

Deducing Disturbance Mechanisms

1 Identify a pattern you observed. (Note: you should provide more detail for report 1 than description below)

- * 2 Douglas fir logs (≈ 70 cm dbh), lying along fall line of slope. Logs fell across trail/old road east of bend in East College Way (east of "Rock Rings" sculpture).
- * Left large gap (~ 150 m²) in canopy
- * Roots attached to boles, depressions/cradles (~ 1 m deep) where roots pulled out.
- * Trees fell at least 20 yr ago: solid covering of moss on upper surface of one, another w/out bark, Sword ferns growing in hole left by root wad.

2 Pose two hypotheses to explain the pattern. Both hypotheses must be plausible.

(Do not state a hypothesis that obviously is implausible, e.g., College gnomes cast a fatal spell on the trees.)

Hypothesis 1: Live trees uprooted by a storm.

Hypothesis 2: Dead or severely diseased trees toppled after fungal root pathogen killed or weakened roots.

3 Use your hypotheses to predict additional patterns related to the pattern in part 1.

Make your predictions before doing parts 4 and 5.

Predictions for hypothesis 1:

- Large root wads upturned, from extensive healthy root systems.
- Deep, wide cradle or hole where roots torn from ground.
- Little decay in roots or log immediately upon falling. Subsequent decay commensurate with 2+ decades.
- Direction of fall ambiguous; west/down more likely.
- Little growth discontinuity (outer rings not overly narrow).
- Scars on trees adjacent to path of treefall, due to wounding by falling trunk or branches.
- Adjacent trees, including same species, in healthy condition.

Predictions for hypothesis 2:

- Small root balls, due to root decay prior to falling.
- Shallow, narrow cradle where small decayed roots pulled from ground.
- Extensive decay in roots or bole (depends on pathogen) upon falling; additional decay in following decades.
- Direction of fall: west/downslope most likely.
- Slow growth prior to death (outer rings very narrow; abrupt narrowing in several/5-10 years before falling).
- Adjacent trees of same or similar species infected (D.fir, not deciduous trees).
 - thin canopy foliage relative to healthy trees of same species and similar size.
 - yellowing/chlorotic foliage, due to limited nutrient supply provided by dying/decaying roots.
- Infection gradient extending outward from logs: Douglas fir trees closer dead or down, Douglas fir trees farther away showing progressively less evidence/impacts of infection.
- Replacement of infected/dead trees with younger non-susceptible species.
 - e.g., Douglas fir trees replace by Bigleaf maples.
- Other evidence of infection (stains, mycelium, delamination, etc)

(continued)

4 Search for the patterns predicted in part 3.Search results for hypothesis 1:

Root wads: small; root extensions not much wider than trunk diameter. Contradicts prediction
 Cradle: narrow, shallow depths. Contradicts prediction
 Decay: extensive in roots; one bole mostly intact, other bole with extensive decay. Contradicts
 Note woodpecker drilling in large root, of one log ⇒ decay & secondary insect invasion.
 Decay throughout south log.
 Direction of fall: west/down and north. Inconclusive relative to prediction
 Outer growth rings: extremely narrow Contradicts prediction
 Scars on trees adjacent to path: no obvious scars or other evidence dating to 2+ decades ago. Contradicts.
 Adjacent trees: thinning foliage, some infected Contradicts prediction

Search results for hypothesis 2:

Root wads: small; root extensions not much wider than trunk diameter. Consistent with prediction
 Cradle: narrow, shallow depths Consistent with prediction
 Decay: extensive in roots; one bole mostly intact, other bole with extensive decay. Consistent
 Note woodpecker drilling in large root, of one log ⇒ decay & secondary insect invasion.
 Decay throughout south log.
 Direction of fall: west/down and north. Inconclusive relative to prediction
 Outer growth rings: extremely narrow Consistent with prediction
 Adjacent Douglas fir trees: thinning foliage, some infected Consistent with prediction
 Infection gradient: closest D.fir trees dead/down, intermediate distance infected, distant trees healthy. Consistent with prediction
 Signs of infection: delamination near base of D.fir log lying upslope of subject logs. Consistent
 Replacement of infected/dead trees with non-susceptible Bigleaf Maple trees. Maple trees smaller and younger than dead/fallen Douglas fir trees. Consistent with prediction

5 Use results of your search to evaluate your hypotheses in part 2.Hypothesis 1 evaluation:

Evidence contradicts 6 of 7 predictions.
 Evidence is ambiguous regarding 7th prediction (direction of fall).
 Little to no support for live trees toppled by windthrow/storm.

Hypothesis 2 evaluation:

Evidence is consistent with 6 of 7 predictions, showing strong support
 Evidence is consistent 7th prediction (direction of fall), but only weakly supportive.
 Strong support for trees weakened or killed by fungal root pathogen, then toppled with reduced roots.

Conclusion: trees were weakened or killed by fungal root pathogen, then fell downslope with severely weakened root systems and support. Evidence and evaluation provide strong confidence in this conclusion.