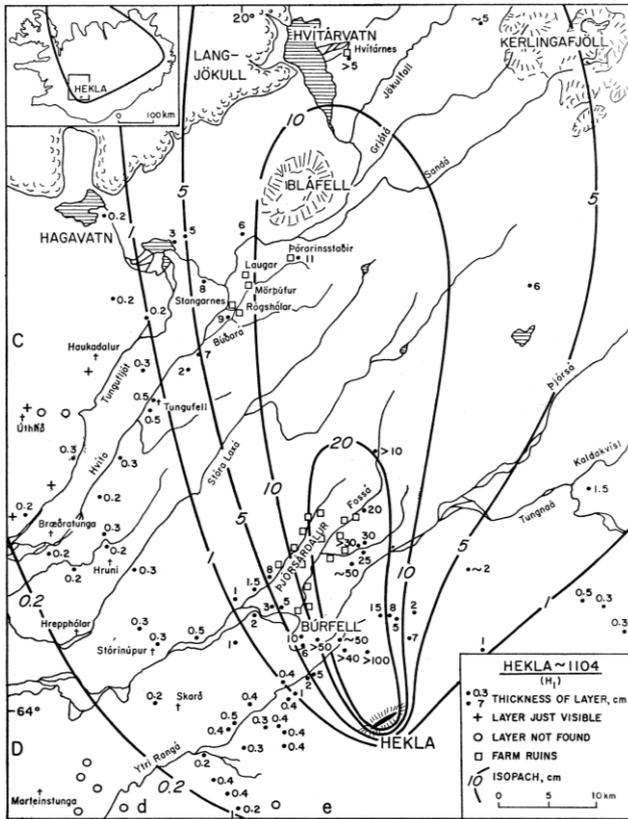


# The preservation of the 1980 Mount St Helens tephra layer

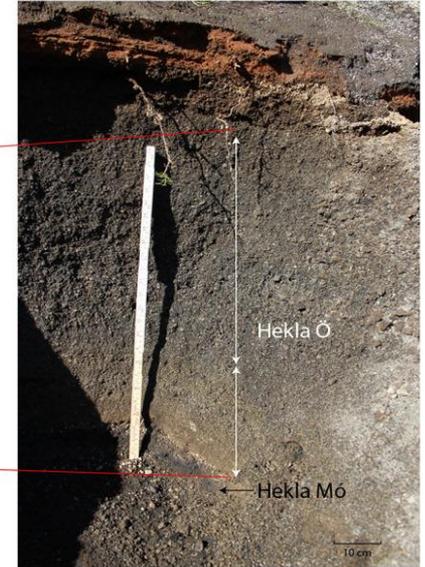
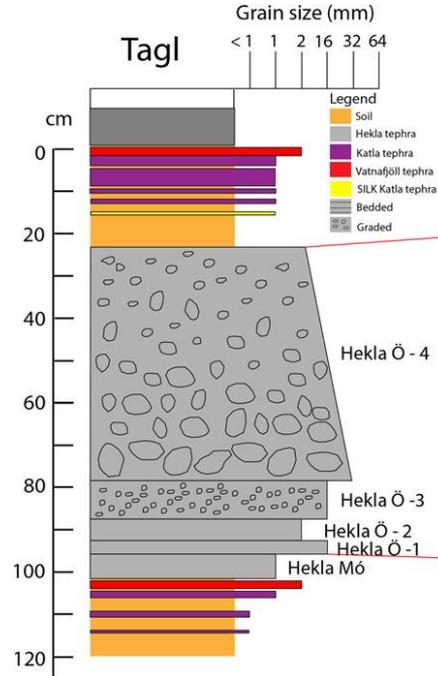


**Nick Cutler** (Newcastle University); Richard Streeter (University of St Andrews);  
Andy Dugmore, Anthony Newton & Polly Thompson (University of Edinburgh)

# Context



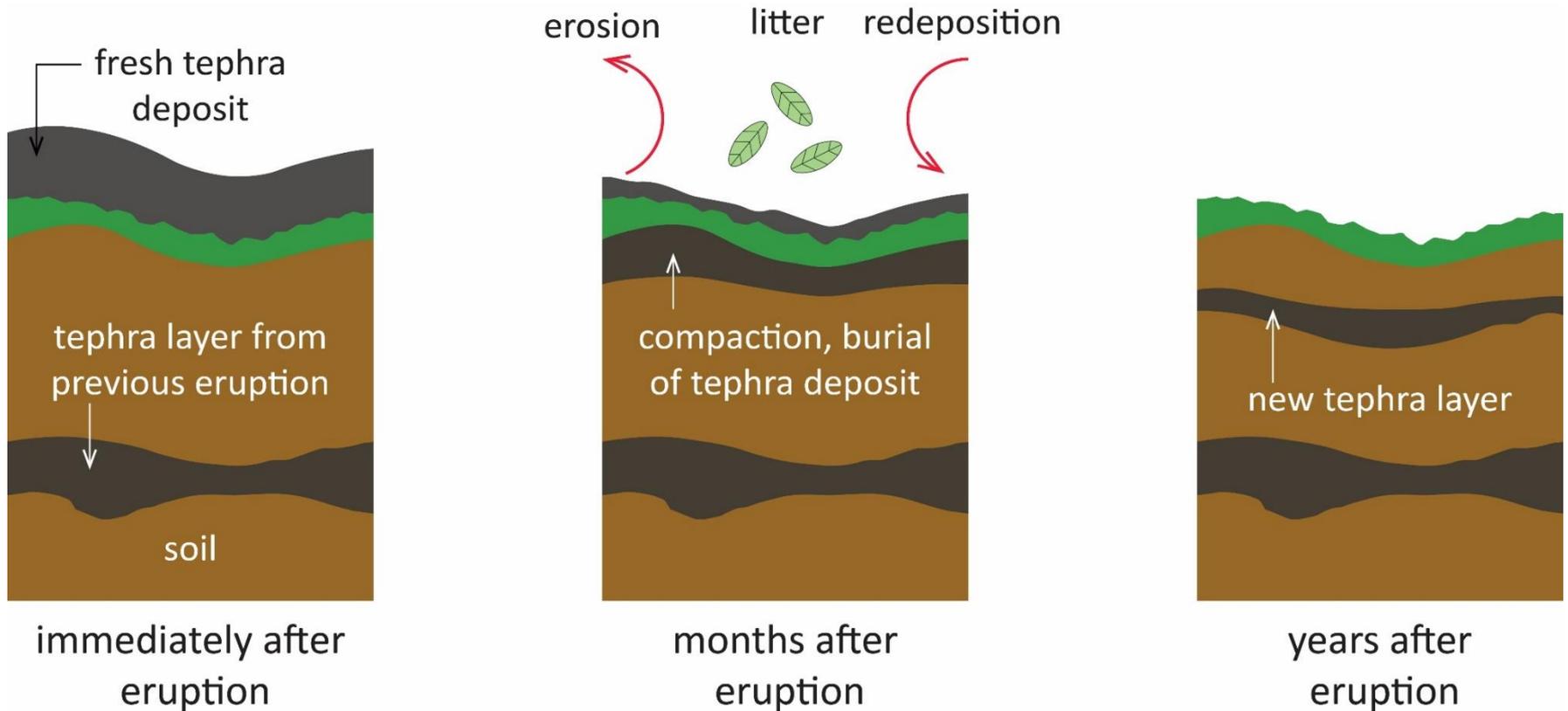
Hekla 1104 CE  
Thorarinsson (1967)



Tephra stratigraphy  
Jónsson et al. (2020)

## Tephra and volcanological inference

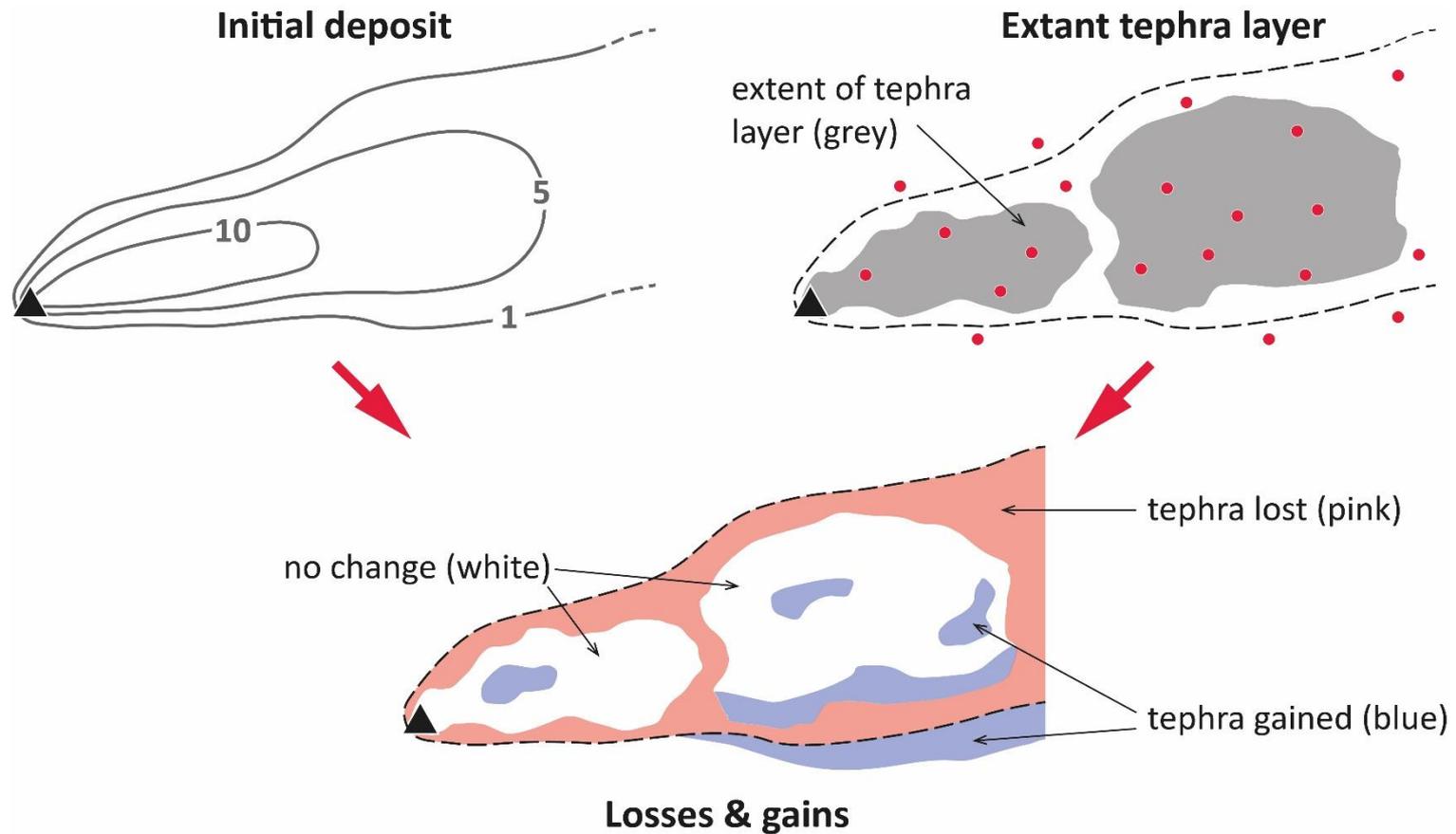
# Context



## Degree of preservation matters

- To what extent do terrestrial tephra layers resemble the deposit from which they are formed?

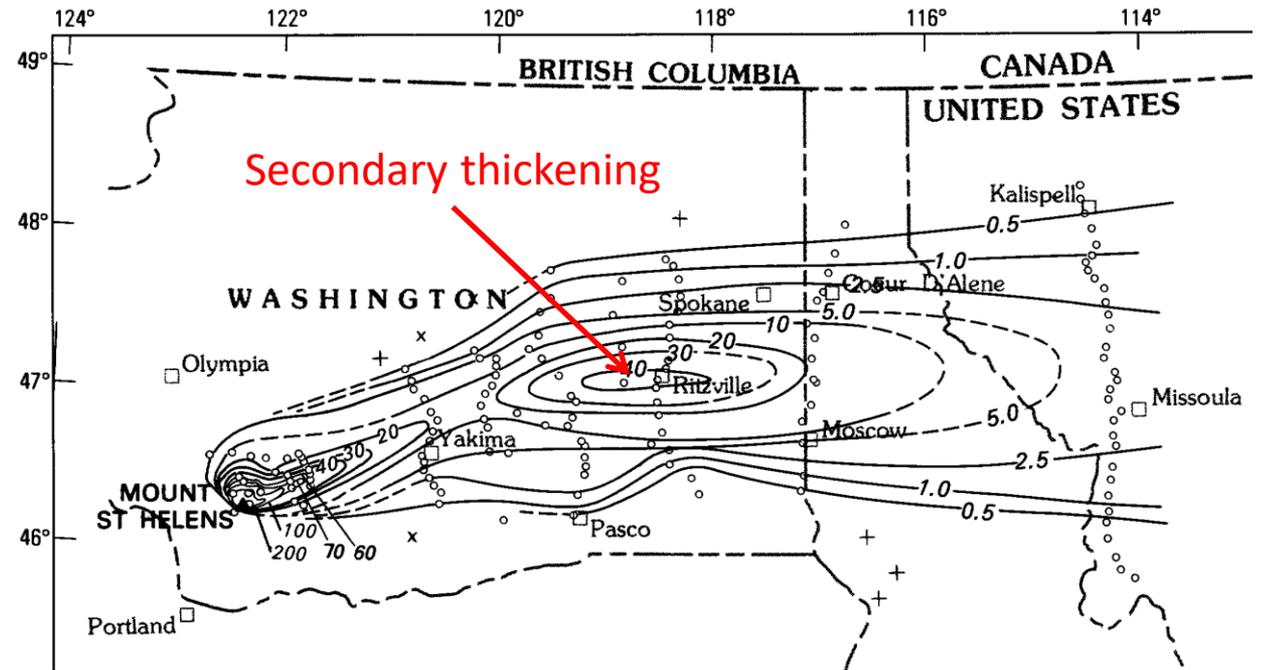
# Methods



## Research strategy

- Re-survey of well known, recent tephra layer

# Methods

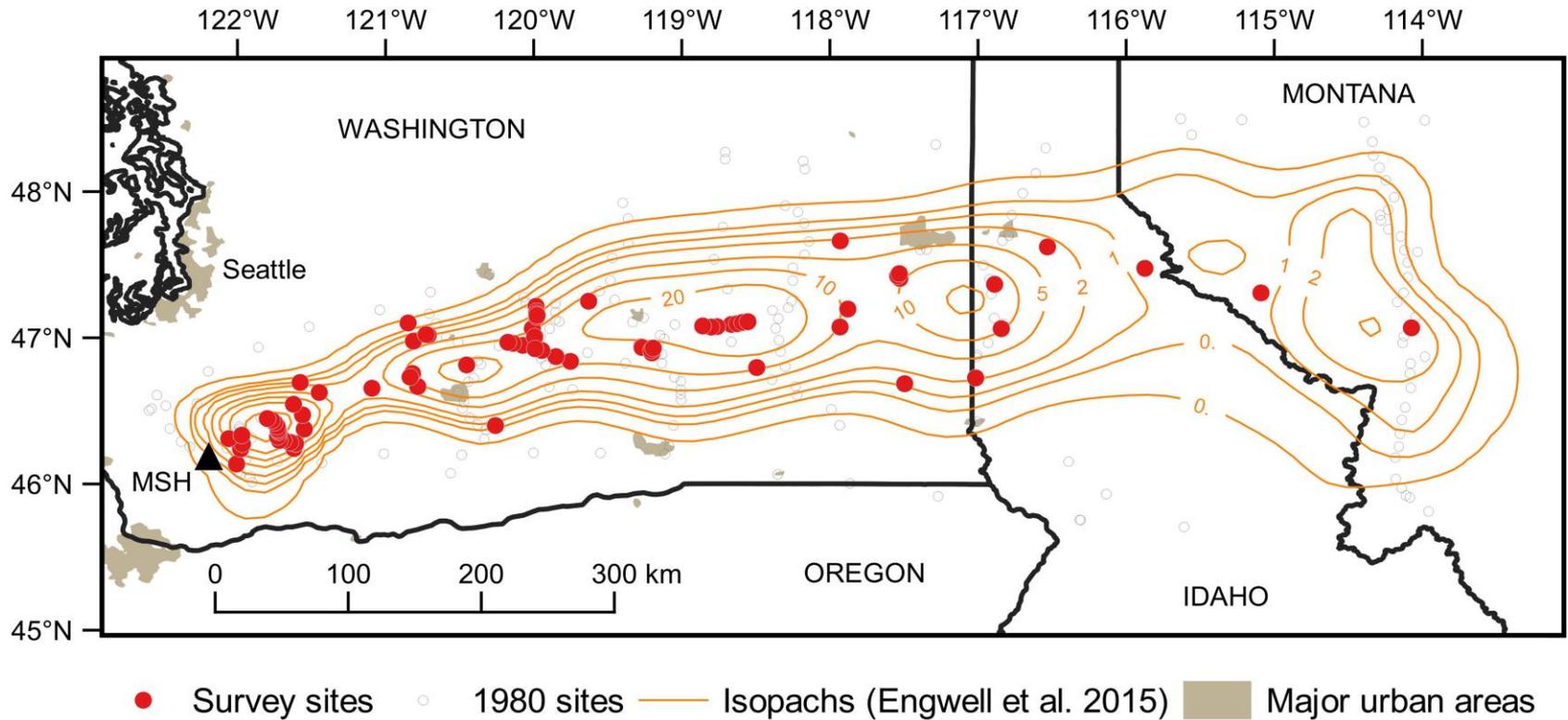


*Sarna-Wojcicki et al. (1981)*

## Research location: Mount St Helens

- Study focussed on tephra from 1980 eruption

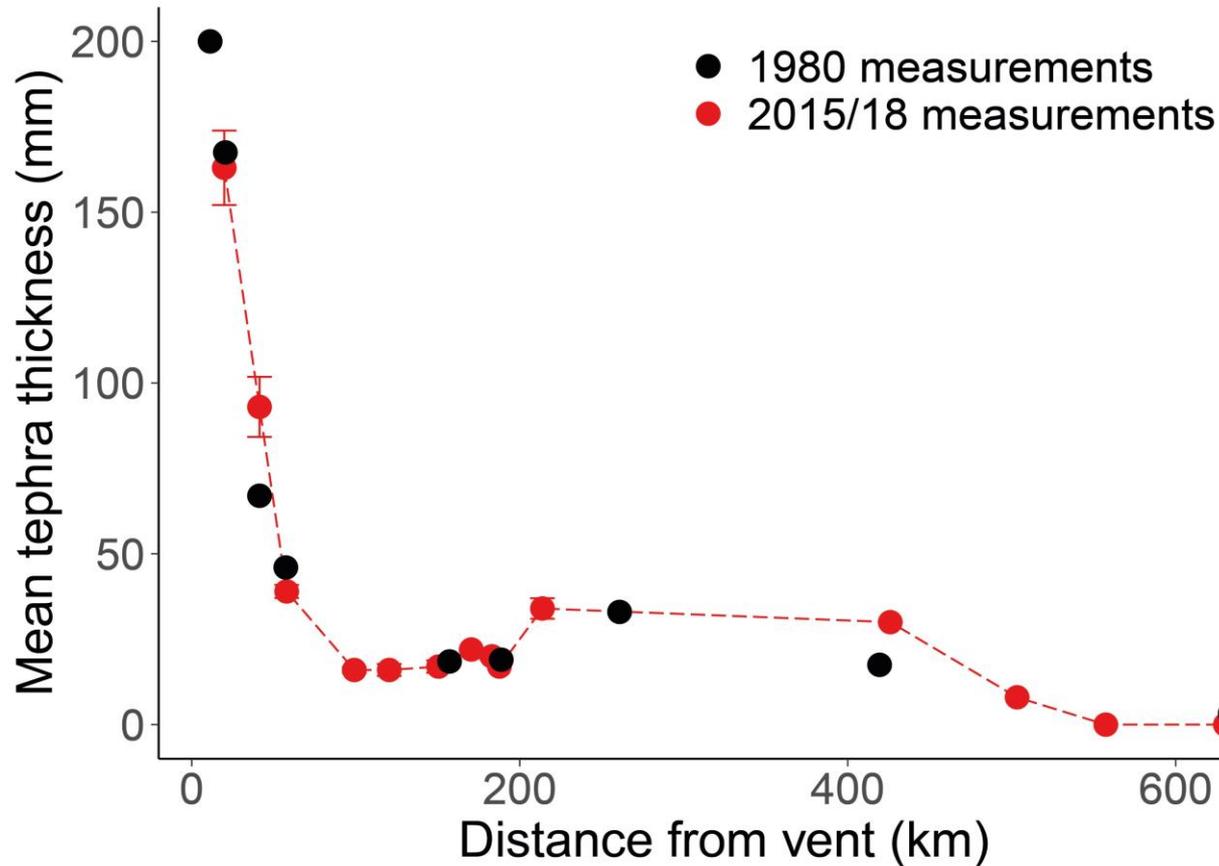
# Methods



## Fieldwork

- 86 Sampling locations, 13 to >600 km from volcano

# Findings

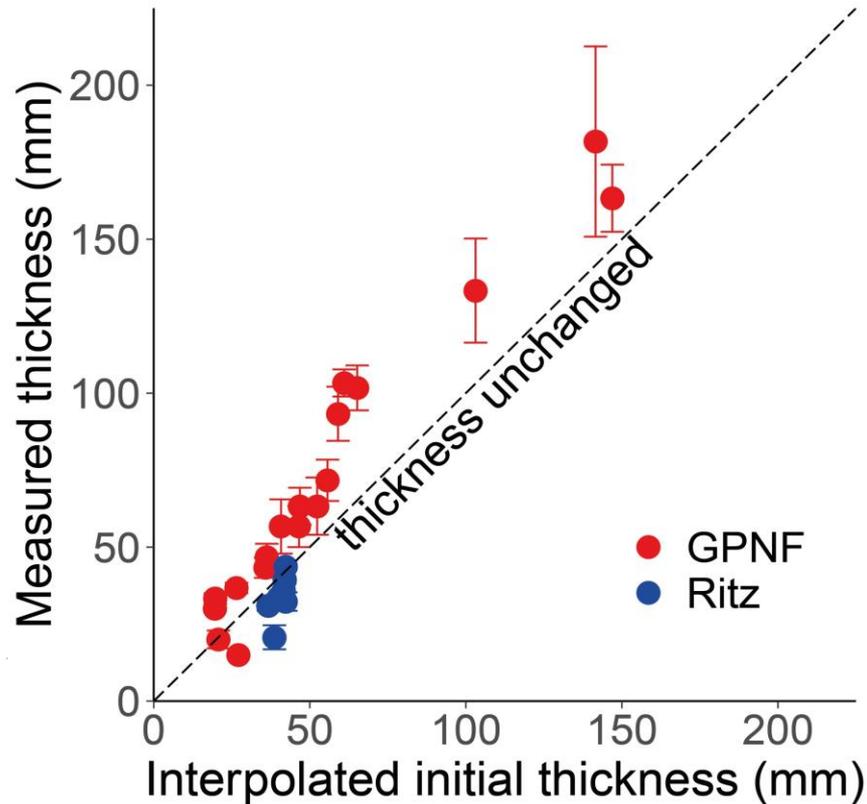


*Tephra thickness along  
plume axis  
Cutler et al. (2020)  
J. Volcanol. Geotherm. Res.*

## Tephra thickness

- Tephra layer thickness closely resembles initial deposit

# Findings

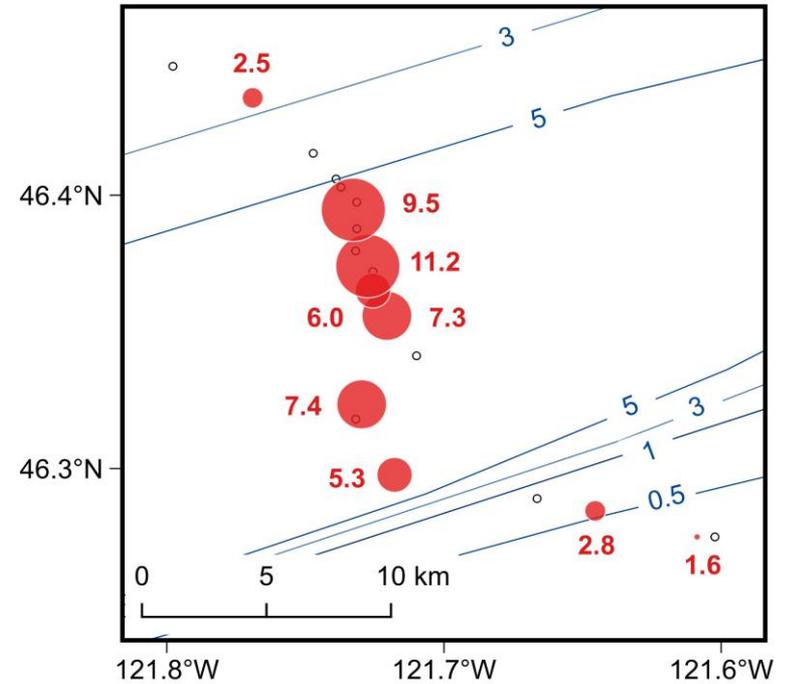
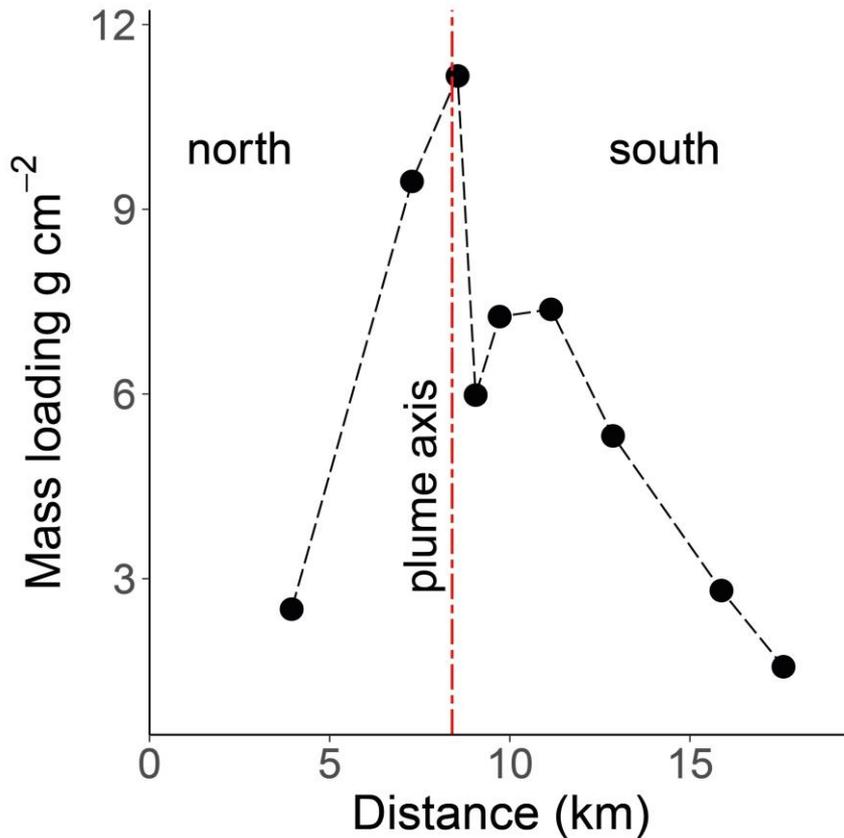


Comparison of a) interpolated deposit & b) tephra layer thickness  
*Cutler et al. (2018) Bull. Volcanol.*

## Tephra thickness

- Tephra layer thickness closely resembles initial deposit

# Findings



MSH1980 mass loading ( $\text{g cm}^{-2}$ )  
1980 in blue, 2015 in red  
*Cutler et al. (2018) Bull. Volcanol.*

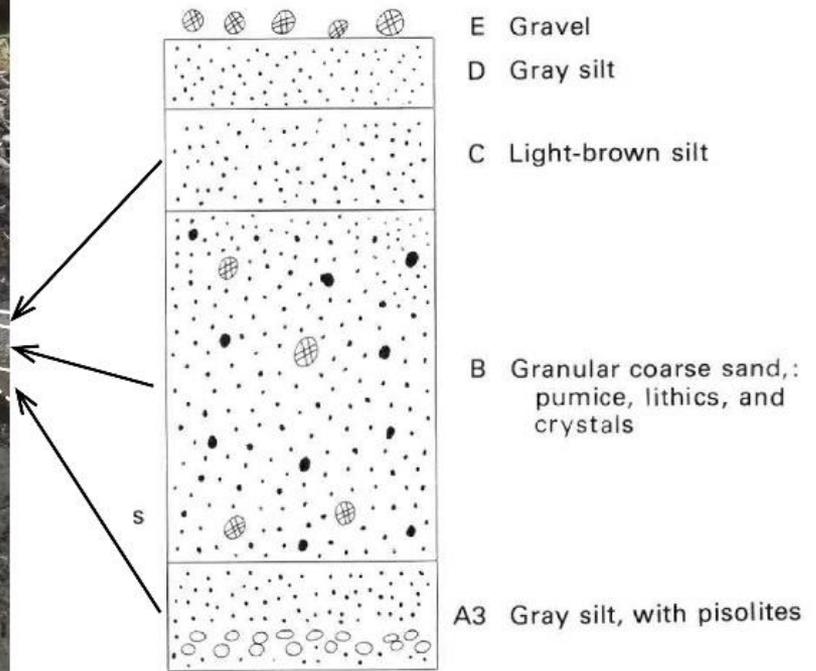
## Tephra mass loading

- Follows thickness, i.e., close to 1980 values

# Findings



A typical section from 2018

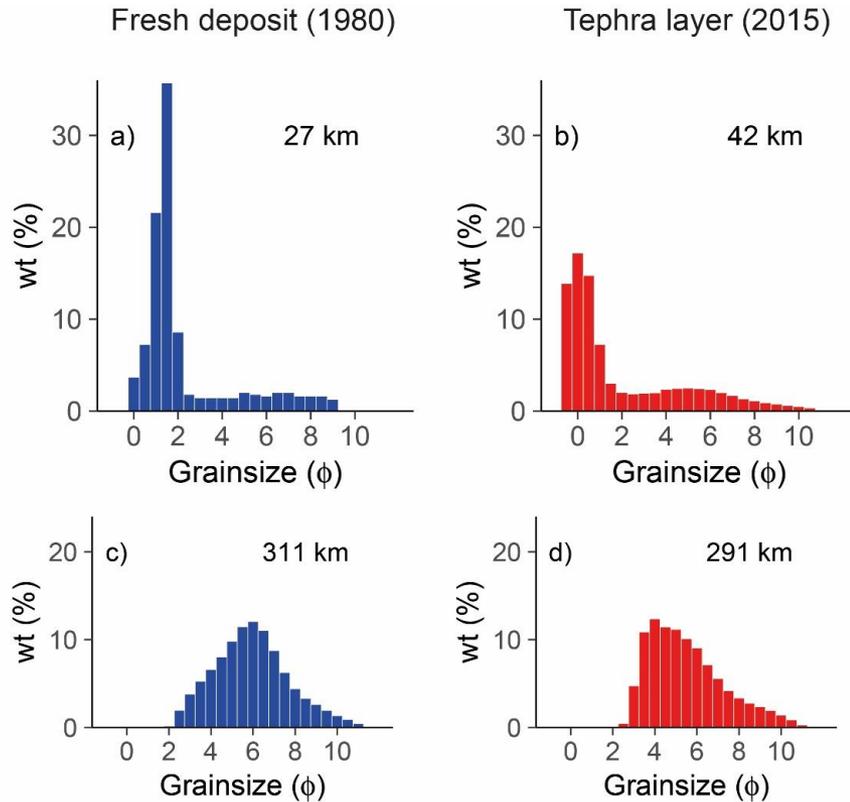


*Waite & Dzurisin (1981)*

## Stratigraphy

- Units observed by USGS in 1980 preserved

# Findings



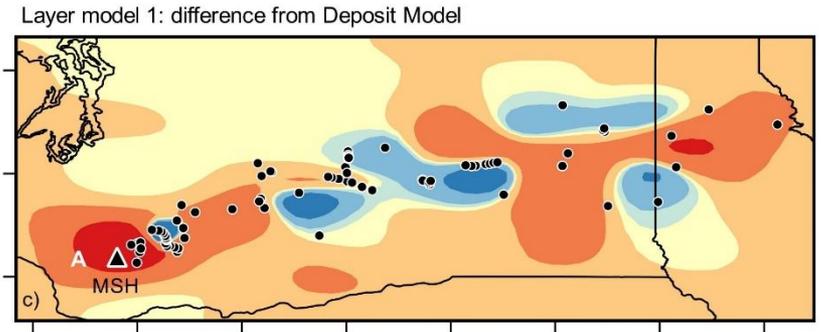
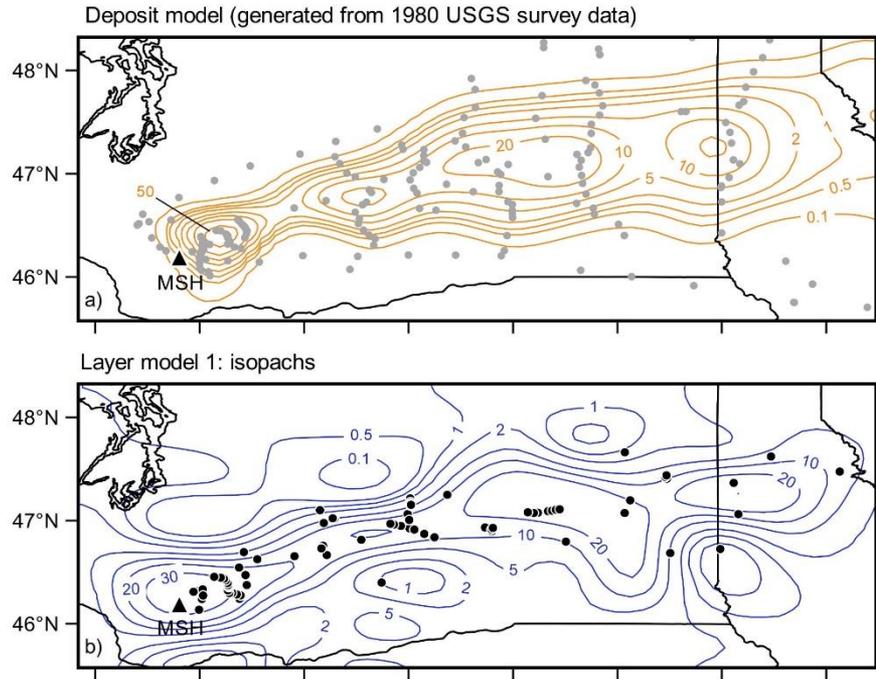
MSH1980 in Ritzville, with biocrust

MSH1980 grain size distributions  
*Cutler et al. (2021) Bull. Volcanol.*

## Grain size

- Distinctive patterns in grain size distributions preserved

# Findings

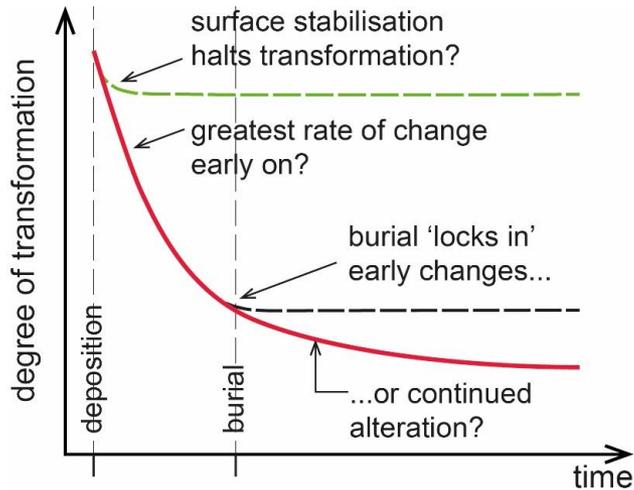


Modelled tephra layer thickness  
Cutler et al. (2020) *J. Volcanol. Geotherm. Res.*

## Reconstruction of fallout

- Our model overestimated fallout volume

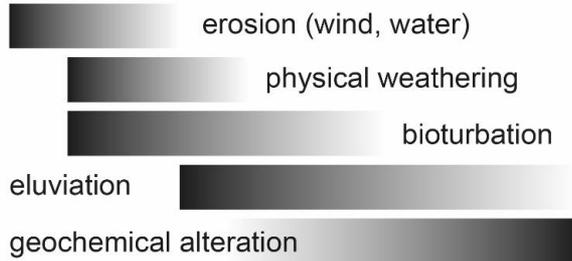
# Next steps



$$s = f(\text{cl}, \text{o}, \text{r}, \text{p}, \text{t})$$

Hans Jenny's soil forming factors (1941)

## Processes



Conceptual model

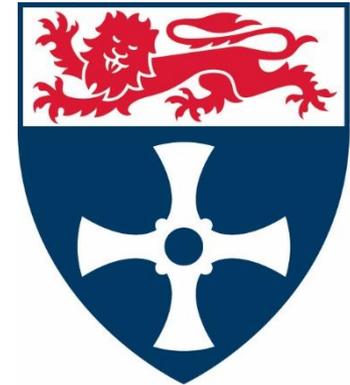


Somewhere in a warehouse...

## The value of experimental applications

- We need long-term experiments

# Thank you for listening!



## Thanks to:

- Britta Jensen, Matt Bolton (Alberta)
- Will Hiles (St Andrews)
- Sam Engwell (BGS)
- Richard Waitt (USGS)

