Changes in forest floor P availability in an unmanaged mountain spruce forest after bark beetle-induced tree dieback: A 15 years study from Šumava mountains

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Background

In unmanaged area of national park Šumava mountains – two mountain catchment-lake systems with dominant mature Norway spruce (*Picea abies*) were disturbed by bark beetle (*Ips typographus*) infestation since 2004. The forest in the Plešné catchments (PL) was infested from 2004 to 2008, resulting in the death of approximately 90% of trees. In the catchment of Čertovo Lake (CT), tree dieback, since 2019 has accelerated.

Trees infested by bark beetles quickly die

Trees lose needles, which are richer in nitrogen, phosphorus and available organic compounds compared to common litter from healthy trees

amount of organic matter on the forest floor increases

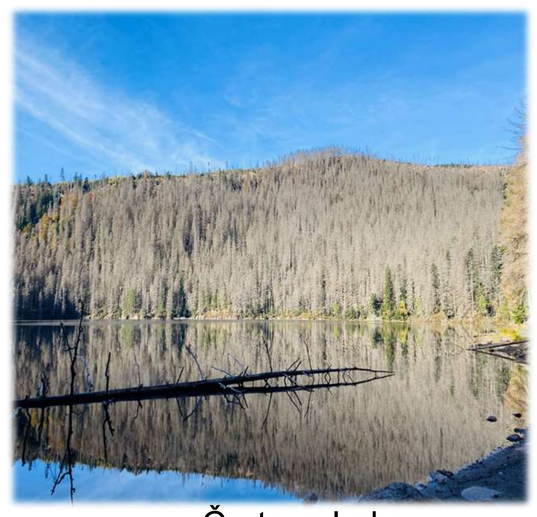
increase in element input to forest floor

Methods

2008 — regular soil sampling in 9-week interval — 2022

- Total phosphorus in soil
- Total phosphorus (TP_{H20}) in water extract
- Soluble reactive P (SRP_{H20}) in water extract
- Organic phosphorus (OP_{H20}) in water extract (=TP_{H20} - SRP_{H20})

Plešné Lake



Čertovo Lake

Findings

- Increasing in litterfall after tree dieback caused the increase in phosphorus concentrations.
- In period of 2006 to 2010 increasing in concentration of TP_{H20} and SRP_{H20} was observed in infested PL catchment.
- The pattern of CT soil response to forest dieback was similar to those of PL, but with lower extent.
- Due to forest regeneration and an increase in phosphorus uptake by trees in subsequent years, the TP_{H20} began to decrease, and proportion of organic P increased.

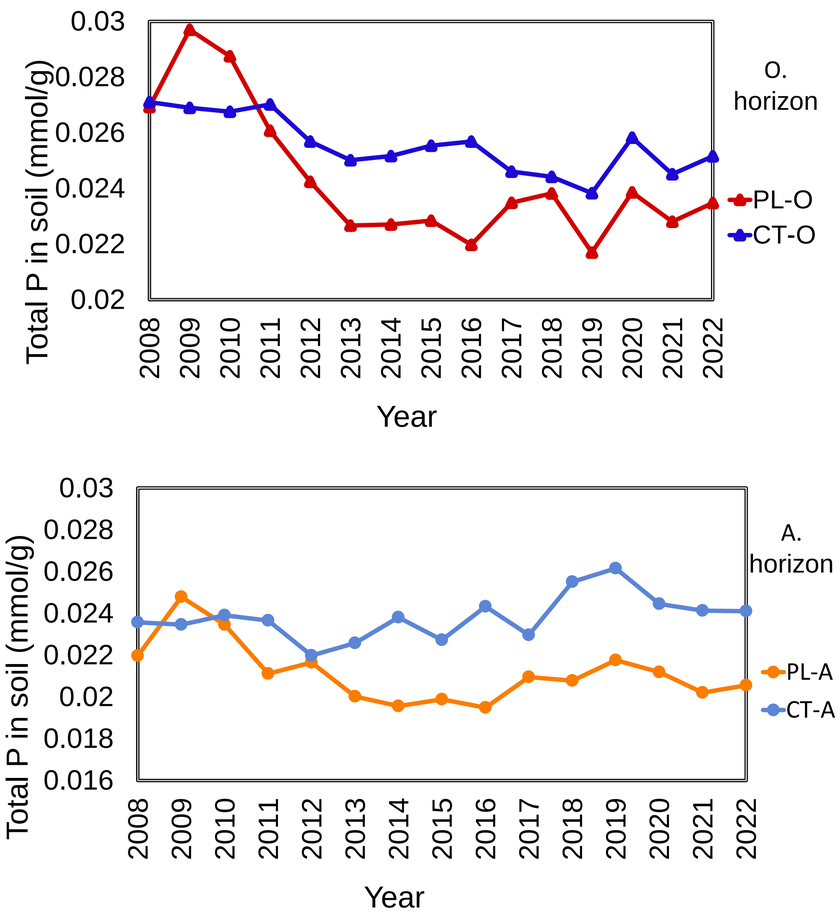


Fig. 1 –Average annual concentration of total P in soil in period from 2008 to 2022 in O – top graph and A horizon in catchments of Plešné (PL) and Čertovo (CT) Lake

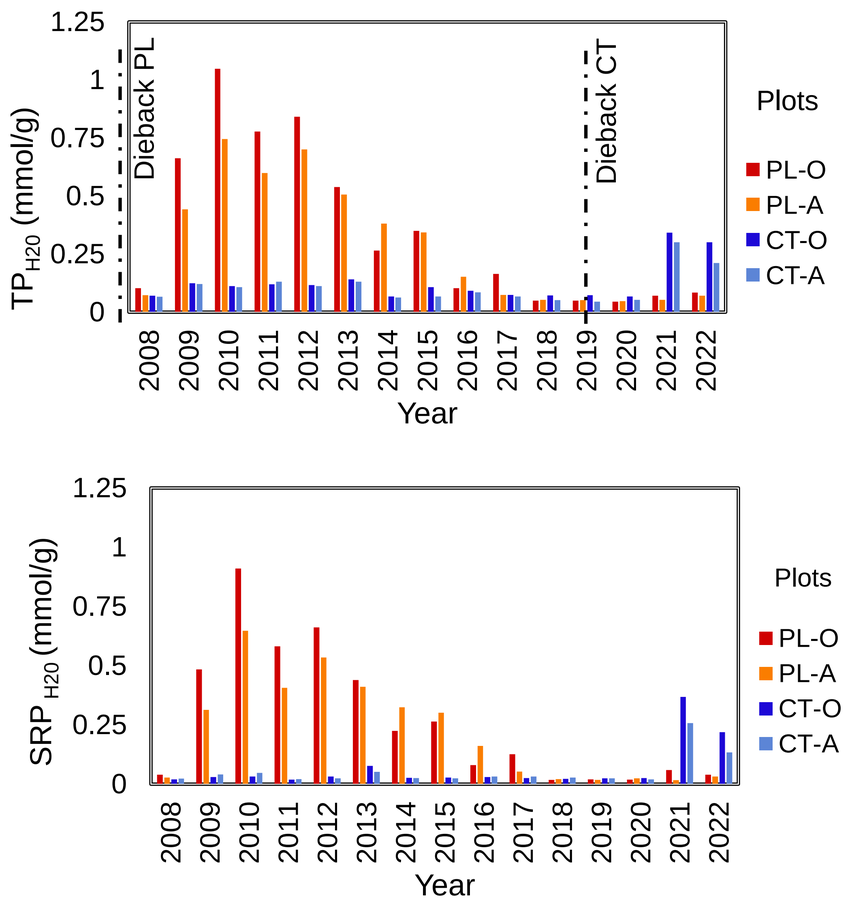


Fig. 2 –Average annual concentrations of TP_{H2O} and SRP_{H20} in period from 2008 to 2022 in O and A horizon in catchments of Plešné (PL) and Čertovo (CT) Lake

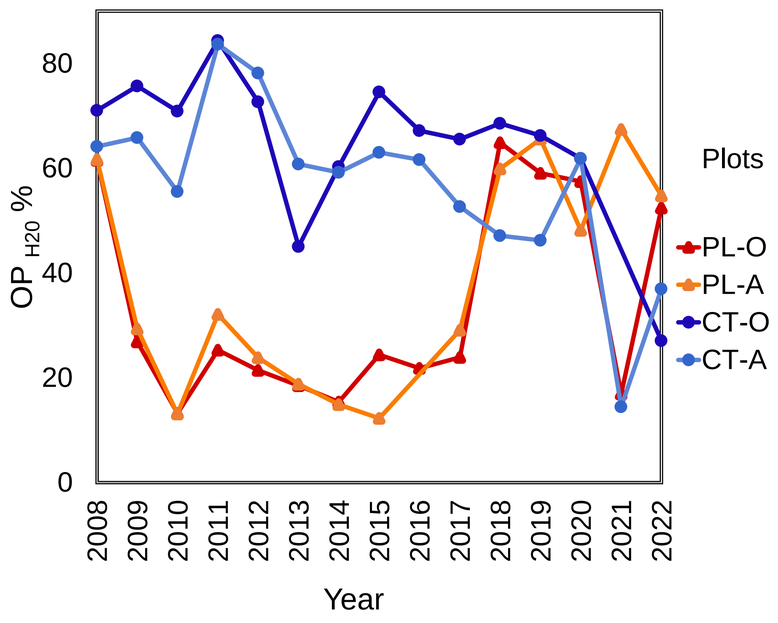


Fig. 3 –Average annual concentration of OP_{H2O} period from 2008 to 2022 in O and A horizon in catchments of Plešné (PL) and Čertovo (CT) Lake

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