EGU2020-15999
https://doi.org/10.5194/egusphere-egu2020-15999
EGU General Assembly 2020


# Tree death as a crucial geomorphic agent in temperate forests: effects of weak and severe disturbances from local to continental scale

**Pavel Šamonil**[1,2], Pavel Daněk[1,3], James A. Lutz[4], Jakub Jaroš[1,2], Anna Rousová[1,2], Kristina J. Anderson-Teixeira[5], and Dušan Adam[1]

[1]Department of Forest Ecology, The Silva Tarouca Research Institute, Brno, Czech Republic
[2]Department of Forest Botany, Dendrology and Geobiocoenology, Faculty of Forestry and Wood Technology, Mendel University in Brno, Brno, Czech Republic
[3]Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic
[4]Wildland Resources Department, Utah State University, Logan, Utah, USA
[5]Conservation Ecology Center, Smithsonian Conservation Biology Institute, Front Royal, Virginia, USA

Hillslope processes in terrestrial ecosystems are significantly modified by changes in climate and land use. At the same time they strongly influence ecosystem retention capacity, pedocomplexity and biodiversity. This undoubtedly makes hillslope processes one of the crucial components of terrestrial ecosystem dynamics. In this study we focus on the long overlooked biogeomorphological impact of tree death in forested landscapes. Tree uprooting caused by strong storms affects soil and regolith formation and movement quite differently from the decomposition of intact root systems of standing trees that died due to e.g. fire or bark beetle infestation. We quantify the biogeomorphic processes associated with tree death in various terrestrial forest ecosystems and specifically assess (i) the significance of these processes in hillslope dynamics (e.g. slope denudation) of forested landscapes and (ii) the extent to which infrequent severe disturbances can shape these dynamics.

We used data from repeated tree censuses carried out in ten permanent forest plots (13–74 ha in area) located in Central Europe and North America, differing in a range of characteristics such as tree species composition, climate and disturbance regime. In total, life history of more than 134,000 trees was recorded over periods of up to 47 years, during which about one third of these trees died. Using this information together with empirical models and allometric equations we were able to quantify the average areas and volumes of soil annually affected by dying trees. These quantities differed markedly between sites with different disturbance regimes. Tree uprooting-related volumes accounted annually for 0.01–13.5 $m^3ha^{-1}$ reaching maximum values on sites with occurrence of infrequent strong windstorms (Zofin and Boubin primeval forests, Czech Republic). Volumes related to trees that died standing ranged anually between 0.17 and 20.7 $m^3ha^{-1}$ and were highest in the presence of stand-replacing fires (Yosemite National Park, U.S.). Comparison of these quantities with long-term erosion rates derived using cosmogenic nuclides ($^{10}Be$) suggests that on certain sites, over the last few millennia, tree uprooting can be the main

driver of soil erosion.