Studying Trait Covariance under Hillslope and Drought Conditions

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Background

Tree mortality is projected to increase due to drought-related stress triggered by climate change. Ecohydrologists – scientists who study water's role in ecosystems – believe predicting forest death revolves around studying drought.
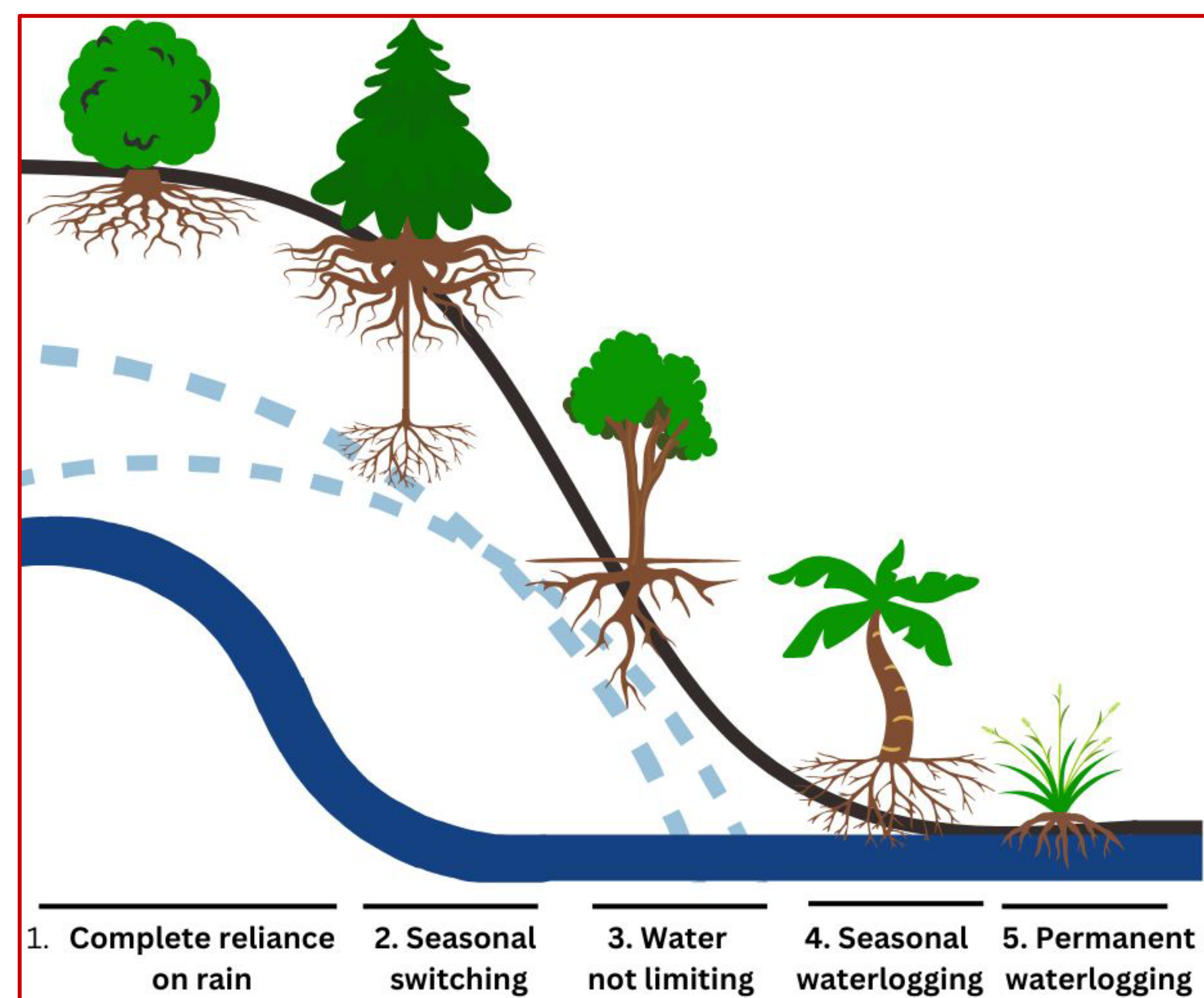

Figure 1. Schematic of soil water profiles along a gradient (Fan, 2017).

Objective

Despite the importance of forecasting drought-stress, discrepancies persist between observed and simulated drought-induced mortality. I will explore underline research gaps in drought modeling by studying drought resistance within the ponderosa pine species (*Pinus ponderosa*).

Hypotheses

I present three central hypotheses:

1) Water-table depth (WTD) selects for drought resistance in affected plants.

2) Intraspecific drought responses vary along a hillslope gradient relative to WTD.

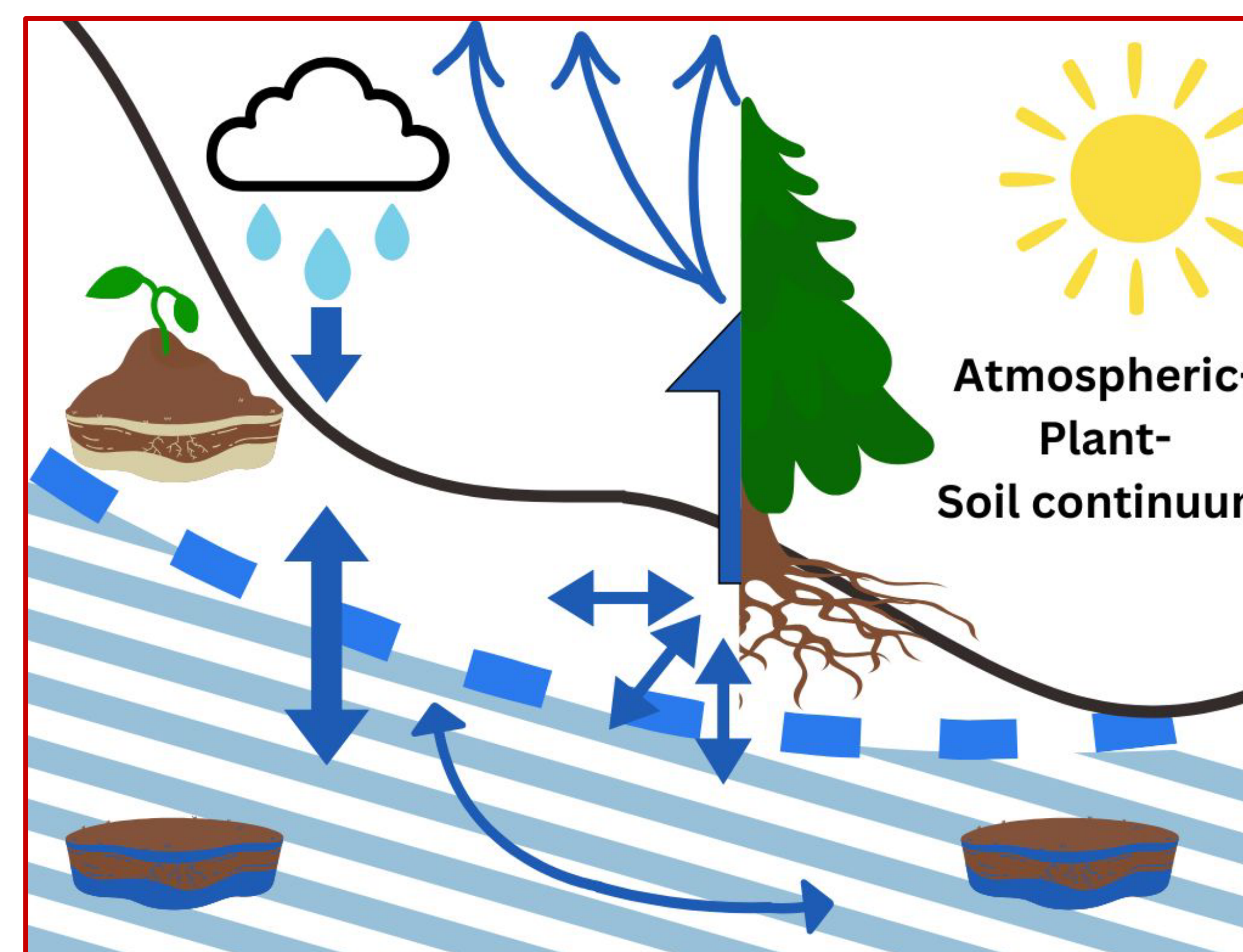3) Individual drought responses impact ecosystemic model accuracy.

Figure 2. Conceptual diagram of model Parflow-TREES (Tai, 2018).

Methods

I will leverage ParFlow-TREES, a coupled model which integrates plant hydraulics with hydrology into a continuum. Using this approach tests simulated water fluxes and plant drought responses to evaluate plant traits along a hillslope gradient of limited reservoir or WTD.

Results

Success towards my hypotheses will be determined by calculating drought model accuracy and correlation to observed forest mortality. Results will be visualized as overlapping graphs of mortality and remote sensing observations.
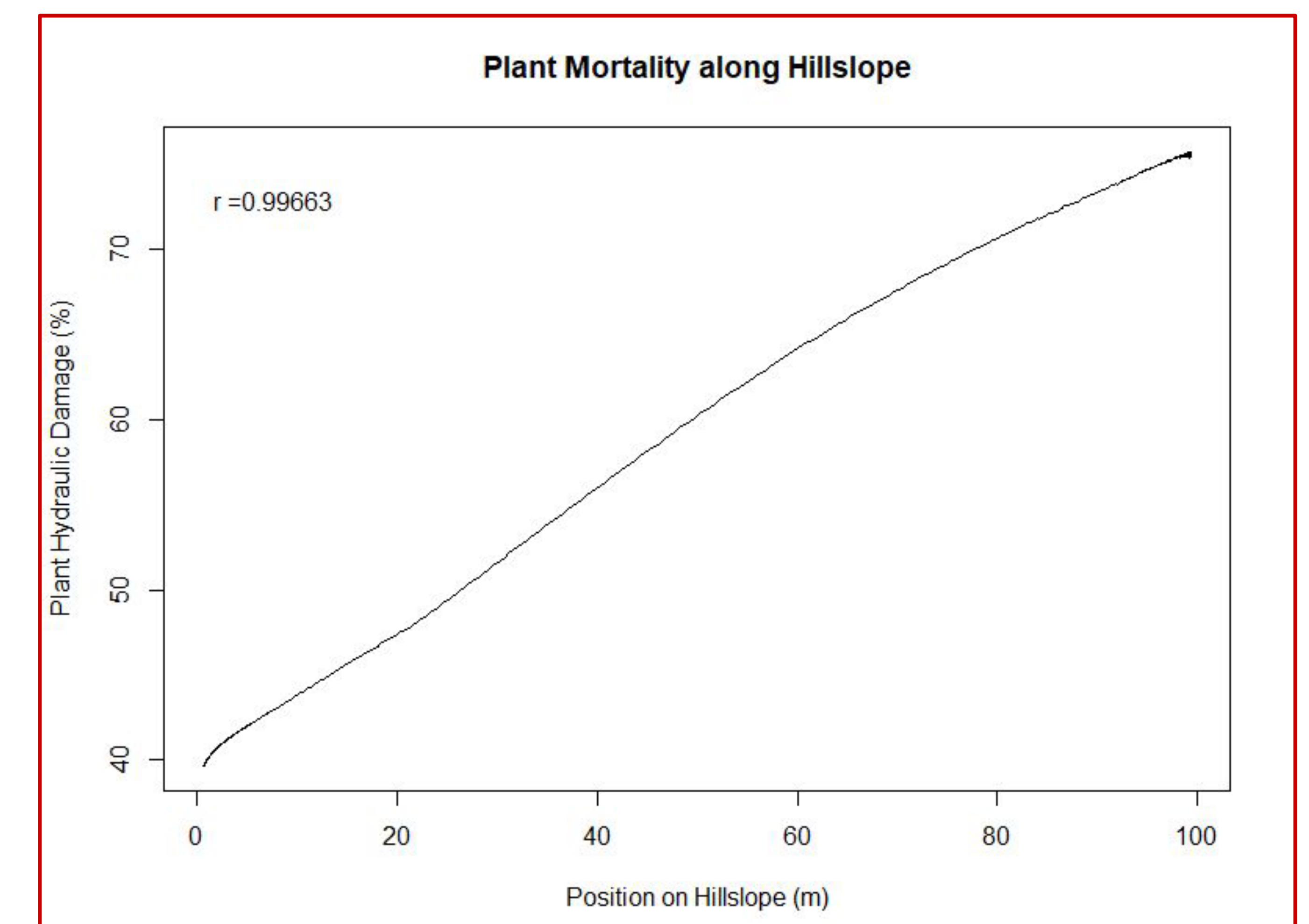

Figure 3. Graph showcasing increasing plant mortality up a hillslope.

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