

Biomechanical effects of trees in a mountain temperate forest

Implications for biogeomorphology, soil science, and forest dynamics

The biomechanical effects of trees are a potentially significant factor in biogeomorphology, pedocomplexity, and – through the influence on the successfulness of tree regeneration – forest dynamics. Nevertheless, apart from tree-uprooting dynamics, research on this issue has been only sporadic so far.

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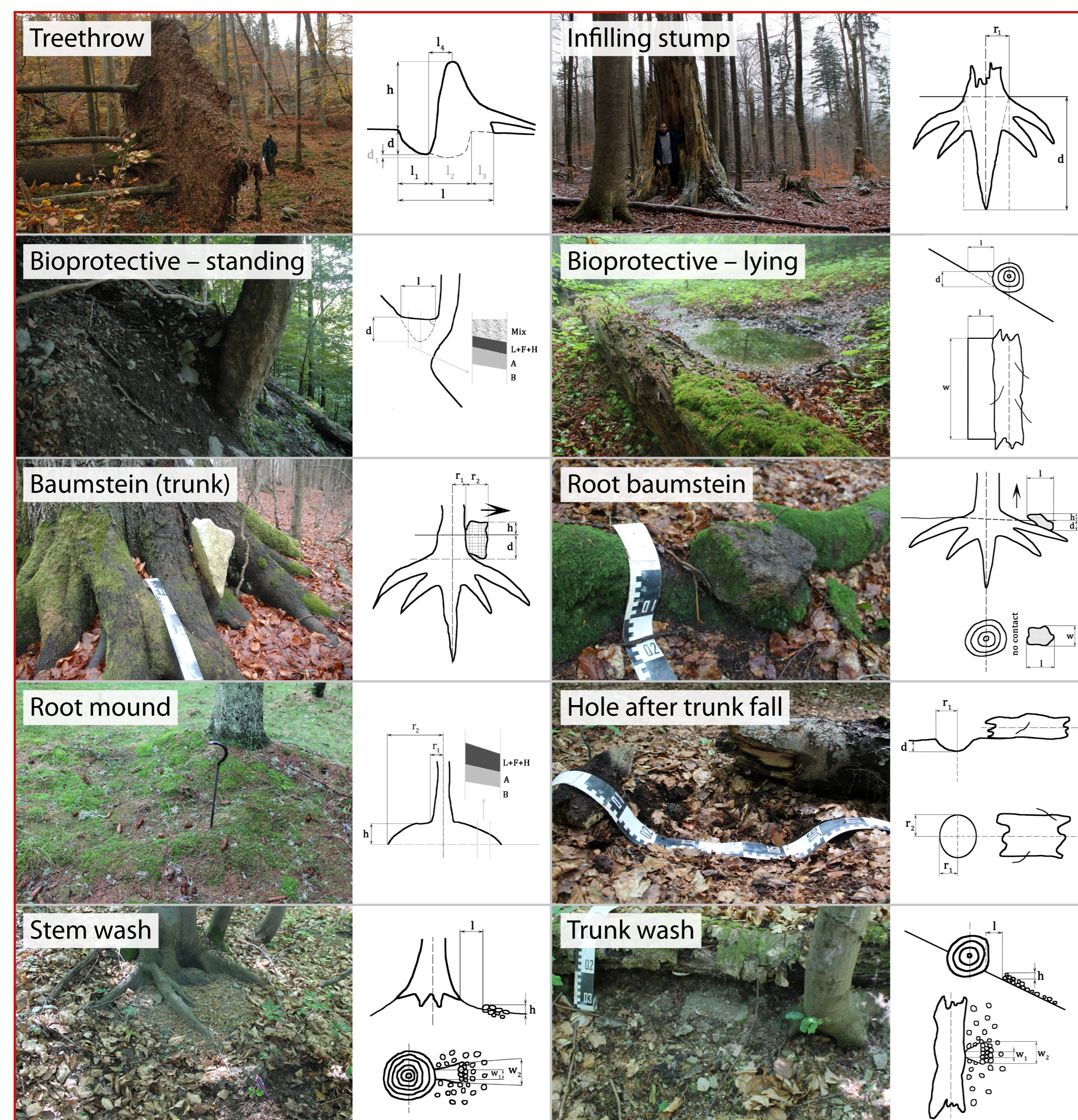
Aims

- 1 To elaborate a detailed and widely applicable methodology of quantification of the main biomechanical effects of trees (BET) in soil.
- 2 To reveal actual (minimal) frequencies, areas and volumes related to these effects in a mountain temperate old-growth forest.

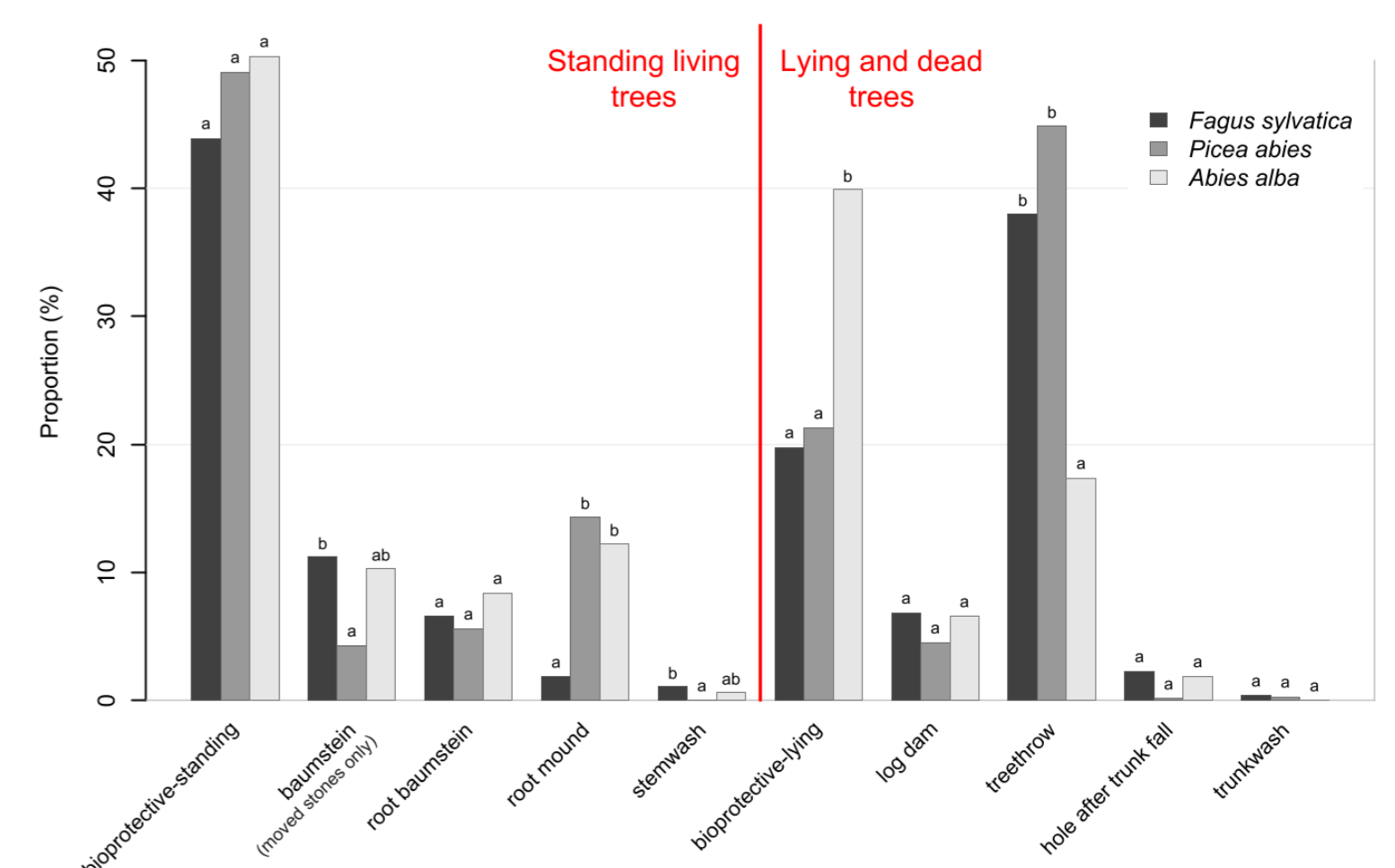
Highlights

10 ha of forest (4,000 trees) studied — 10 BET identified — 59% of standing and 51% of lying dead trees with non-trivial biomechanical effects — opposing phenomena expressed simultaneously by 1/10 of trees — significant differences in BET between tree species and diameter classes — bioprotective function most frequent — 343 m² ha⁻¹ influenced by living trees — 774 m² ha⁻¹ occupied by older treethrow pit-mounds — 228 m³ ha⁻¹ of soil associated with studied phenomena (predominantly treethrows, followed by stump infilling)

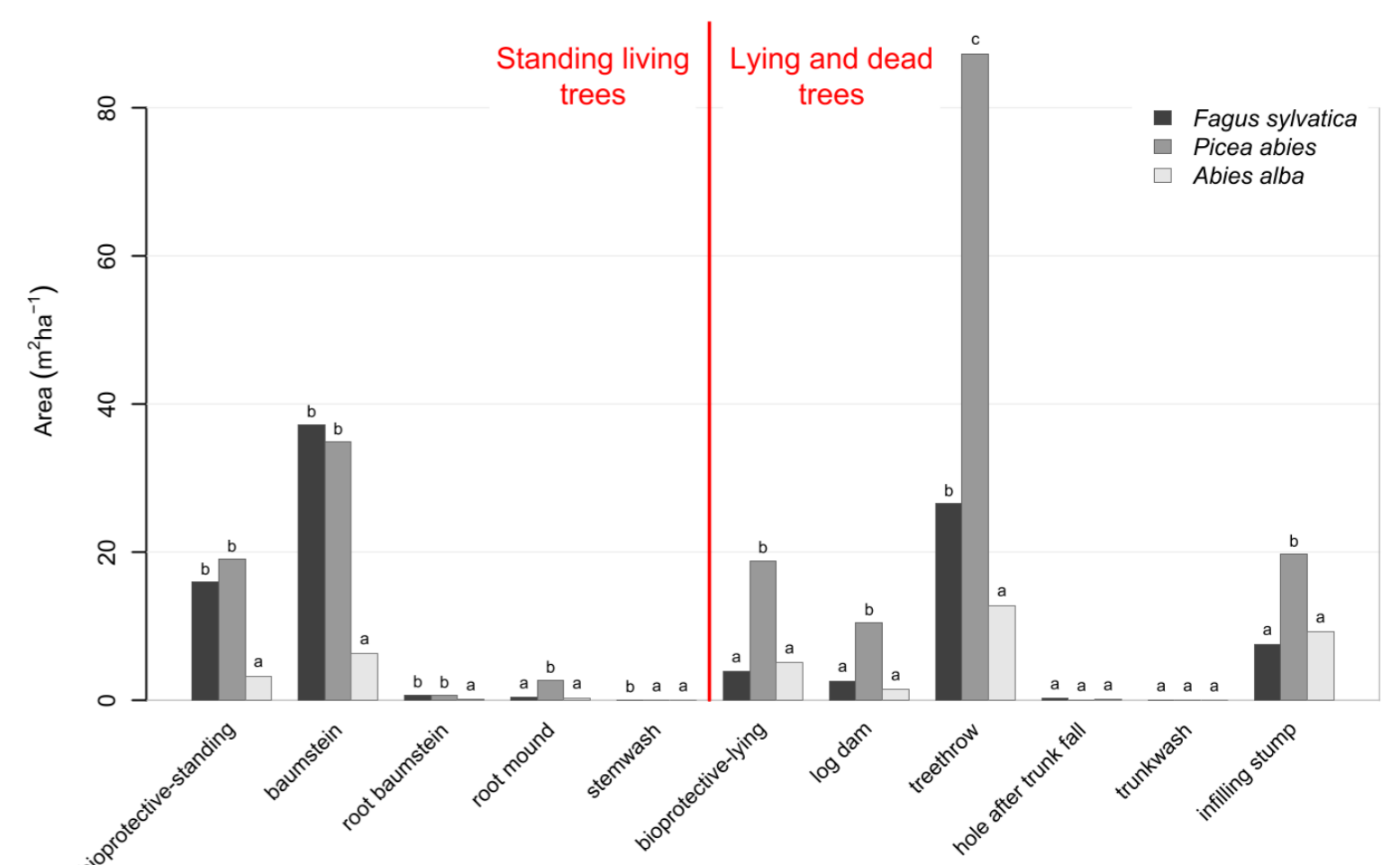
Identified BET



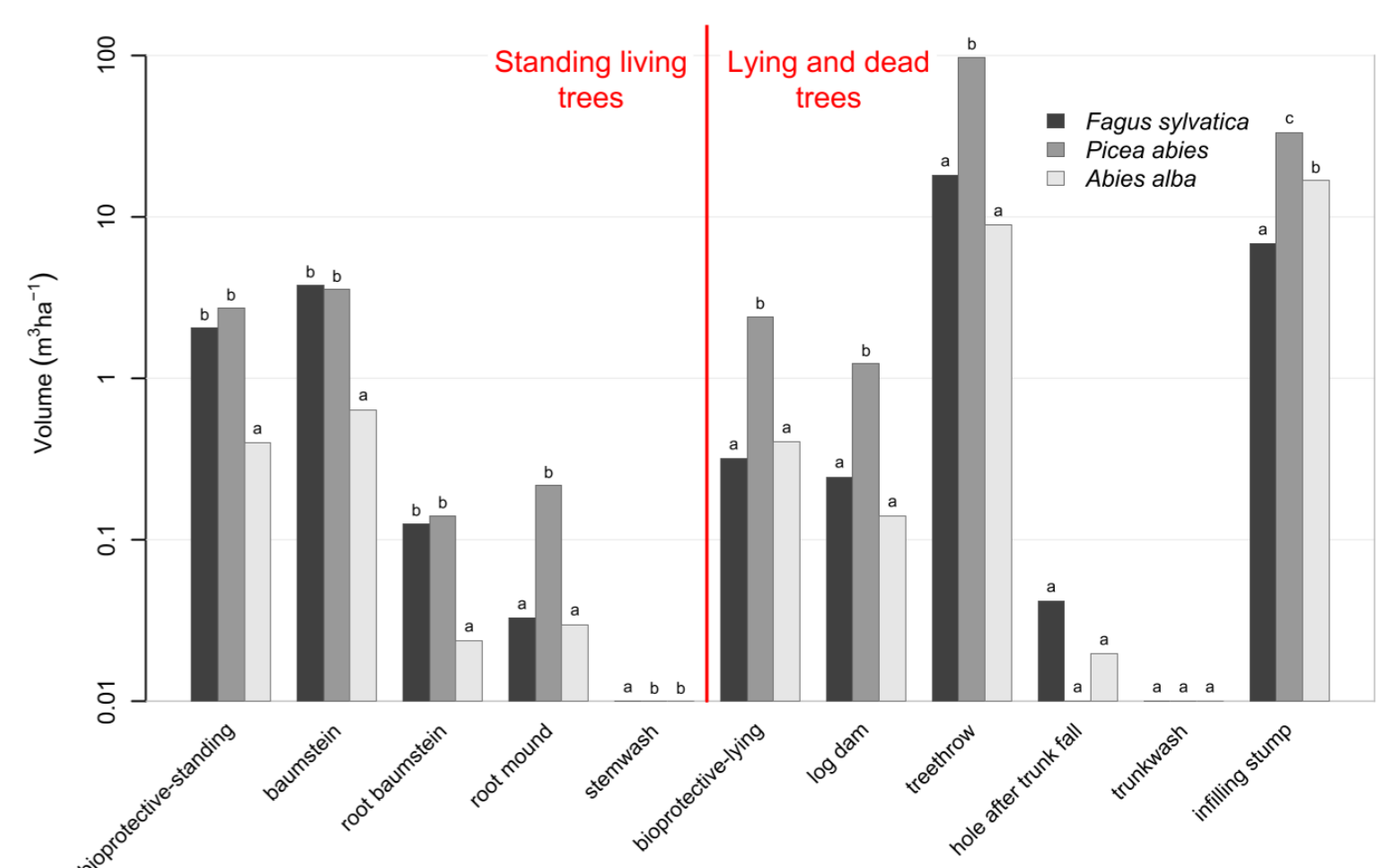
Comparison of BET



Proportions of trees of different species exhibiting individual BET



Areas associated with the studied BET according to tree species



Volumes associated with the studied BET according to tree species (note the logarithmic scale of y axis)

Methods

The research took place in the Boubín Primeval Forest in the Czech Republic. The forest reserve is dominated by spruce (*Picea abies*) and beech (*Fagus sylvatica*) with an admixture of fir (*Abies alba*) and belongs among the oldest protected areas in Europe. The reserve occupies NE slopes of an average inclination of about 14° on gneiss at an altitude of 930–1110 m a.s.l. We evaluated effects of all standing or lying trees of diameter at breast height (DBH) ≥ 10 cm in an area of 10.2 ha. We accepted and measured only clearly visible effects of trees, and therefore we expect that at least the minimal extents of the biomechanical processes were evaluated. During areal and volumetric assessments, each form was approximated by basal geometric shapes.



Study area location

These results demonstrate the ability of trees to significantly contribute to soil and landscape evolution. We assume significant differences in the structure of biomechanical effects of trees in managed forests.

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