



# Sacred Breath of the Columbia Gorge Project: Influence of Atmospheric Pollutants on Rock Image Stability

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## Project overview

- The University of Washington and the Yakama Nation Environmental Management Program
- Research in the Columbia Gorge National Scenic area on pollutant sources, transport and its effects
- Addressing the preservation of Native American rock images including petroglyphs and pictographs

## Rock images

- Rock images are the written record in the indigenous homeland of the American Indian Tribes that are now known as the *Columbia River Treaty Tribes*.
- Rock images were painted or etched on columnar basalt bedrock at numerous locations.



- Painted on basalt



- Etched into patina on basalt

## How are Rock images degraded?

- Direct affects
  - Acid rain
  - Acid fog
  - Soot
- Indirect effects
  - Lichen growth fertilized by excess nitrogen leading to accelerated weathering
  - Fenn and Geiser study show elevated nitrogen and more nitrogen-loving lichen growth in the CRG

## Goals

- Review ways that atmospheric pollutants may accelerate surficial rock weathering in the CRG.
  - association of known air quality parameters with locations of Rock Images
  - first level assessment of the potential increase in rock weathering rates due to direct acidification.

## Goals

- Identify the major nitrogen sources to determine the potential sources.
  - Isotopic studies allow the possibility that we will be able to identify the relative contributions from known nitrogen sources
  - Sources: traffic, fossil fuel burning, farming practices
  - $^{15}\text{N}$  in ammonia and nitrate and  $^{18}\text{O}$  have been shown to be indicators of nitrogen sources

## Goals

- Knowledge of potential damage to the Rock Images and indicators of atmospheric pollution will be helpful in establishing practices for Rock Image preservation and air quality improvements.