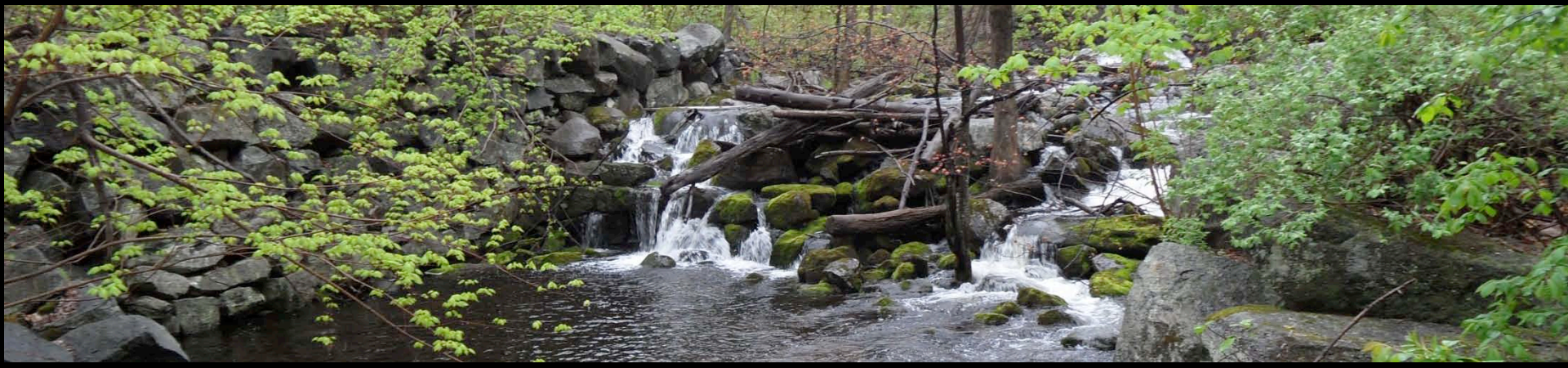
Using our Over-Sampled Environments to Design Efficient Monitoring Programs



Mark B. Green
EMEP Conference
November 6, 2013

Plymouth State University

FOREST SERVICE
USDA
DEPARTMENT OF AGRICULTURE

Acknowledge

Ruth Yanai – SUNY ESF
and
John Campbell – USFS

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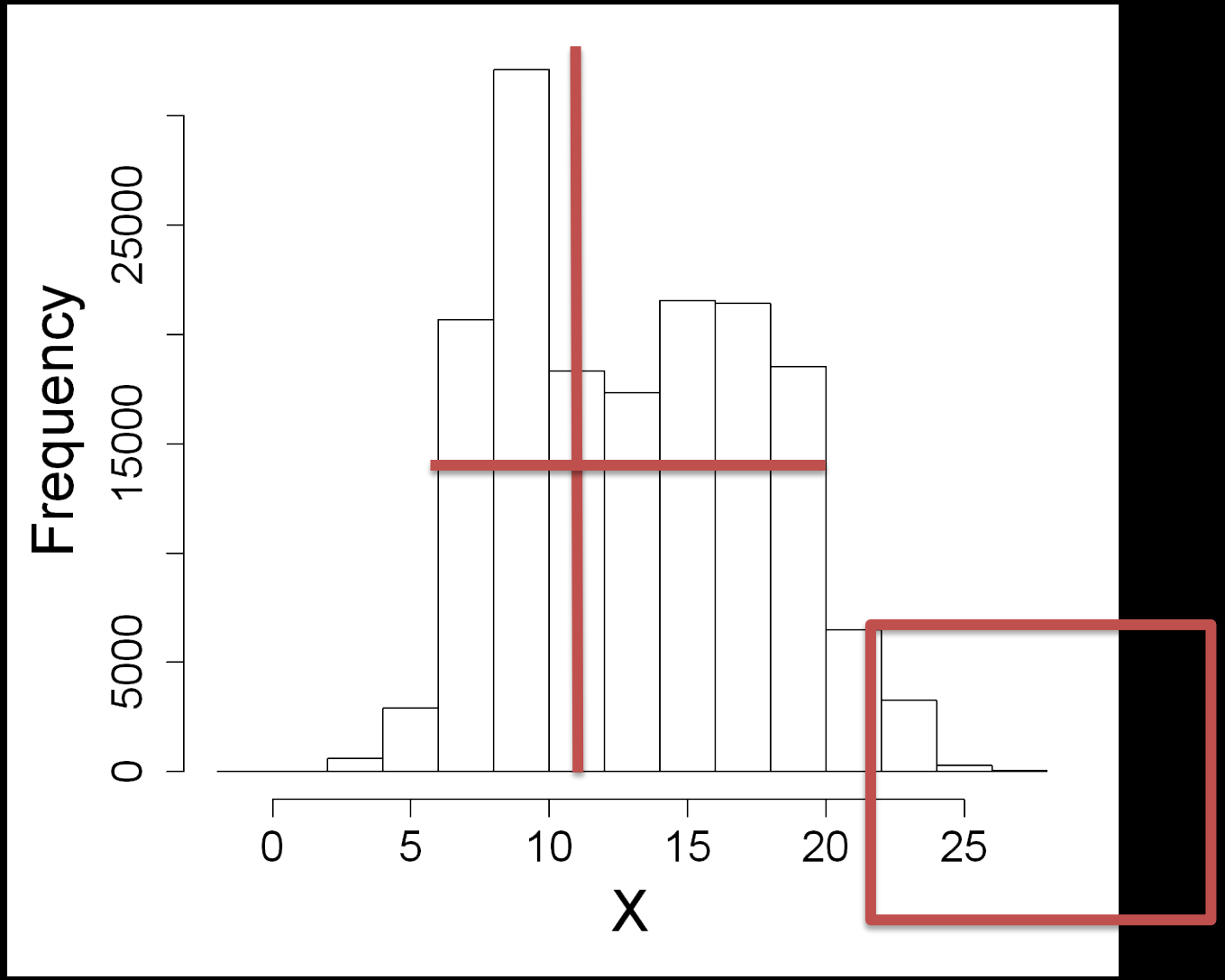
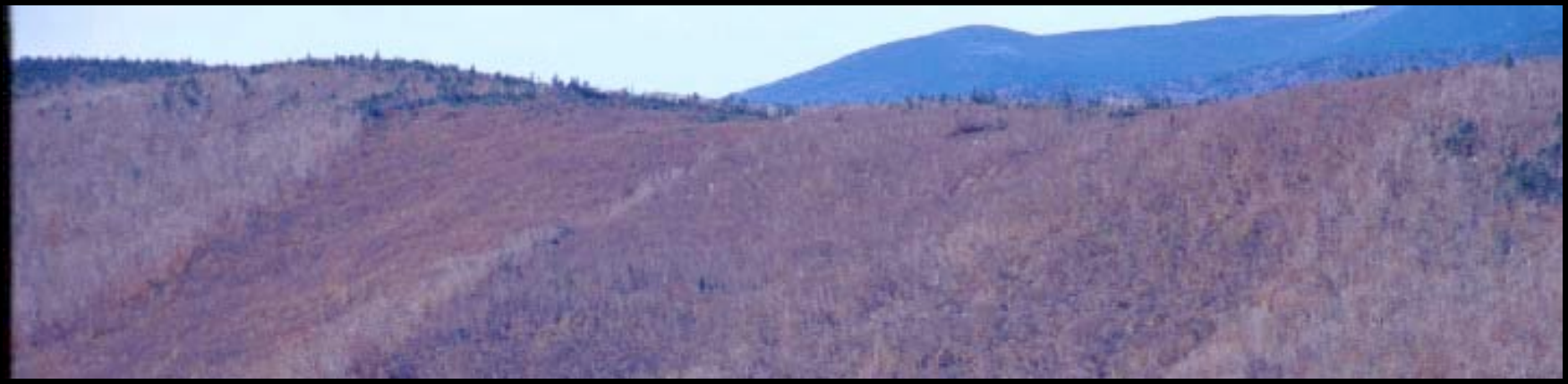
Characterizing Environmental Variability



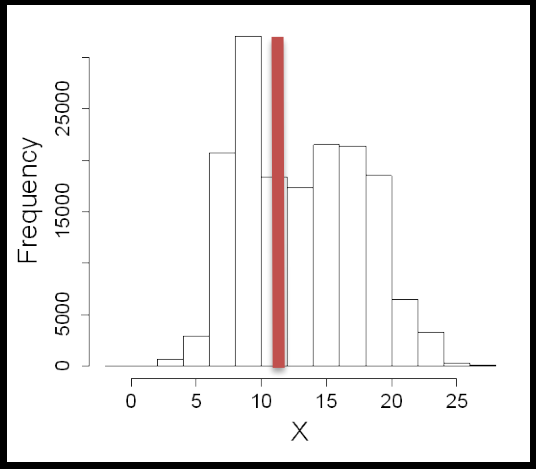
Over-Sampled Environments

- Often research sites…

In order to conduct research, we need many observations. In the monitoring world, this is too many observations, which is useful.

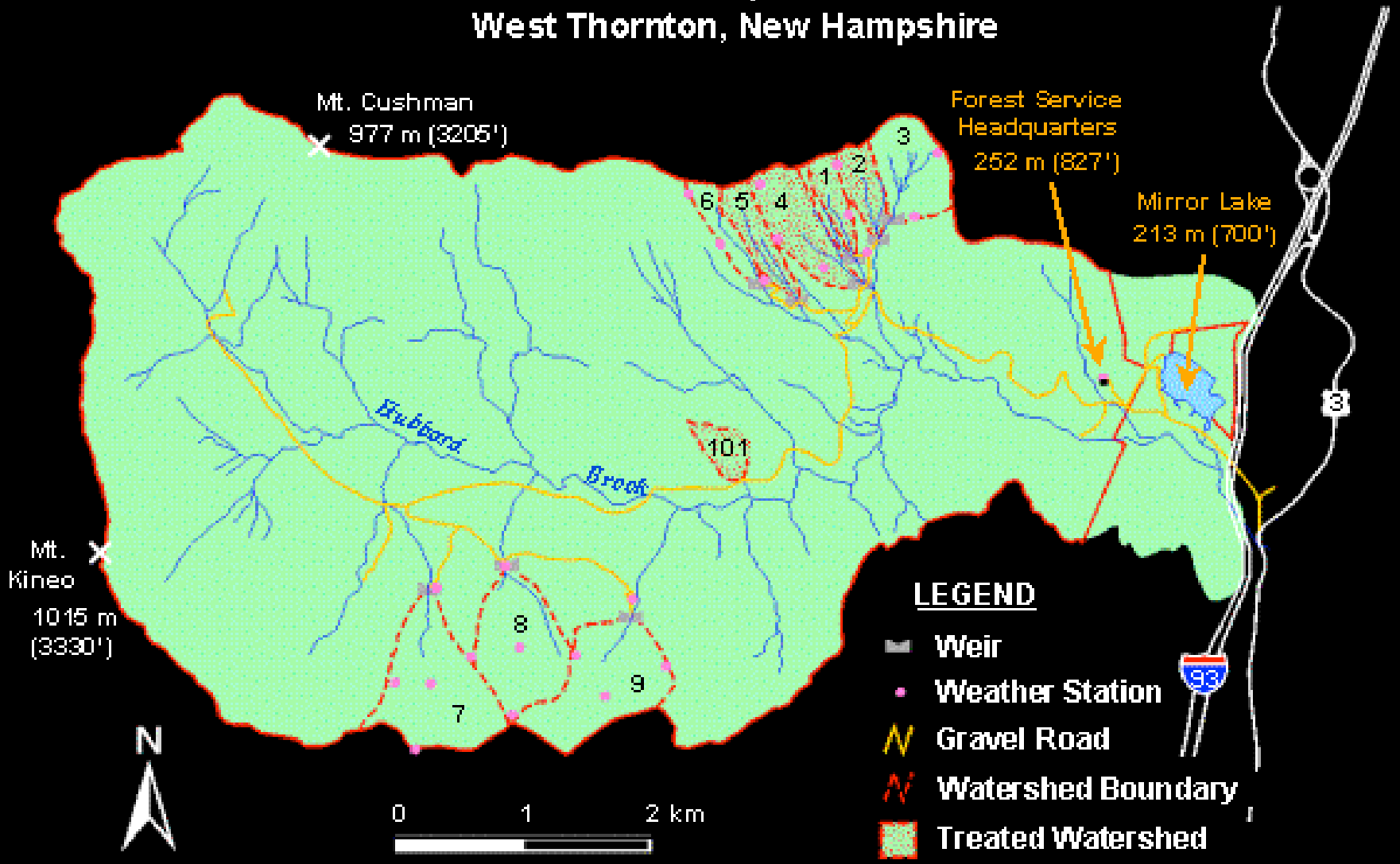


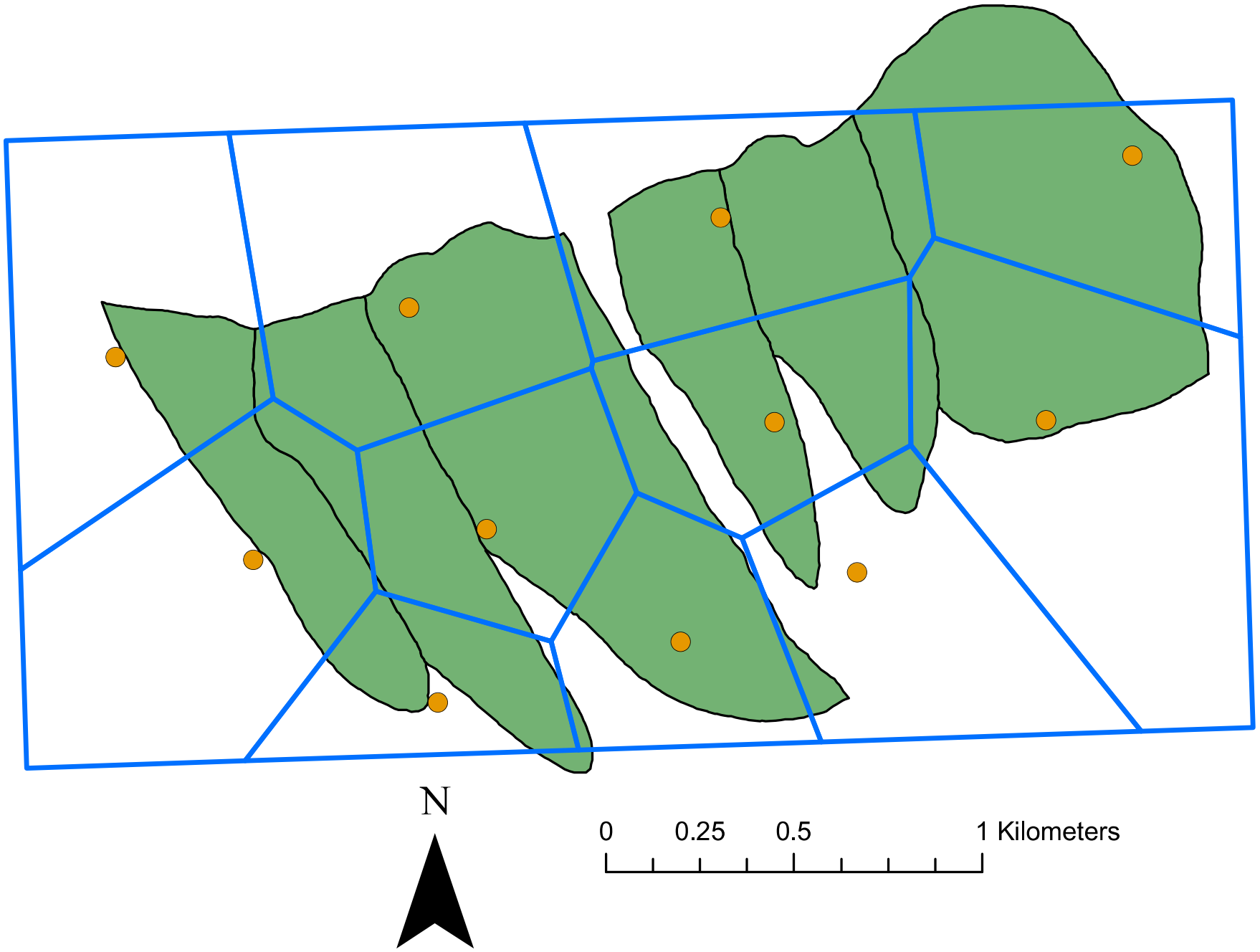
How many rain gauges are needed to characterize inputs to a watershed?



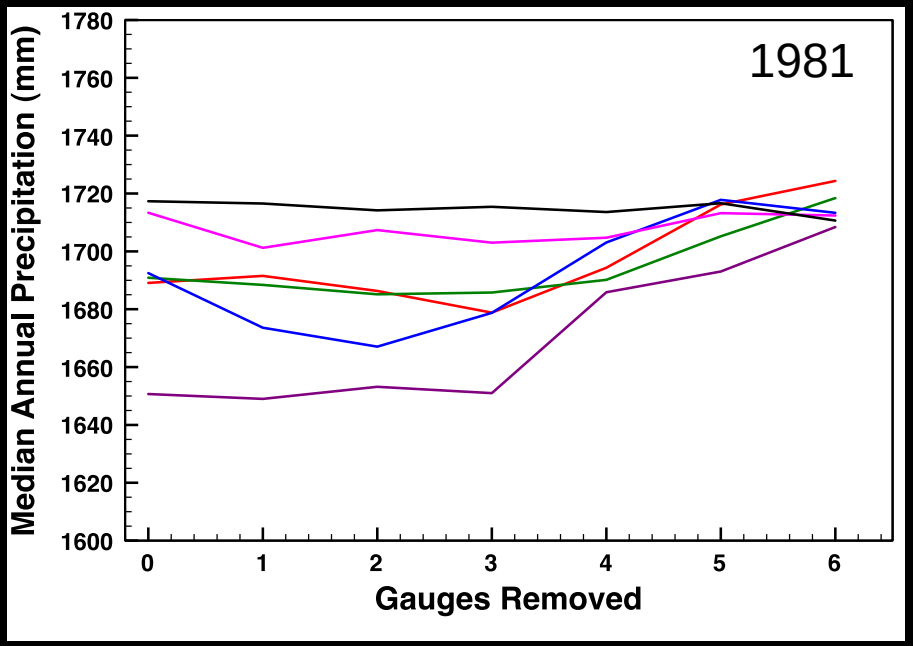
Hubbard Brook Experimental Forest

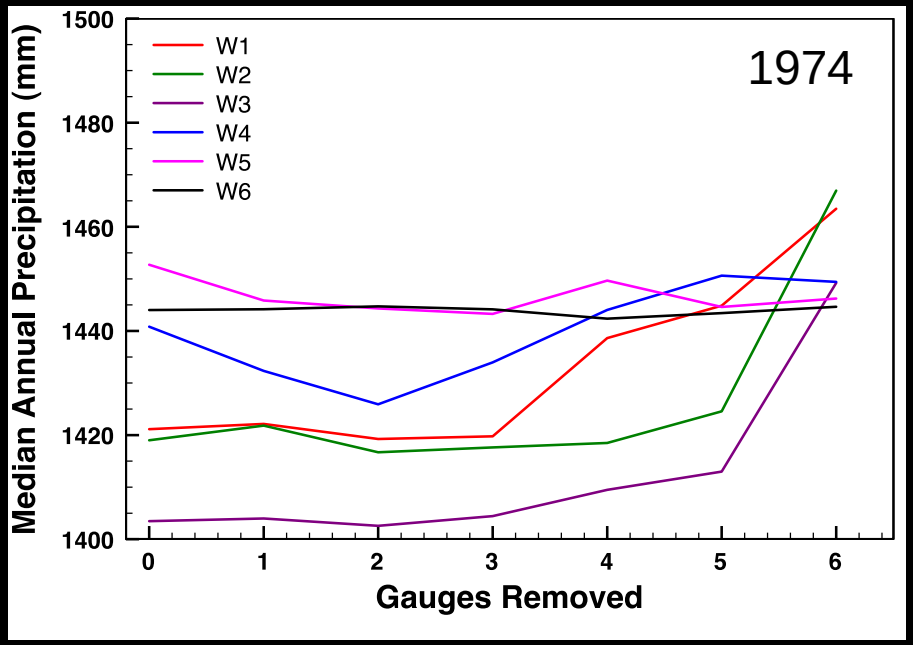
West Thornton, New Hampshire

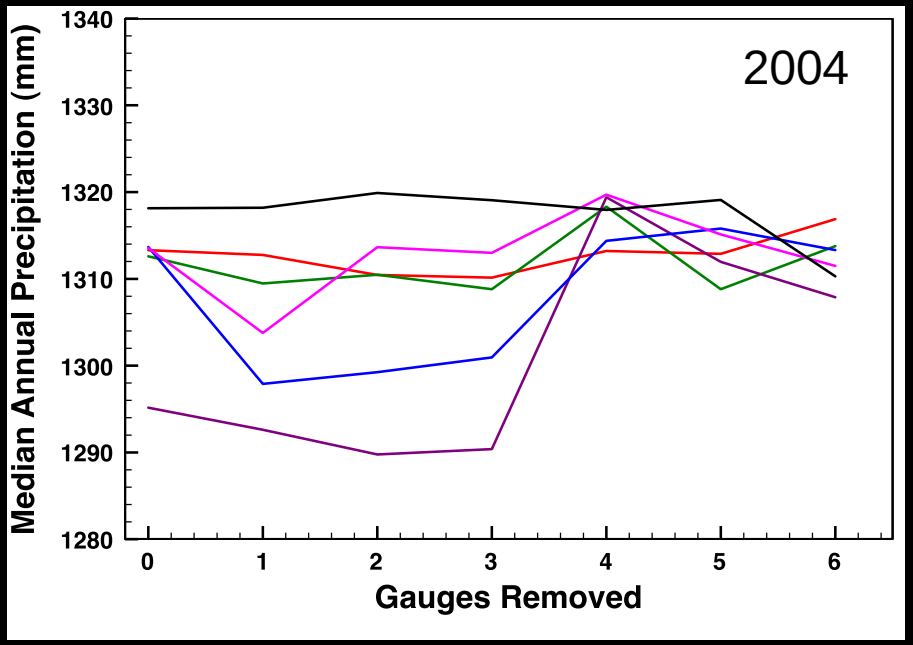



N
0
0.25
0.5
1 Kilometers

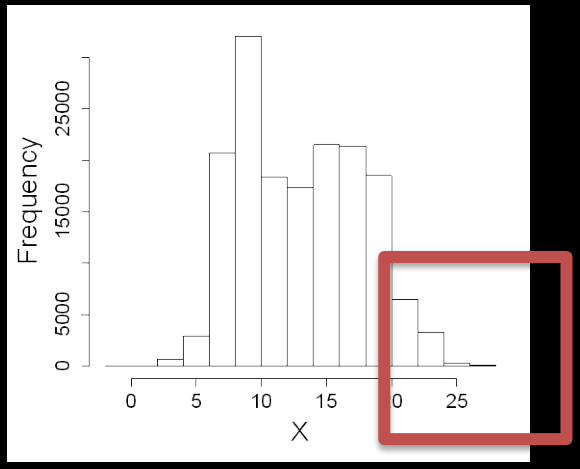
Median Annual Precipitation



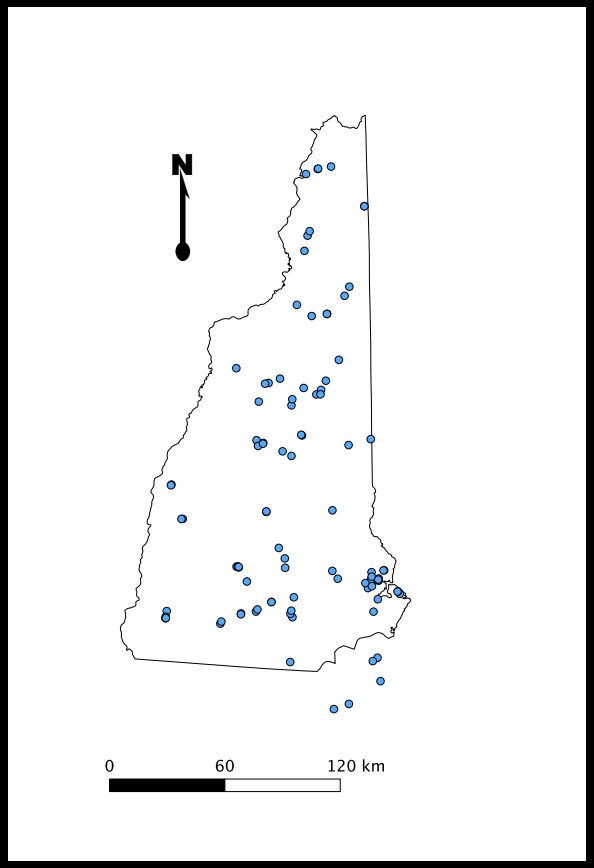




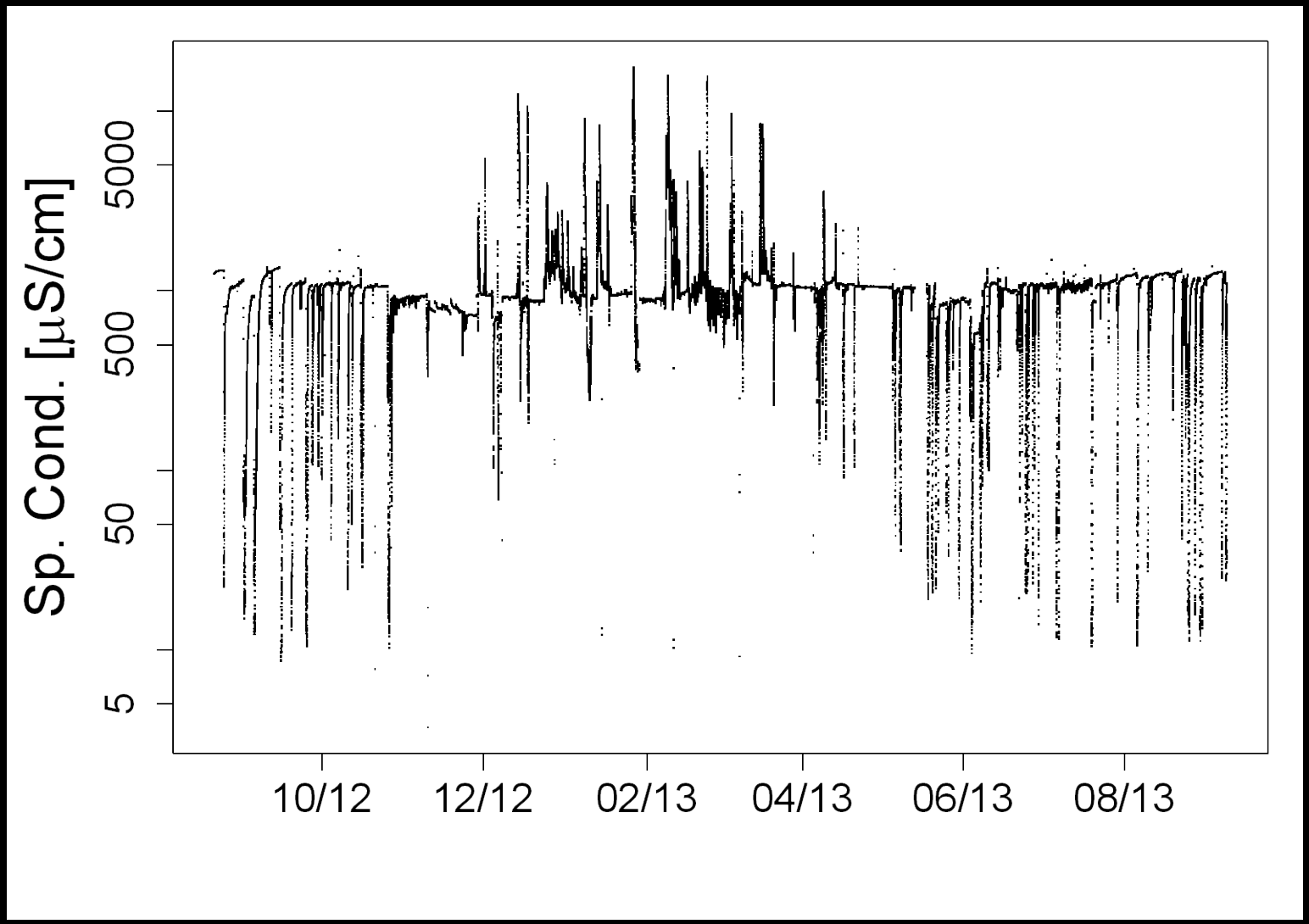
What is optimal water sampling frequency to characterize extremes?



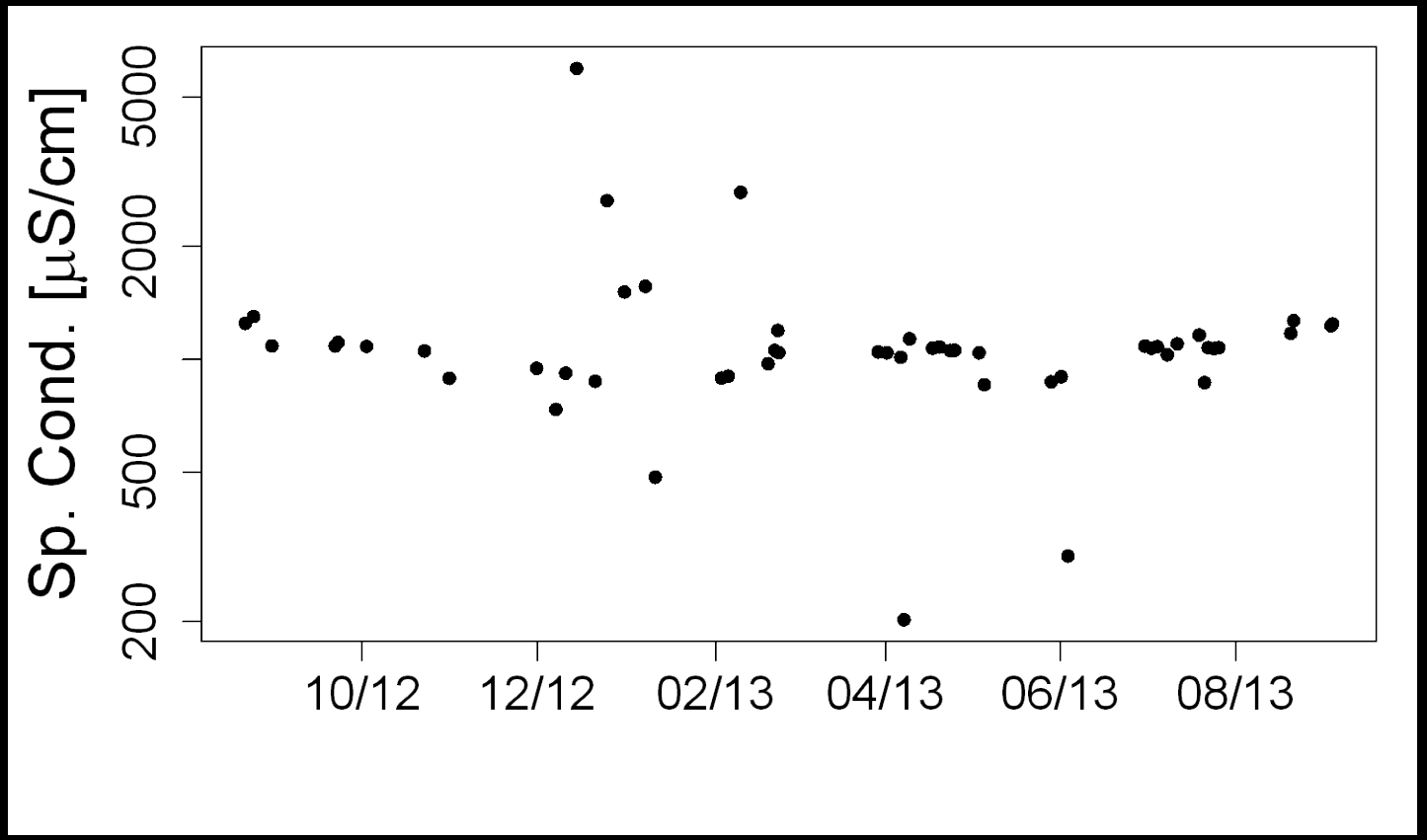
Road salt pollution can impair aquatic ecosystems. How large are the salt peaks they experience?

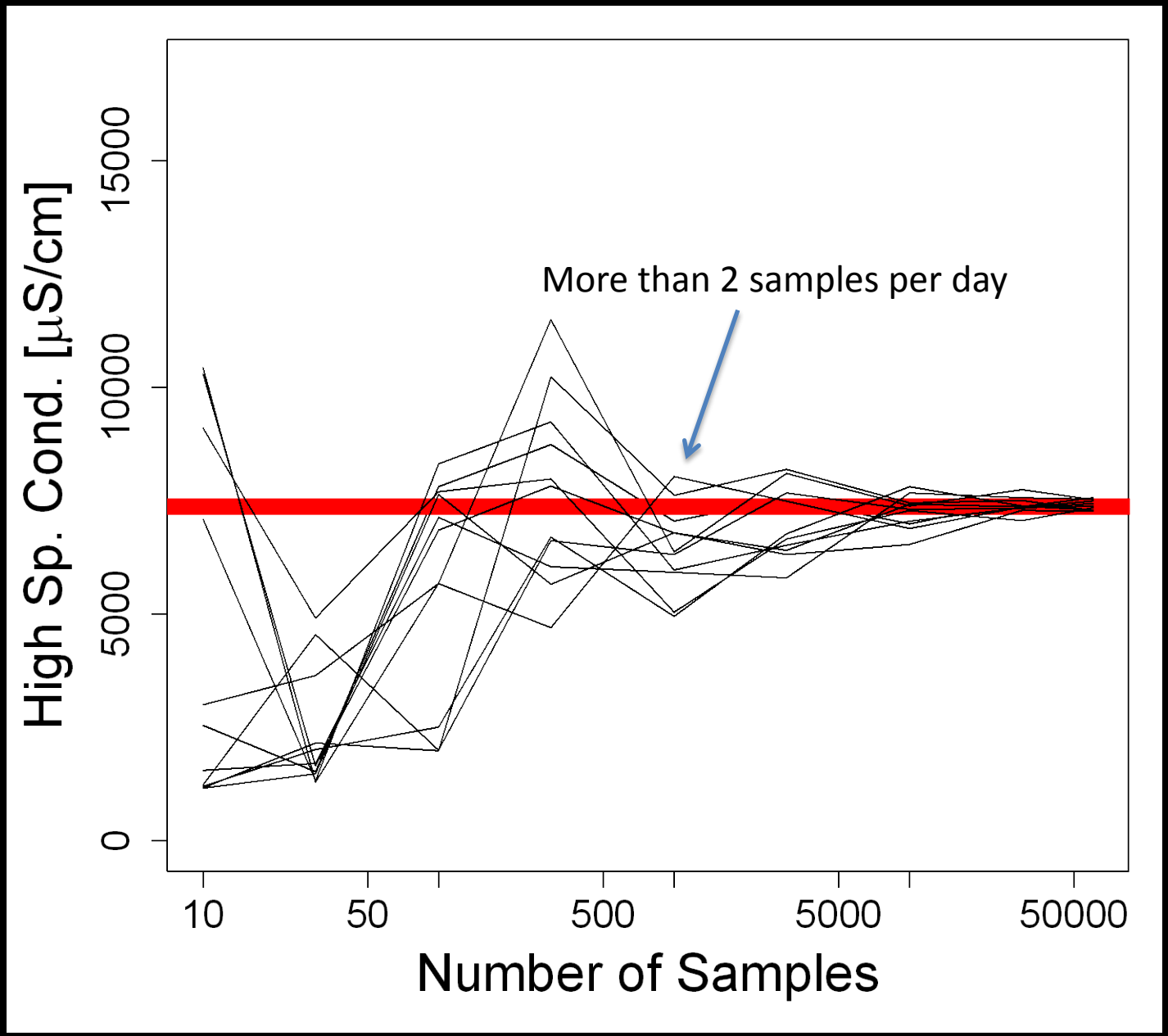


Actual Variability



52 Random Samples




High Sp. Cond. [µS/cm]
0
5000
10000
15000
More than 2 samples per day
10
50
500
5000
50000
Number of Samples

How many plots should be sampled to report forest biomass with known confidence?

Data sets used in analysis:

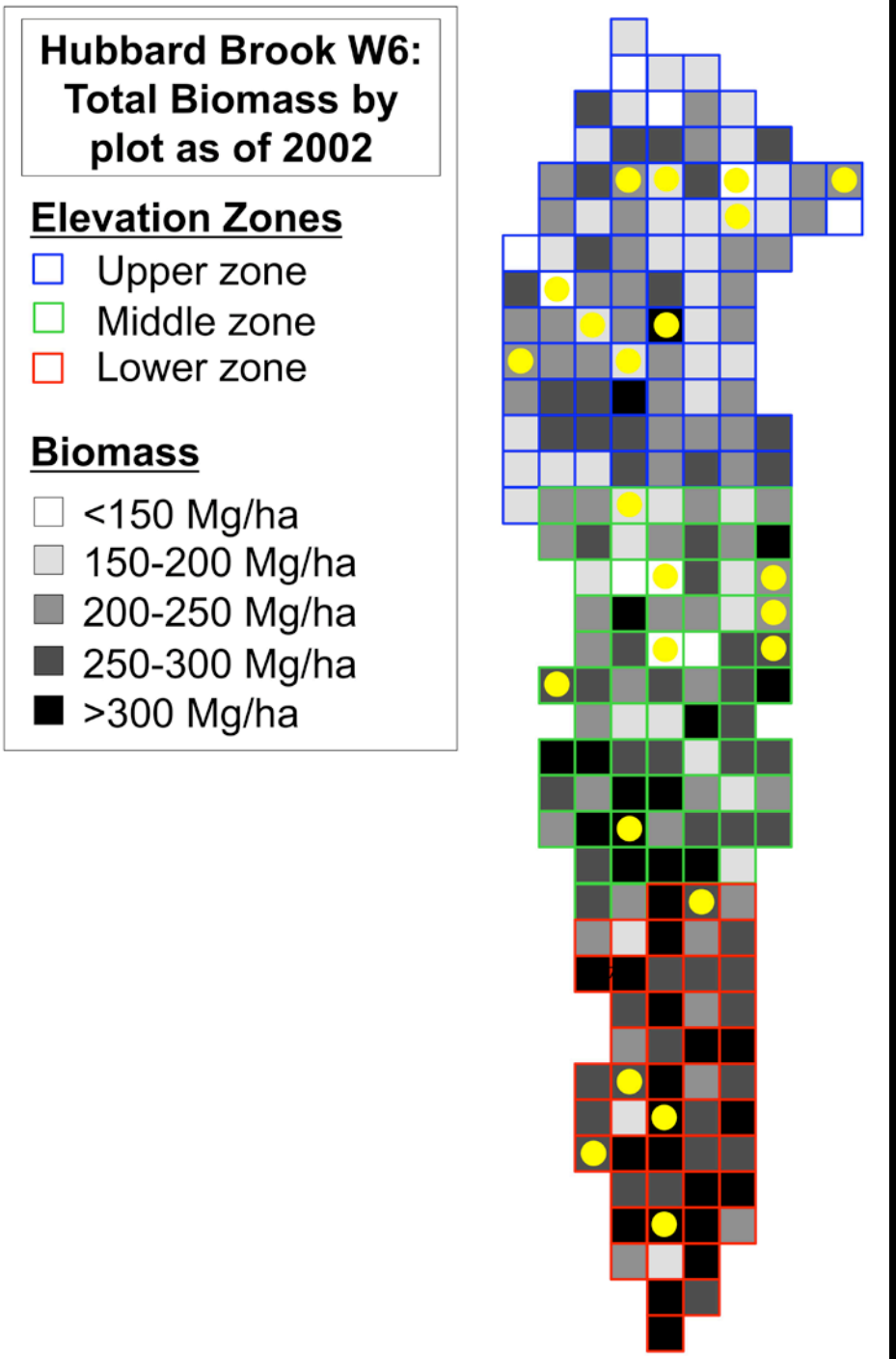
• Hubbard Brook Watershed 6, where every tree is measured on each of 208 plots (each 25m x 25 m) every 5 years. We used data from 2002.

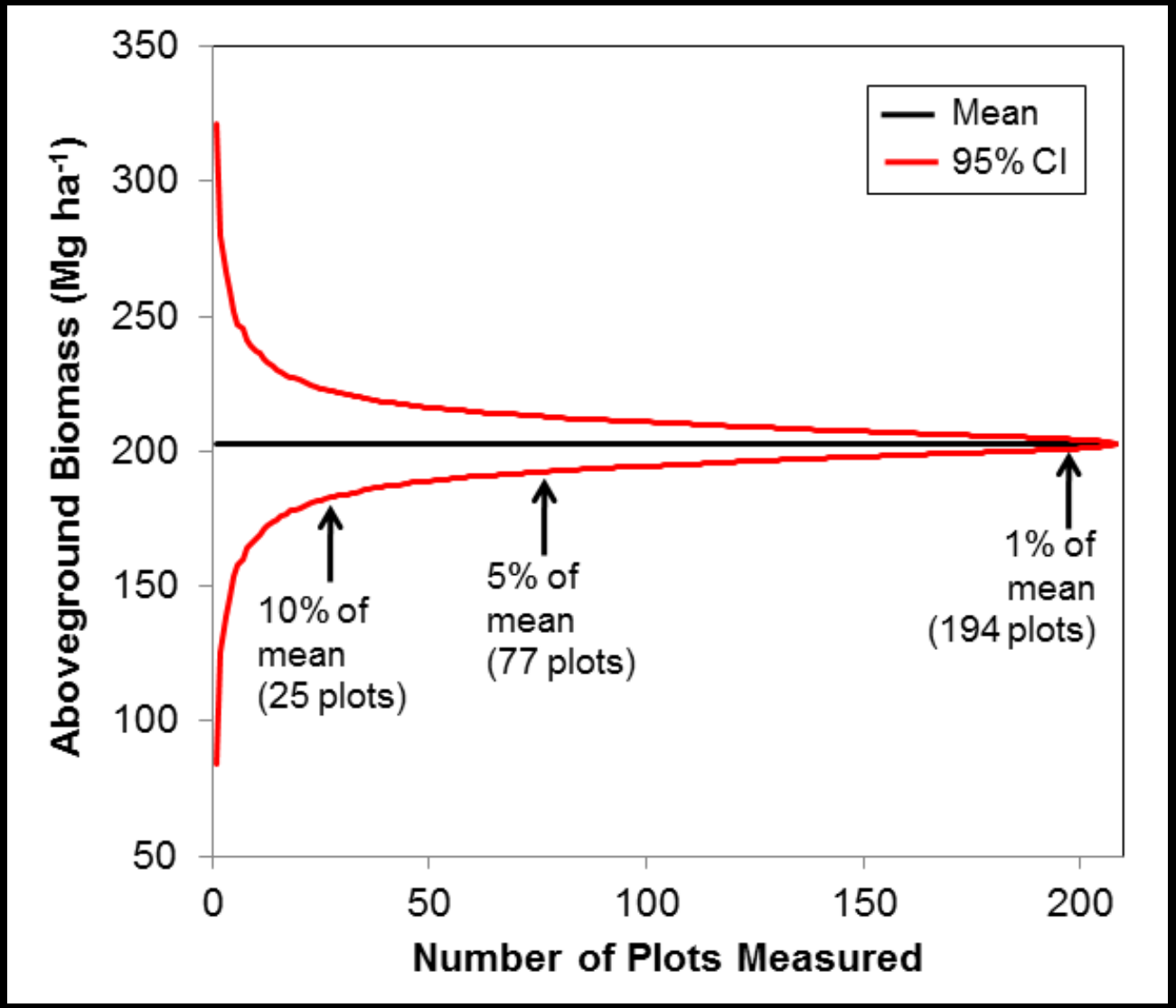
Analytical approach:

• We randomly selected subsets of plots and reported uncertainty in the estimates of forest biomass.

www.plymouth.edu

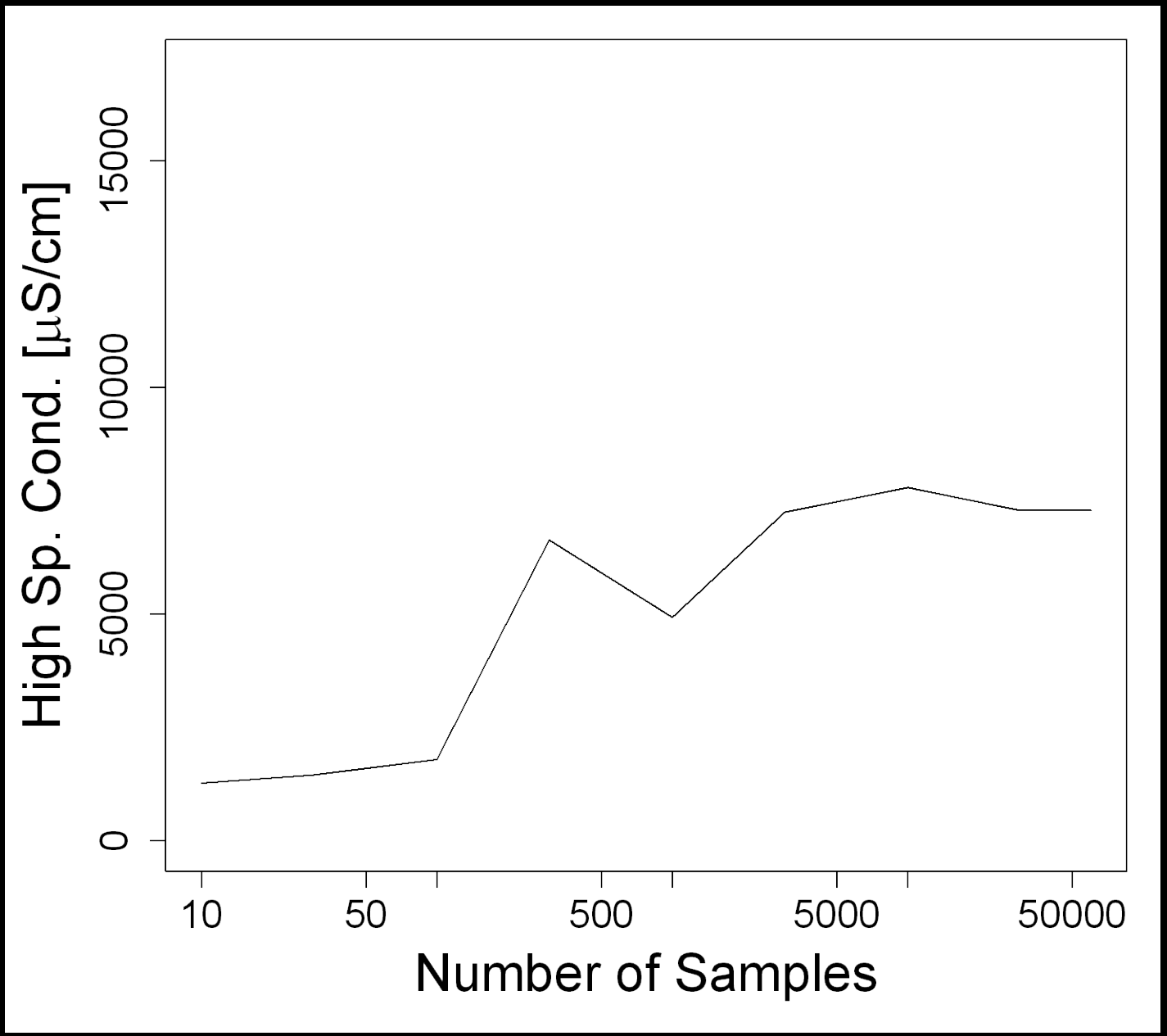
The range in elevation is 550-700 m, with significant vegetation change. Biomass equations were developed for three elevational bands. We used these three bands as strata when subsampling.



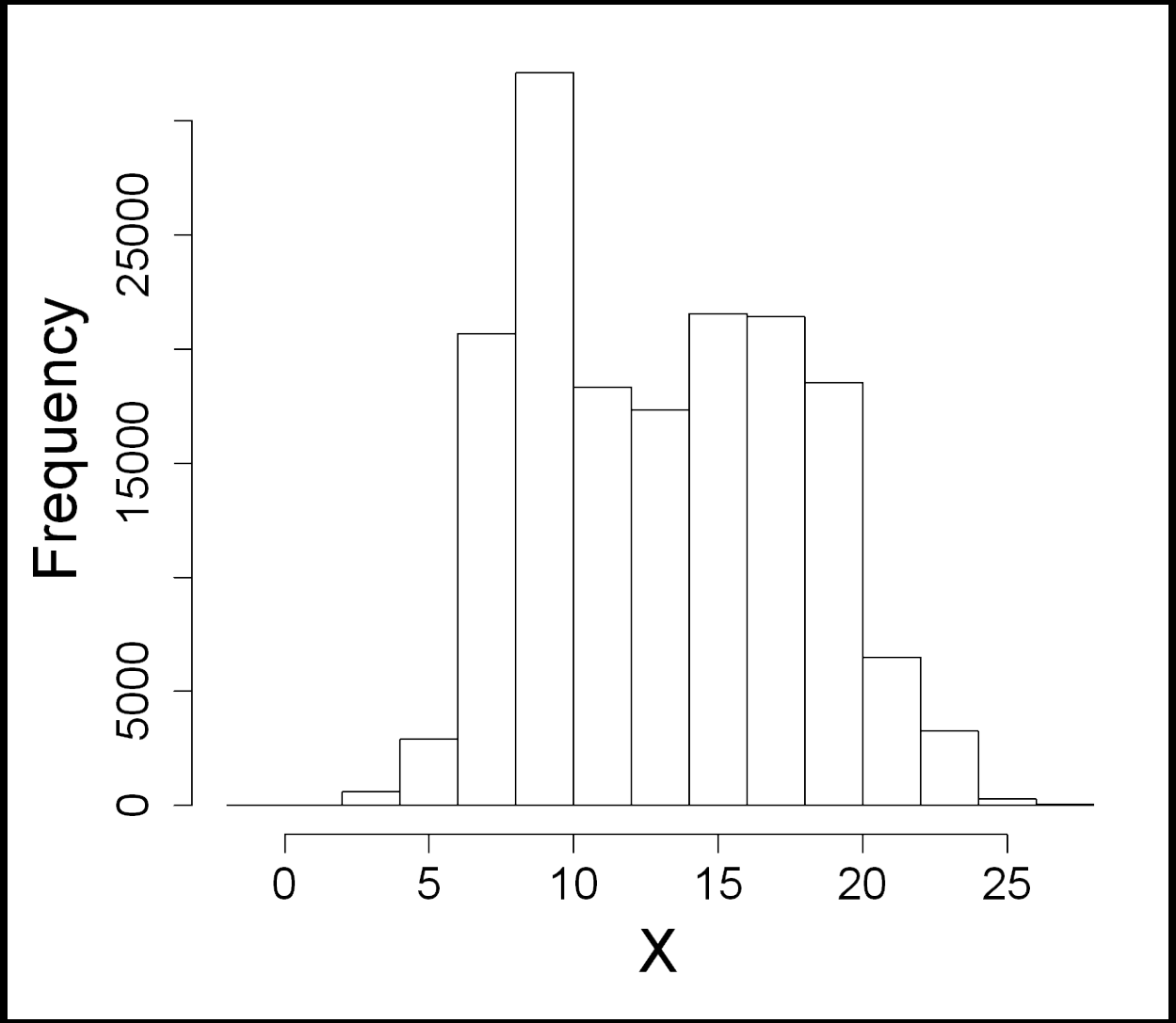


Yanai et al. 2012

How can these ideas be applied now?


High Sp. Cond. [µS/cm]
0
5000
10000
15000
10
50
500
5000
50000
Number of Samples

Update the histogram as new observations become available.



Conclusions

- We need to be using our heavily sampled environments to quantify information saturation.
- Subsampling approaches can produce new insights into monitoring efficiency.
- Running mean and running percentile approaches can help identify information stability.

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