

Characterizing the evolution of dynamic pressure resulting from the 18 May 1980 pyroclastic density current of Mount St. Helens using tree damage

V31H-0104

Nicole K. Guinn, James E. Gardner, Mark A. Helper

Department of Geological Sciences, The University of Texas at Austin

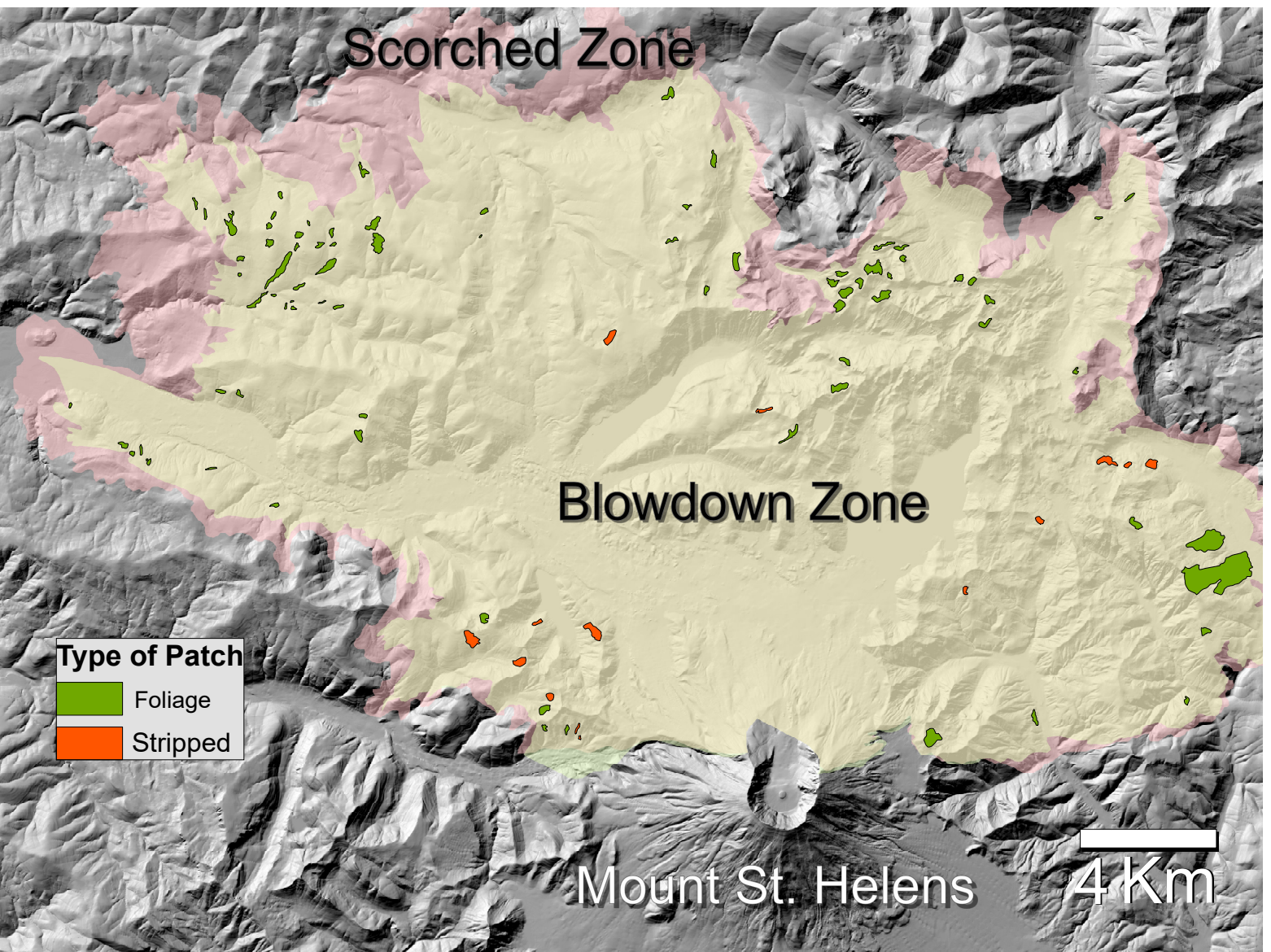


Summary

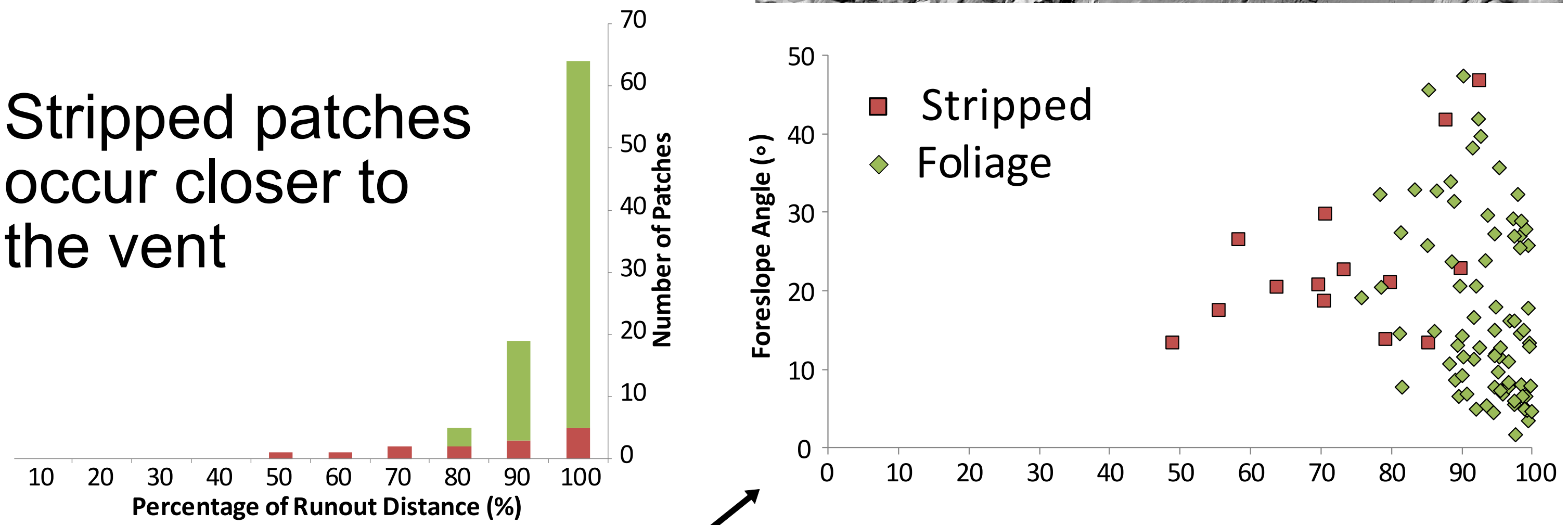
The lateral blast damaged 600 km² of forest. However, tree patches and isolated trees remained standing in the blowdown zone. Tree patches can be separated into patches with foliage versus those stripped of foliage and respectively indicate that peak dynamic pressure had risen above the tops of the trees, whereas the latter suggests peak dynamic pressure was still low enough to damage trees even though the current had jumped over topography. The density of isolated standing trees provides evidence that dynamic pressure noticeably decreases near the end of the PDC runout.

Tree patches

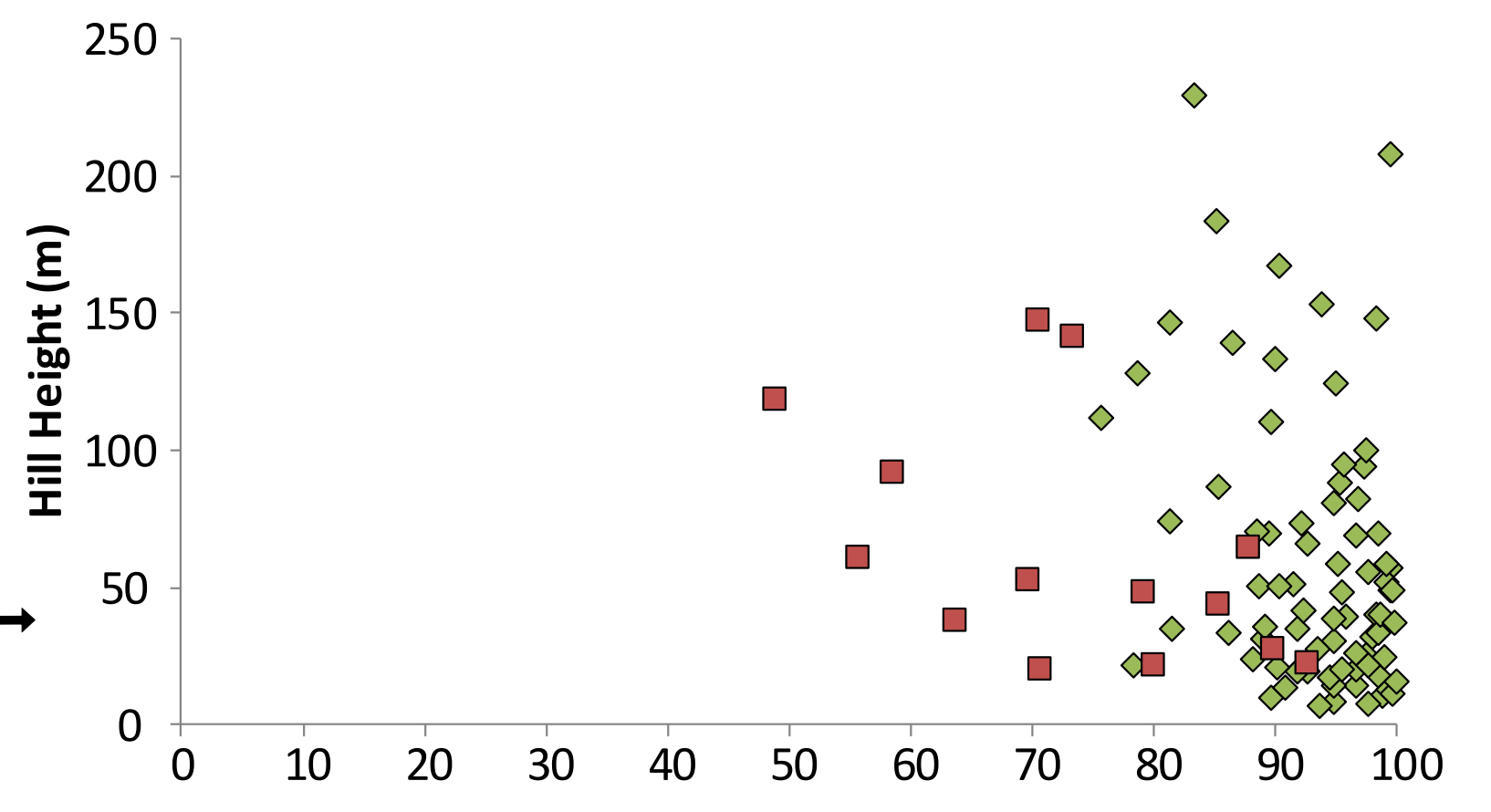
- Ninety-five tree patches were left standing
- Two types of patches: (1) trees with foliage (2) trees stripped of foliage and branches



- Stripped patches occur closer to the vent

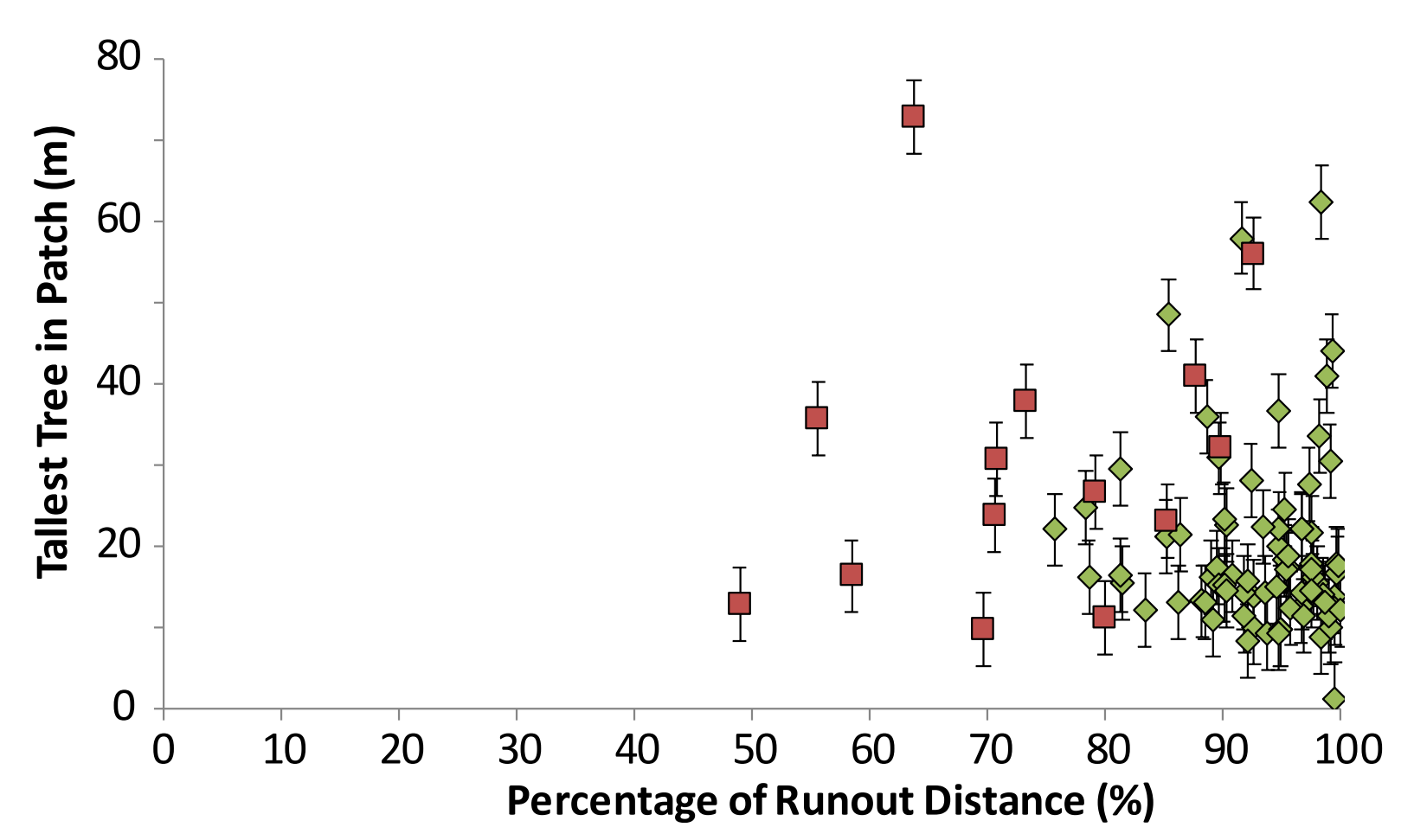


- Stripped patches have larger foreslopes

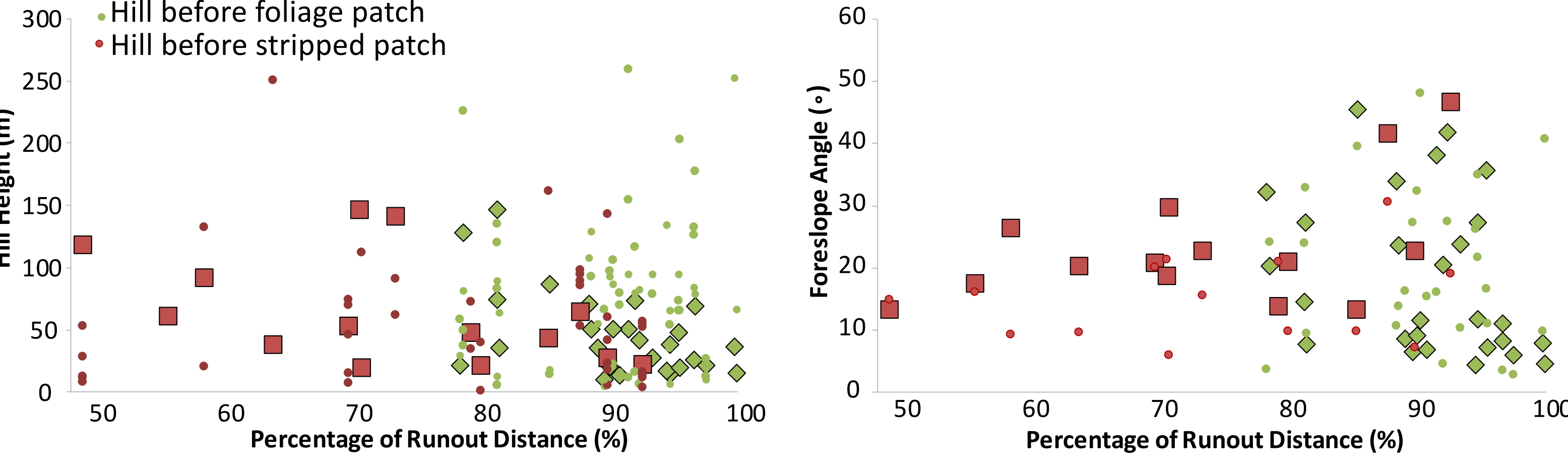


- Hill height does not have an effect on patch type

- Tallest stripped trees are on average 31±18 m
- Tallest foliage trees are on average 19±11 m



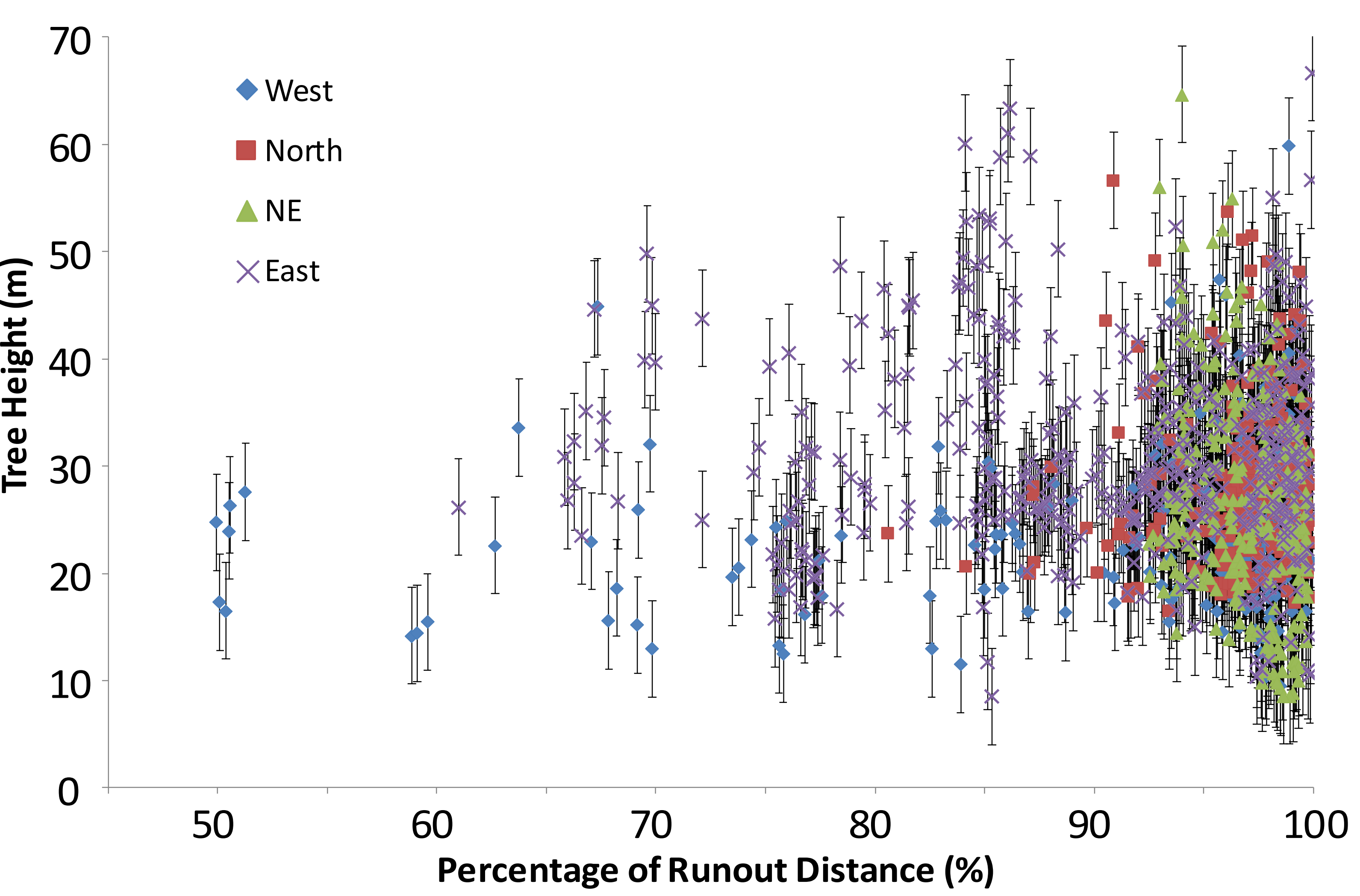
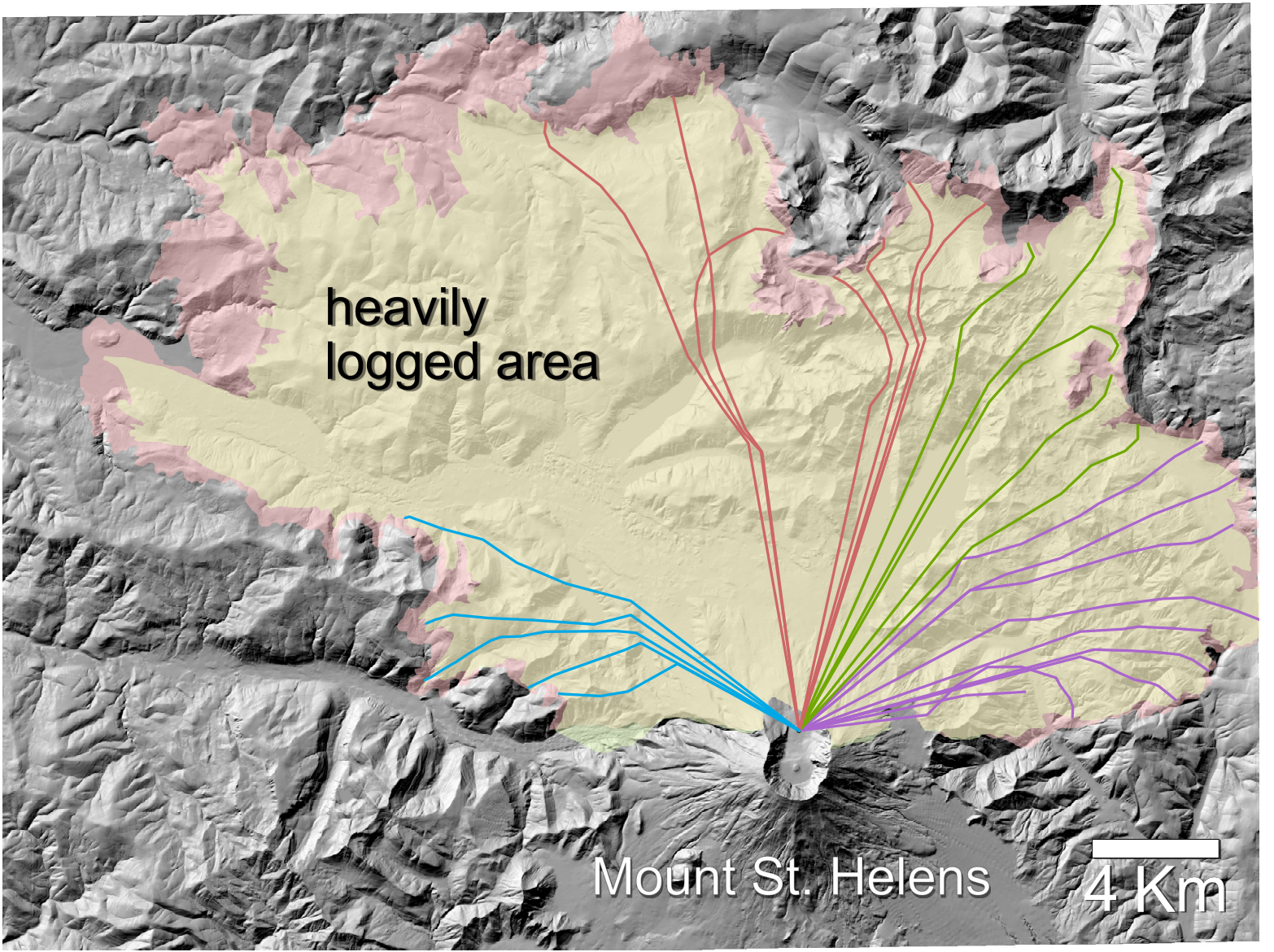
Transecting Topography



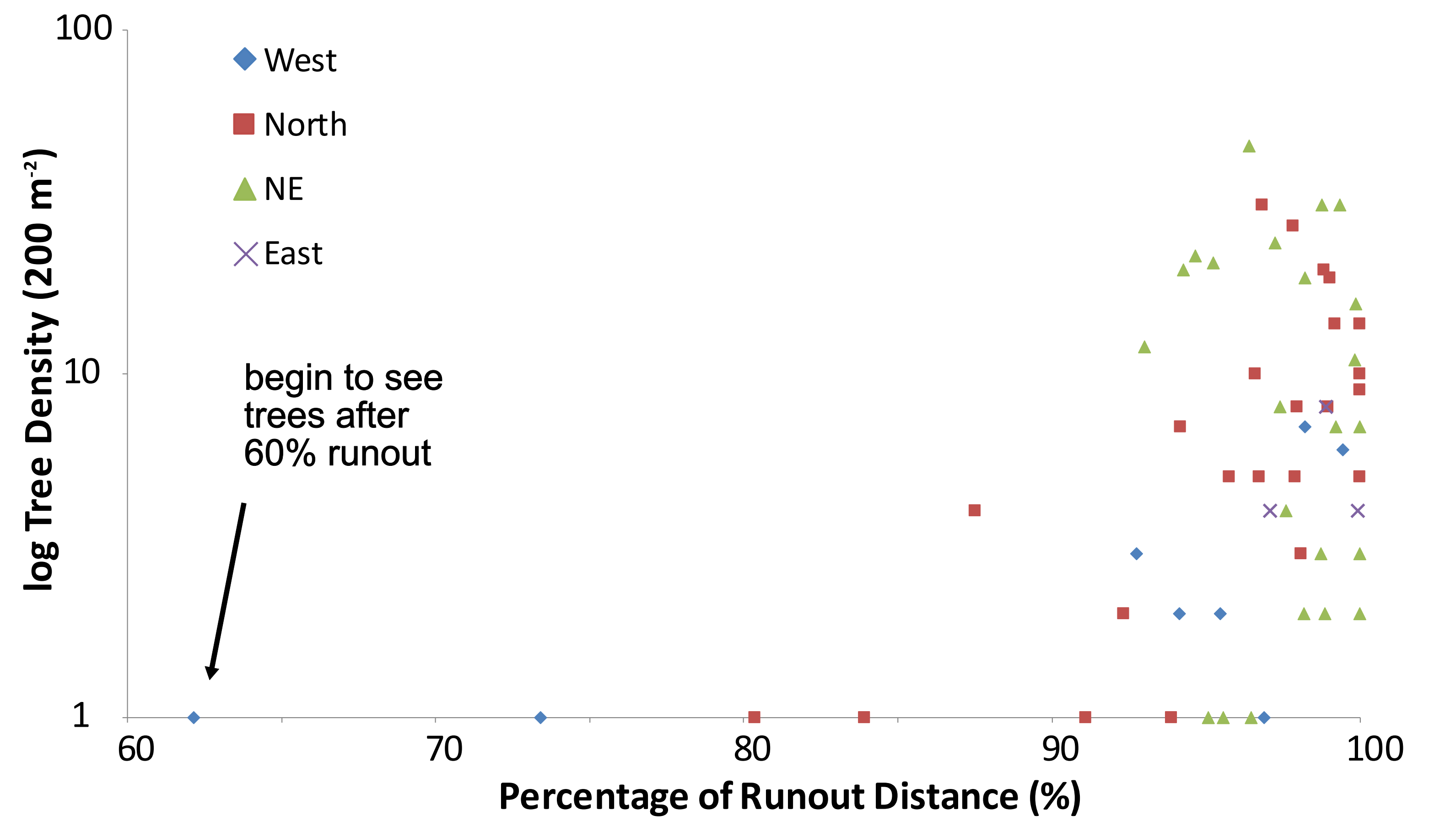
- Most hills with patches have preceding hill(s) that are taller
- Most hills with patches have higher angles

Isolated trees

- Flow lines were mapped from the directions of fallen trees



- Tallest trees left standing increase with runout distance



- Marked increase in tree density in the last 10% of runout

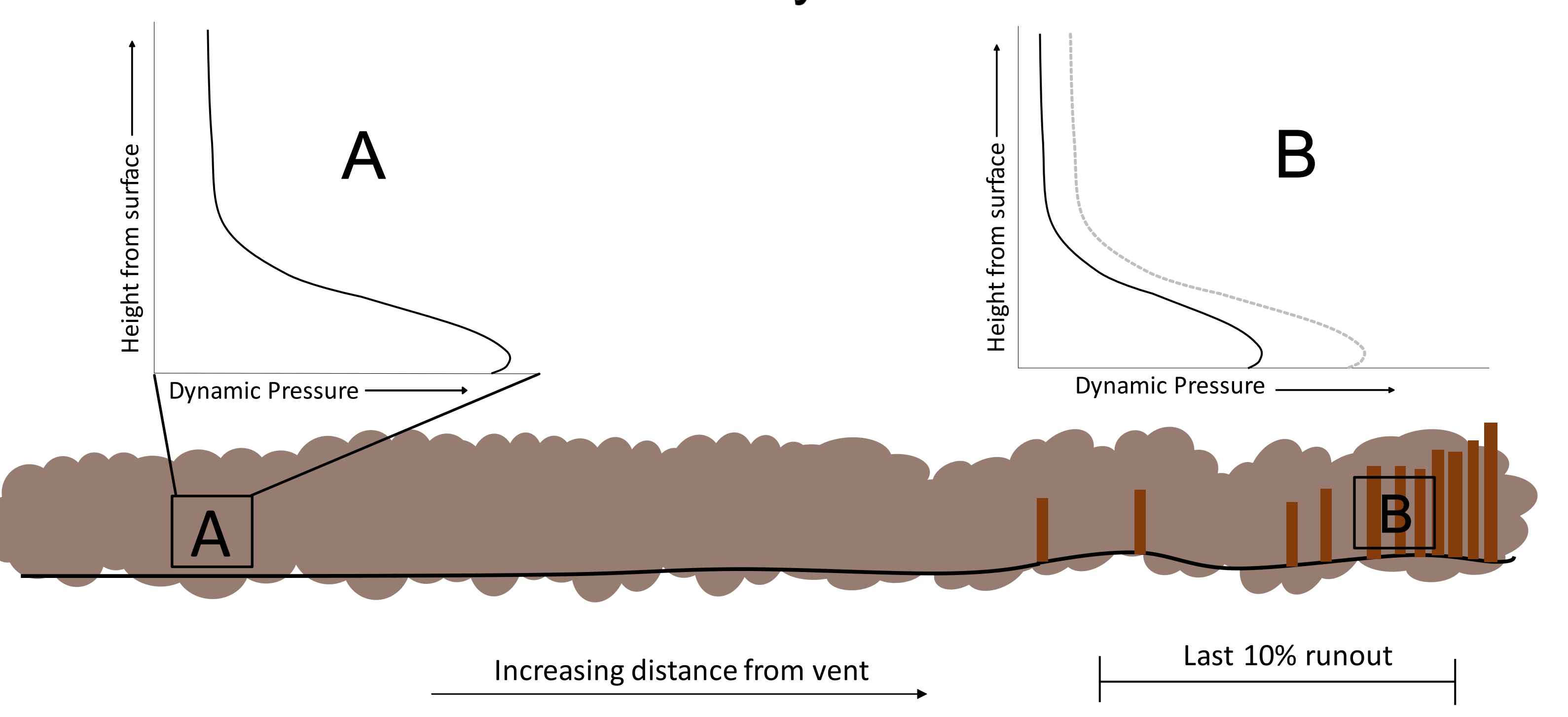
Discussion

Dynamic Pressure

$P_{dyn} = (1/2)\rho v^2$ Dynamic pressure for PDCs is expected to decrease as density and velocity decrease through sedimentation and the entrainment of outside air

Dynamic pressure evolution: without topography

A - Dynamic pressure profile near source
B - Dynamic pressure profile for last 10% of runout
The decrease in dynamic pressure is interpreted from the marked increase in tree density



Dynamic pressure evolution: with topography

C - Tall hills near the vent do not have patches
D - Stripped patches show where the peak dynamic pressure was lifted but was still low enough to strip trees of branches and foliage
E - Foliage patches show where the peak dynamic pressure was lifted over the trees

