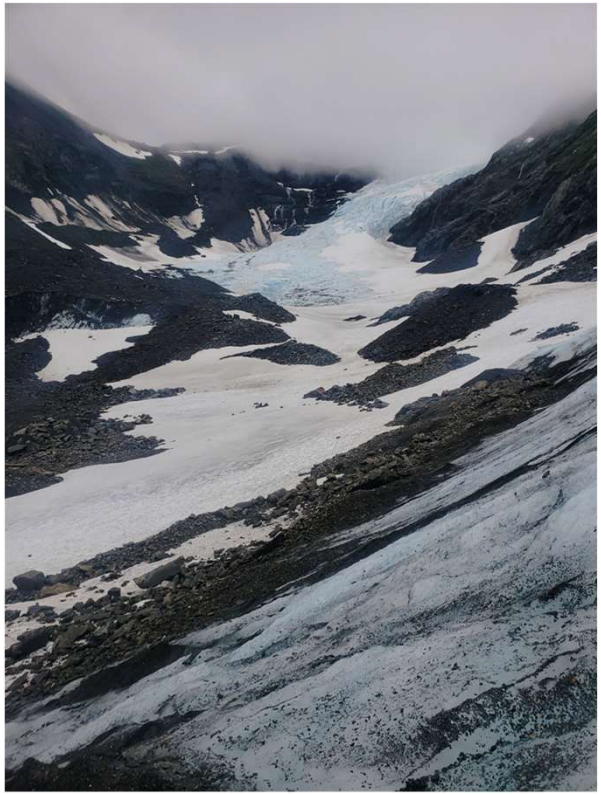
Outline of Presentation

- Terrestrial microplastics
- Microfibers in Snow
- Aeolian Transport of Pesticides
- Research Questions
- Choosing sample sites
- Microplastic Flux and Transport
- Experimental Design for Analysis

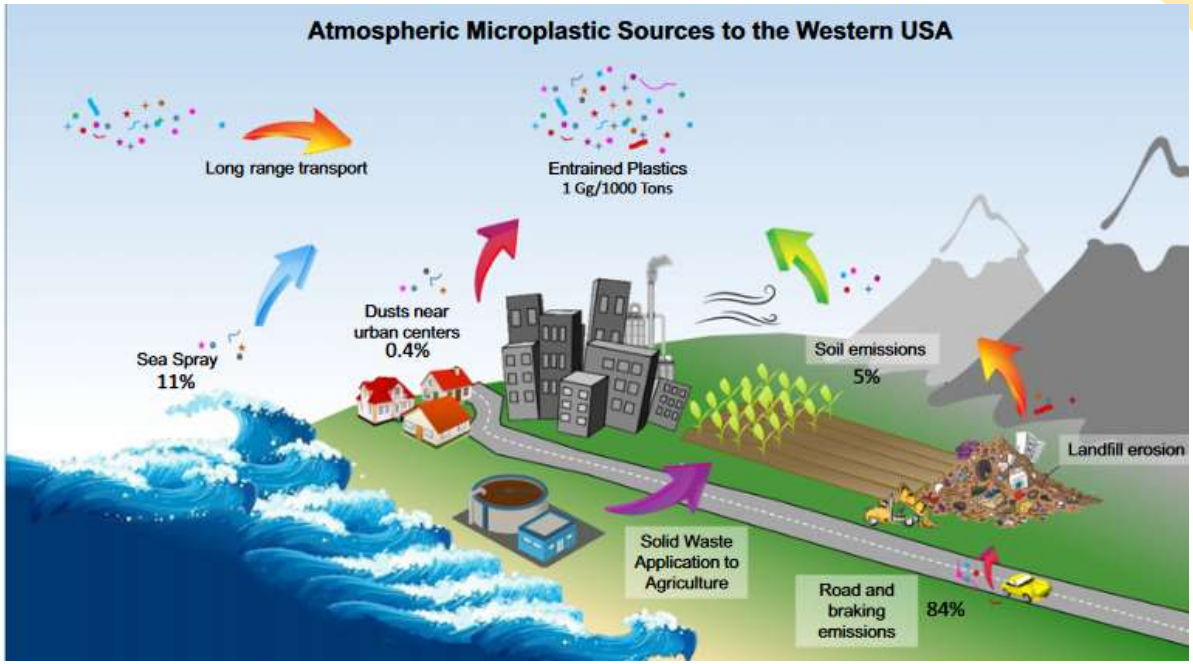


Next year I hope to be presenting results at this workshop ☺

Terrestrial Microplastics

- 4-23 times more MPs in terrestrial environments than in the ocean
- Abundance in concentrations ranges from 0.002-7%

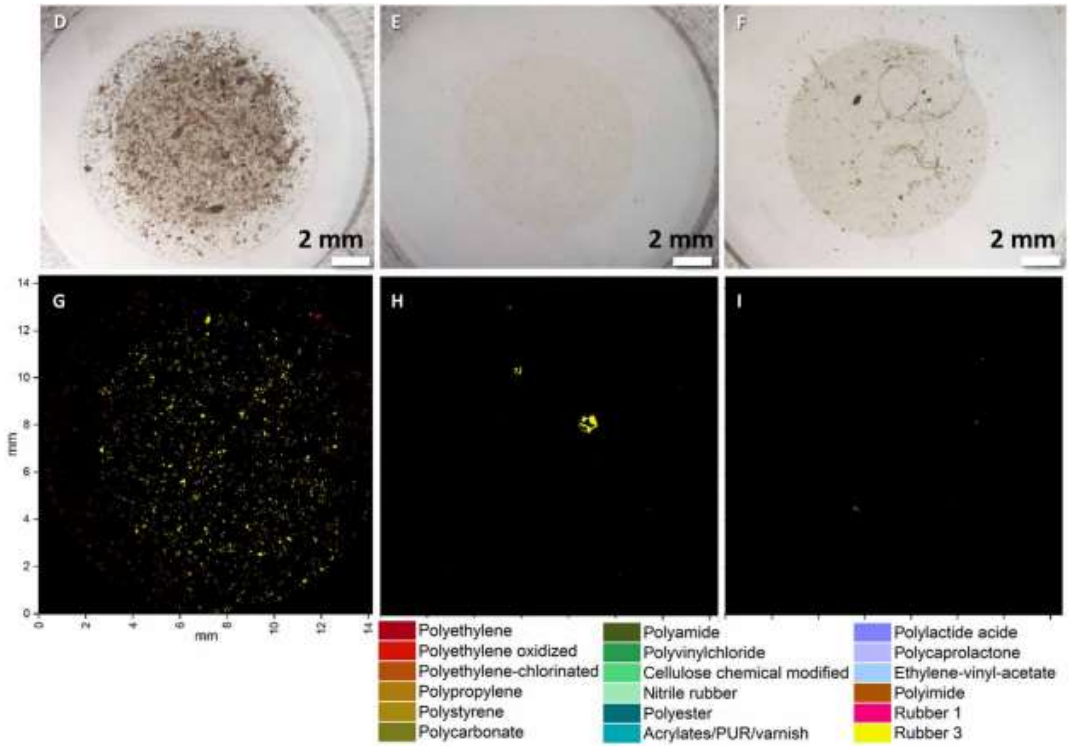
- Many properties, it is not a single substance!
- Polystyrene and polyethylenesulfone are the most common
- 80% carbon but cannot “count” in the carbon cycle



Lozano and Rillig. Environ. Sci. Technol. 2020, 54, 6166−6173
Brahney et al. PNAS 2021 Vol. 118 No. 16

Microplastics in Snow

- Snow presents a feasible way to ma analyze microplastics in terrestrial environments
- Nanoplastics
- Varnish was the most frequent and abundant polymer types
- Chronic inhalation
- Direction of the cycle



Bergmann, Melanie, Sophia Mützel, Sebastian Primpke, Mine B. Tekman, Jürg Trachsel, and Gunnar Gerdts. "White and Wonderful? Microplastics Prevail in Snow from the Alps to the Arctic." *Science Advances* 5, no. 8 (August 1, 2019): eaax1157. https://doi.org/10.1126/sciadv.aax1157.

Aeolian Transport of 4-Nonylphenol

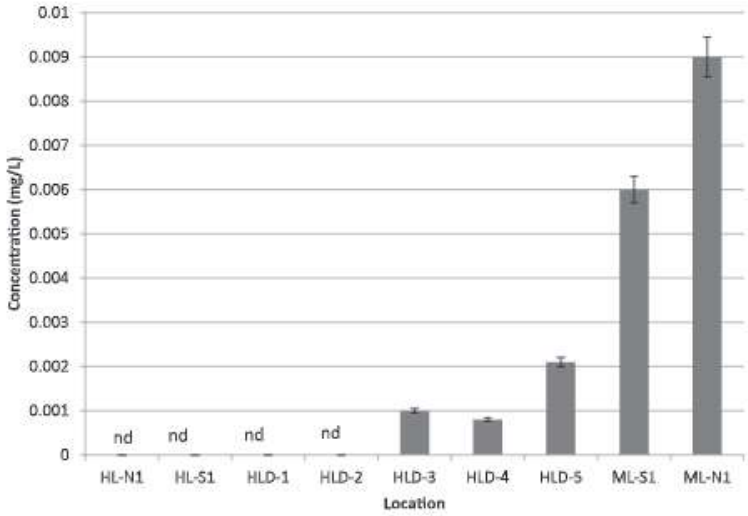
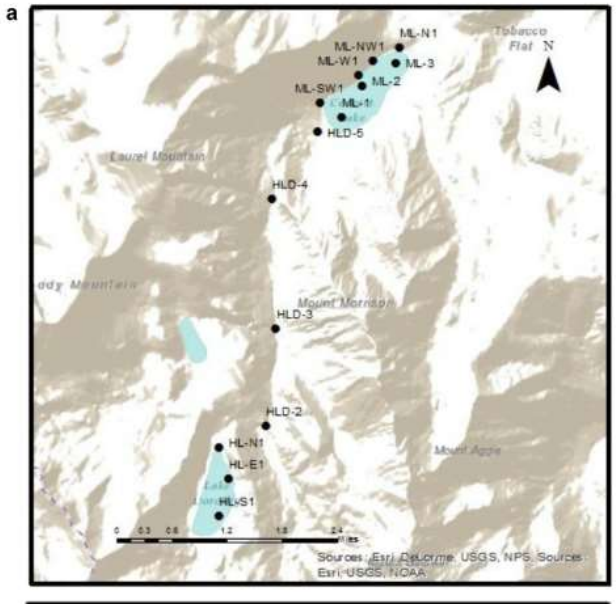


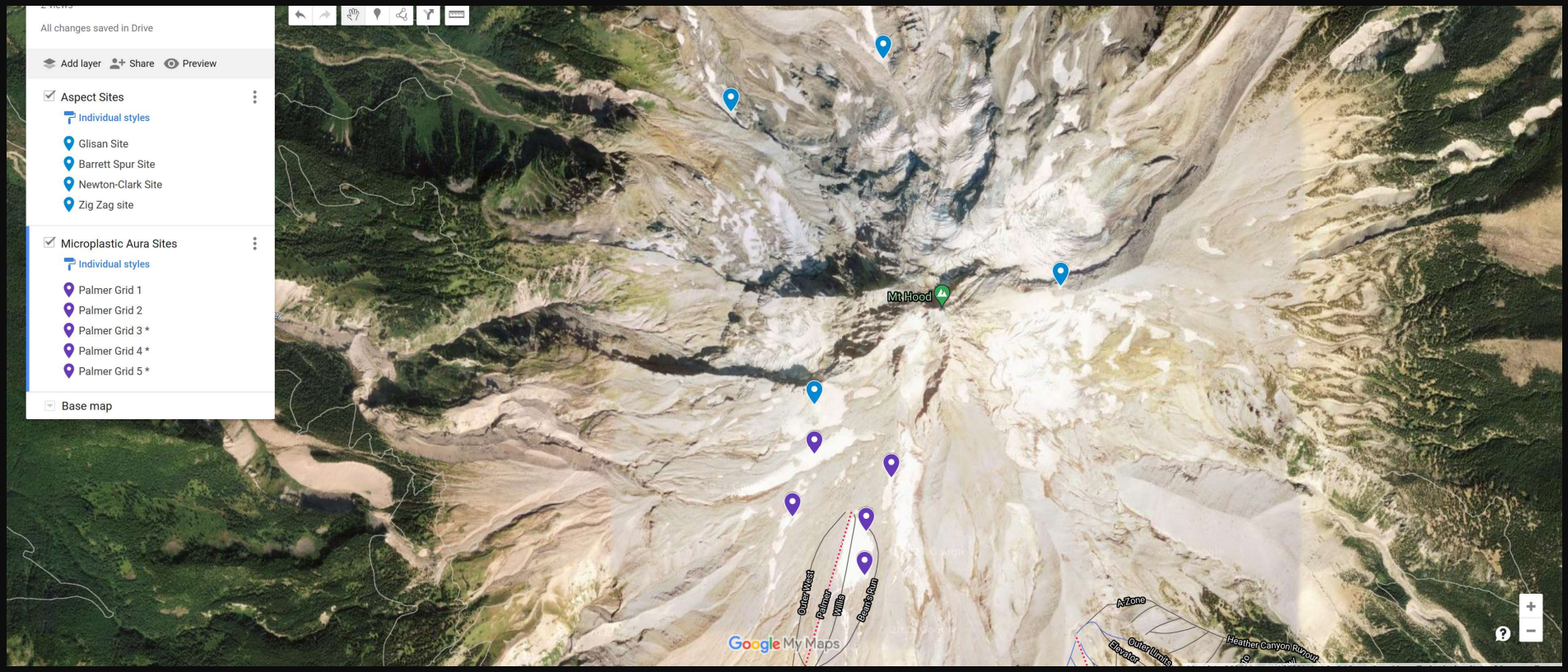
Fig. 7. 4-NP concentrations in surface water yearly averages sampled in order of descending elevation along Convict Creek drainage. Error bars represent CI95%.

R. Lyons et al. / Environmental Pollution 195 (2014) 123–132



Research Questions (4-5 years)

- What kind of microplastics are depositing in alpine environments via aeolian transport?
- Does aging of microplastics increase toxicity?
- How does mixing of microplastic exposure affect toxicity?
- What is the significance of POP adsorption to microplastics at the ecosystem scale in comparison POP adsorption to organic materials?


All changes saved in Drive
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Aspect Sites
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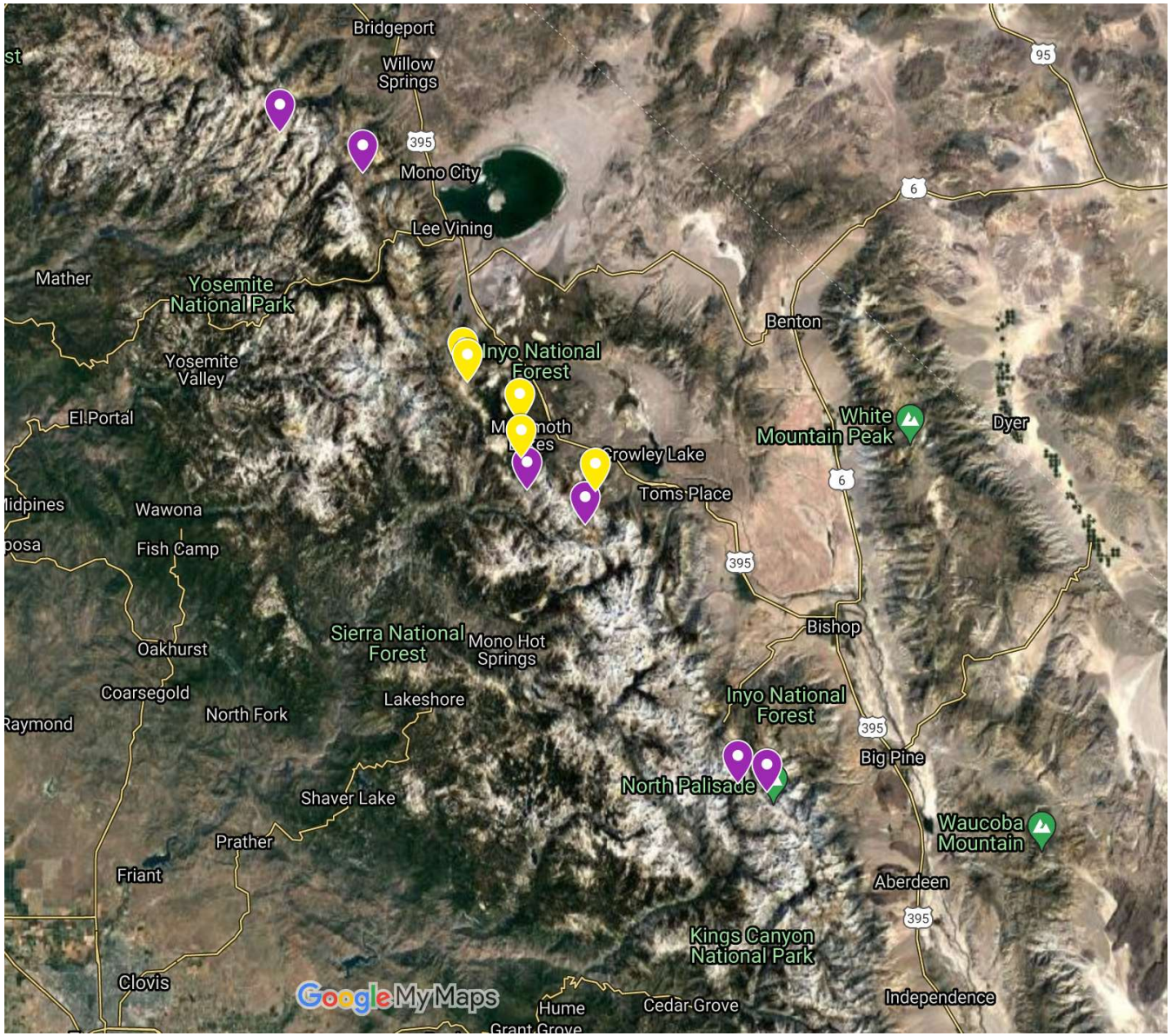
Zig Zag site
Microplastic Aura Sites
Individual styles
Palmer Grid 1
Palmer Grid 2
Palmer Grid 3 *
Palmer Grid 4 *
Palmer Grid 5 *
Base map
Mt Hood
Outer West
Palmer
Wilis
Beanie Rim
A-Zone
Outer Limits
Elevator
Heather Canyon Ryzour
Google My Maps


Bridgeport
Willow Springs
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Mono City
Lee Vining
Mather
Yosemite National Park
Yosemite Valley
El Portal
Inyo National Forest
Benton
White Mountain Peak
Dyer
Crowley Lake
Toms Place
6
95
Wawona
Fish Camp
Oakhurst
Sierra National Forest
Mono Hot Springs
Bishop
Coarsegold
North Fork
Lakeshore
Raymond
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Big Pine
North Palisade
Shaver Lake
Waucoba Mountain
Prather
Friant
Aberdeen
Kings Canyon National Park
Clovis
Google My Maps
Hume
Cedar Grove
Independence
Grant Grove

Airborne Microplastic Deposition and Flux in Terrestrial Environments

- Microplastic deposition rates and characterization
- Wet and dry deposition rate
- Develop standardized approaches for sampling
- Point source studies
- Snow provides convenience and opportunity to do increased amount of sampling
- SNOTEL

Experimental Design

Sampling

- Digest sample
- Filter melt water through aluminum oxide or cellulose filter
- Use all plastic-free equipment and use blanks

Imaging/Characterization

- FTIR/Raman Spectroscopy
- Confocal or optical microscope after dying sample with Red Nile dye
- CNM, x-ray diffraction at the synchrotron

Additional experimental studies: UV aging, plant uptake, MP flux in sludge, adsorption, acid environment aging

Thank you!

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the AMERICAN ALPINE club