

Treeline Migration, a Driver or Mitigator of Future Climate Change?

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RESEARCH QUESTION

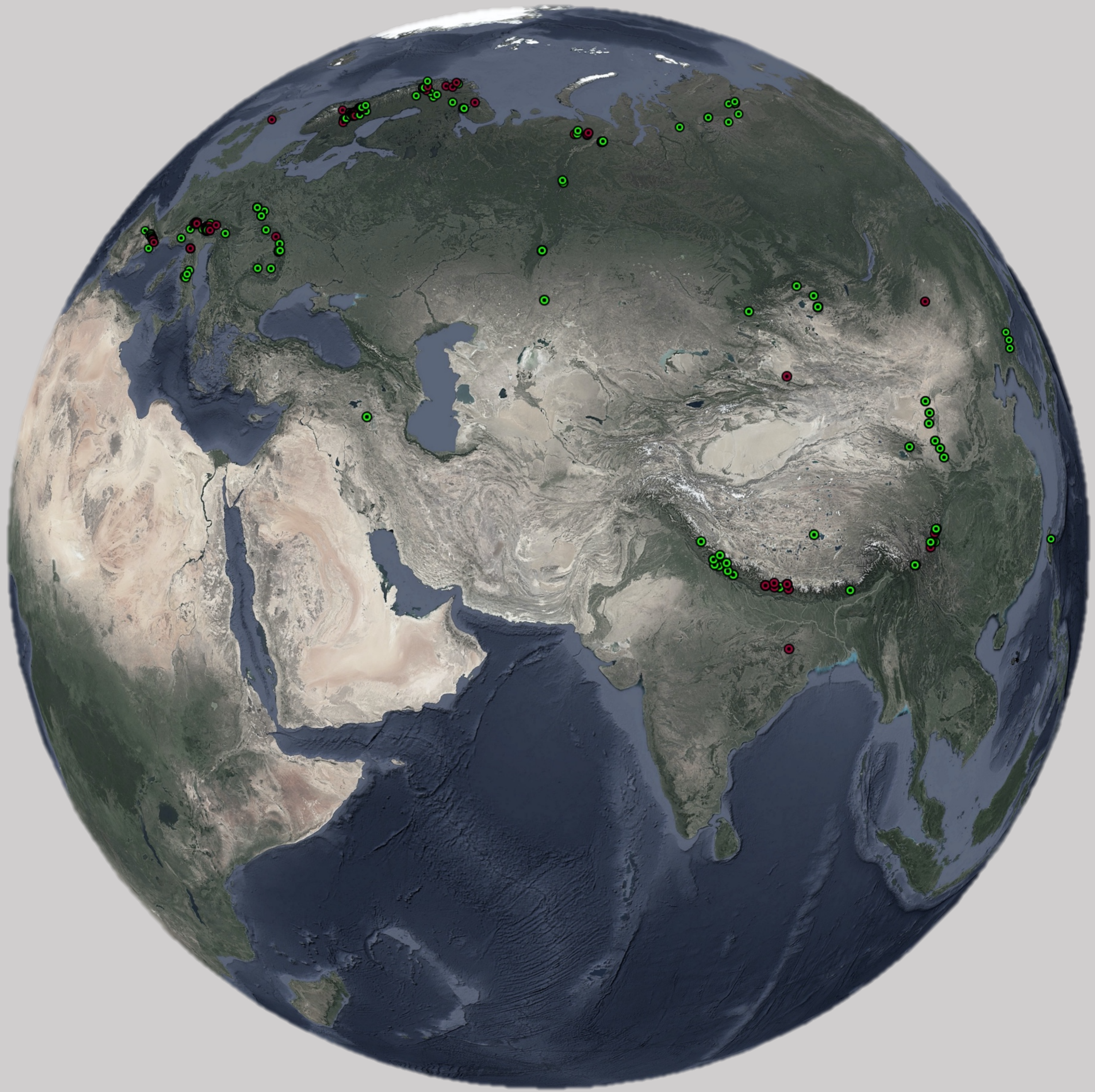
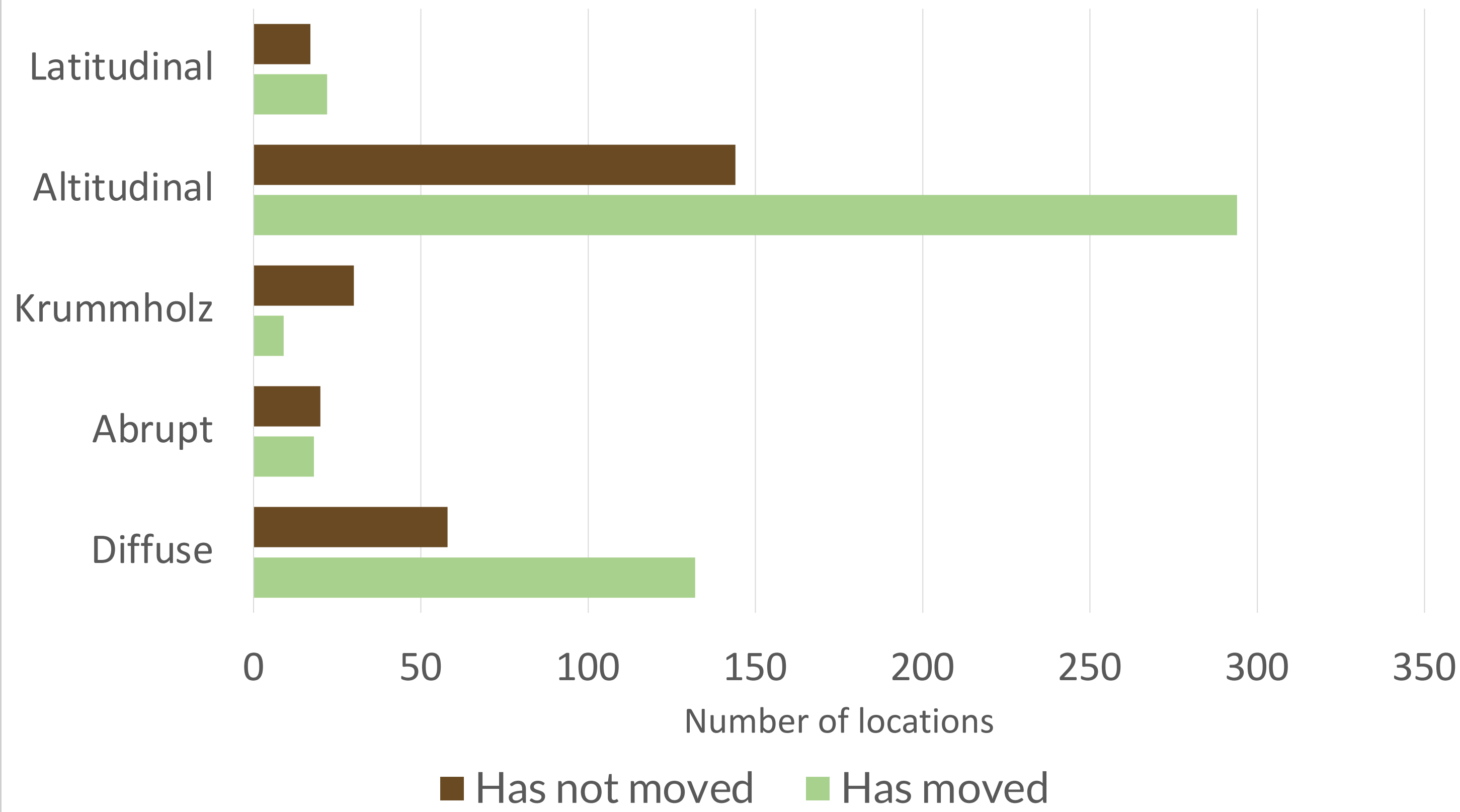
How will future climate change influence treeline migration, and what are the consequences for ecosystem carbon budgets?

INTRO

One of the major ecological changes currently occurring across mountain regions and tundra landscapes is the expansion of forests. Approximately 66% of globally studied treelines (the limit between forest and non-forest) have increased their extent during the past century¹. Treelines commonly form because of harsh growing conditions, and can change in both composition, density and extent of species distribution as temperature and patterns of precipitation are altered by climate change.

Treelines can be split into altitudinal and latitudinal depending on if they exist on a mountain or a flat tundra landscape, and can also be split after their physical characteristics based on if the tree-line form a sharp boundary (abrupt), if it is a gradual transition zone (diffuse) or if it consist of trees with stunted growth forms (krummholz). These can further influence the likelihood of tree-line migration.

Tree-line movements split after tree-line form and type



How will climate change influence global treeline movements?



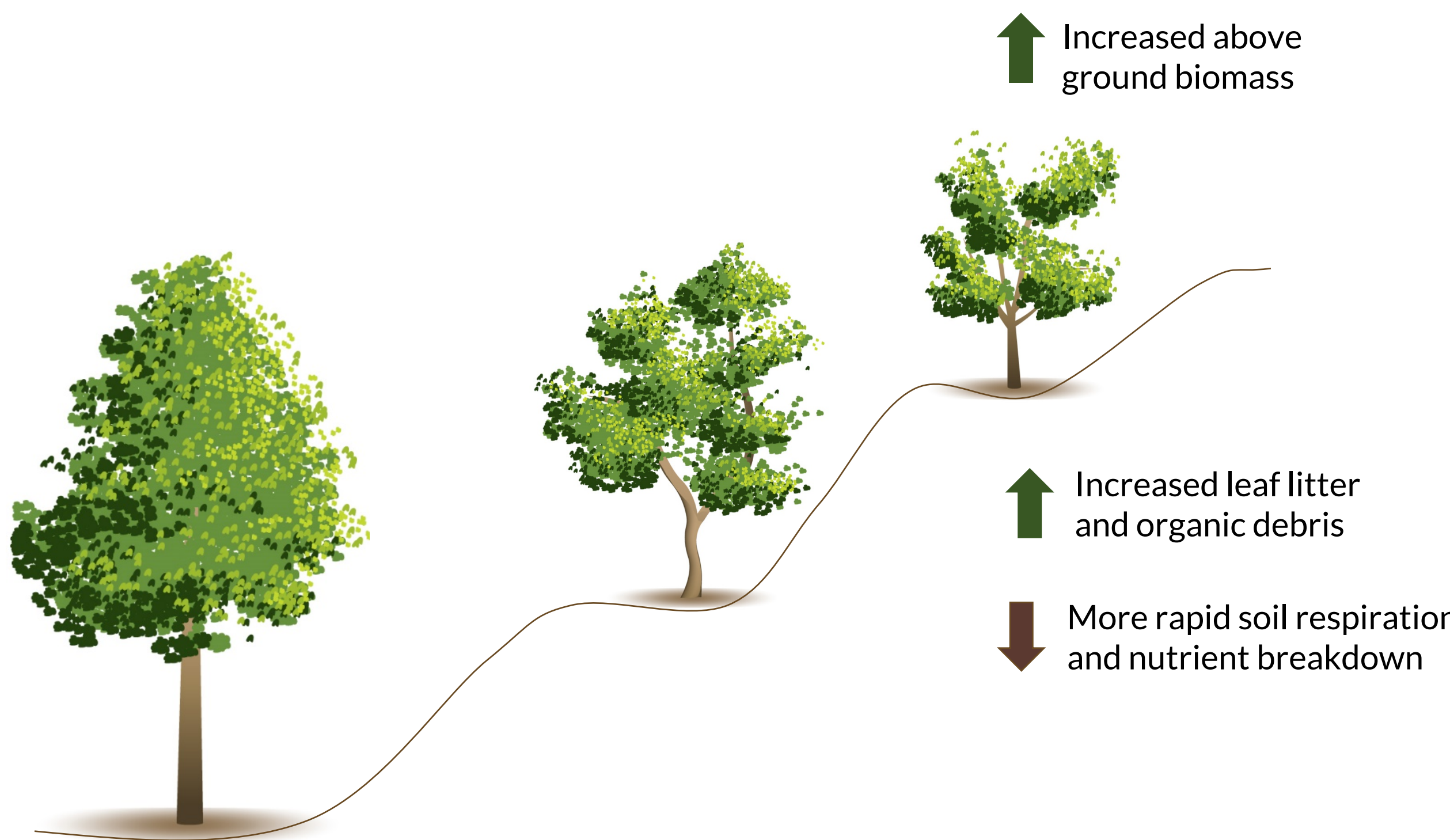
Green circles indicate where tree-lines have moved, red represents locations where tree-lines have remained stationary

HYPOTHESIS

What happens to carbon budgets when treelines migrate?

Three main hypotheses have been suggested;

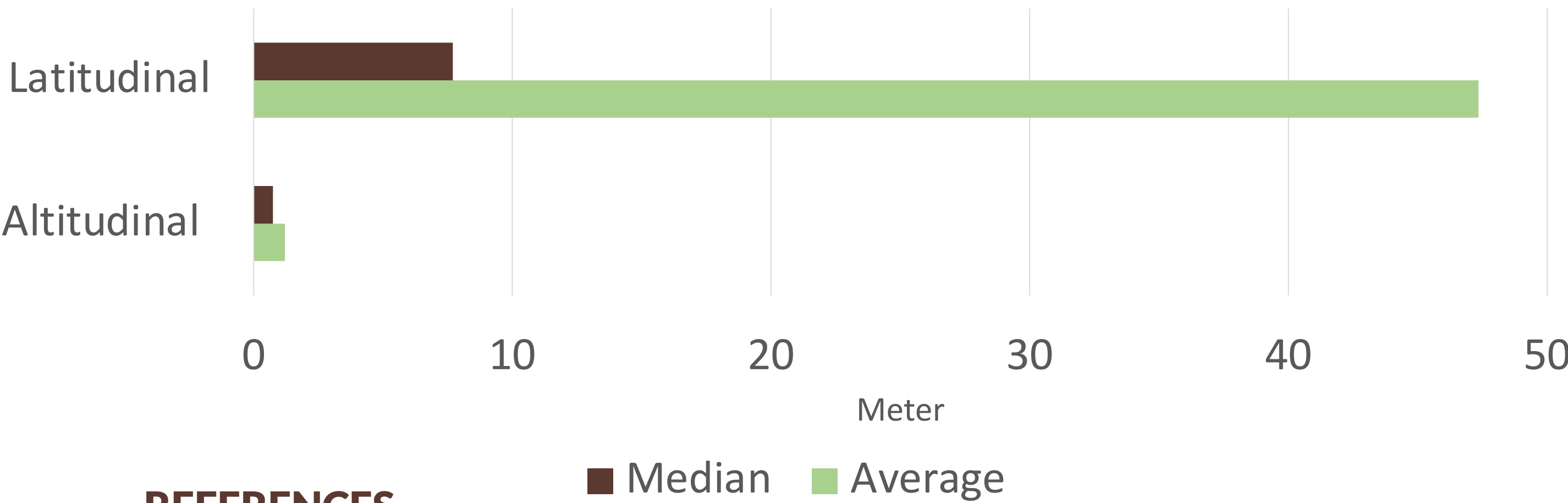
- (i) increased above ground biomass will lead to greater carbon sequestration and storage with more litter increasing both soil and above-ground carbon storage²,
- (ii) shrub expansion will cause a net release of carbon, as shrubs increases the rate of respiration and causes more rapid soil carbon turnover³,
- (iii) these changes will balance themselves out, leading to no change in the overall carbon storage of the ecosystem⁴



TREE-LINE MOVEMENT IN MOUNTAINS vs TUNDRA

The influence treeline movements have on carbon storage also depends on how quickly the change is occurring. Latitudinal treelines tend to move at a much quicker rate than altitudinal treelines. Consequently, tundra is quickly converted into forests in several high arctic regions. This can have potentially catastrophic impacts on carbons storage.

Annual treeline movement



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