Influence of the bark beetle outbreak in the watershed Plešné Lake on the physico-chemical characteristics of terrestrial and aquatic ecosystems

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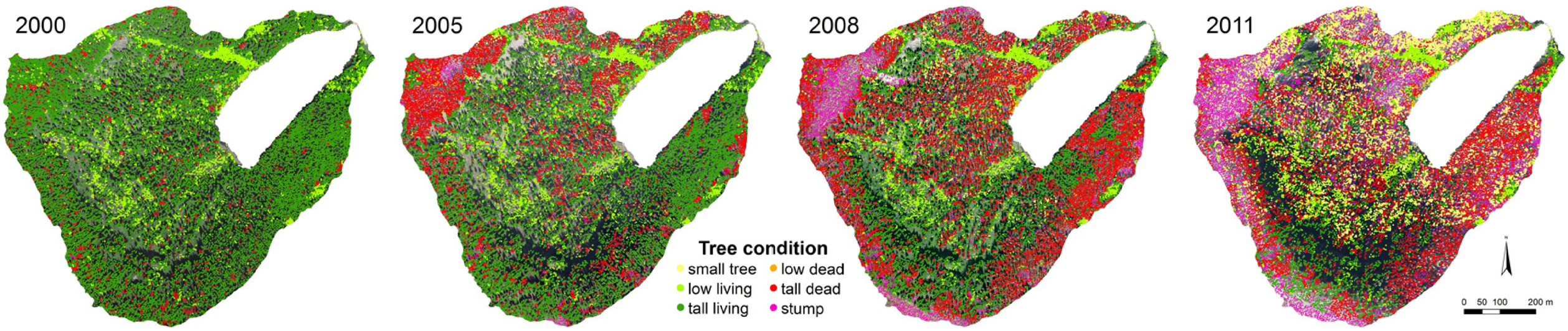
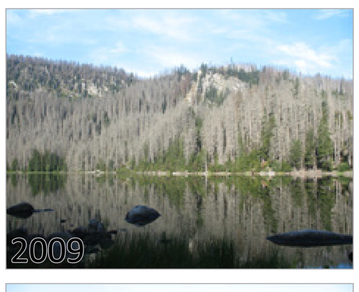
An input of organic matter and nutrients into the soil temporarily sharply increases due to the decay of mountain spruce forests (litter aerial parts of trees and roots decay). Nutrients retention in the tree layer decreases at the same time. Climatic conditions of soil (humidity and temperature) change by opening forest undergrowth. It alters nutrient mineralization, nitrification rates, nitrate leaching intensity and further element cycles. Changes in the soil and water chemistry are caused by increased element runoff.

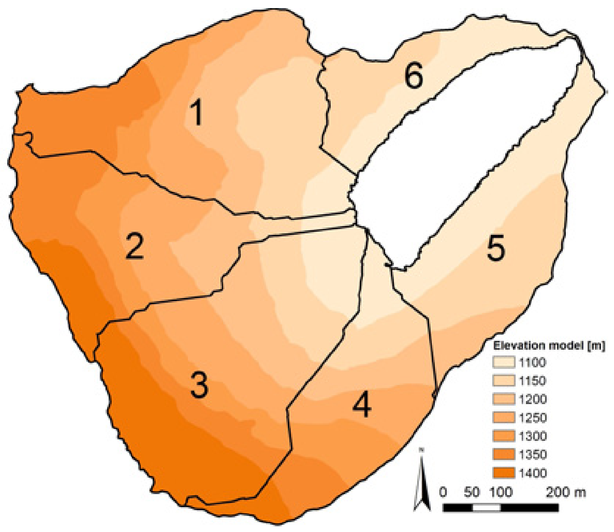




Semi-hemispherical photography

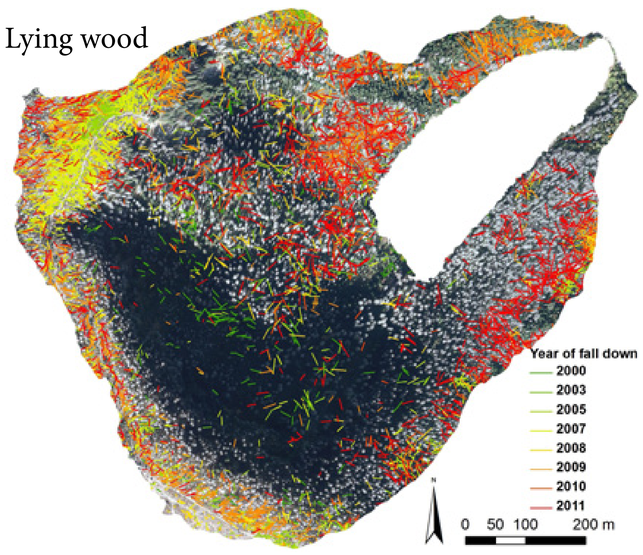
Goals

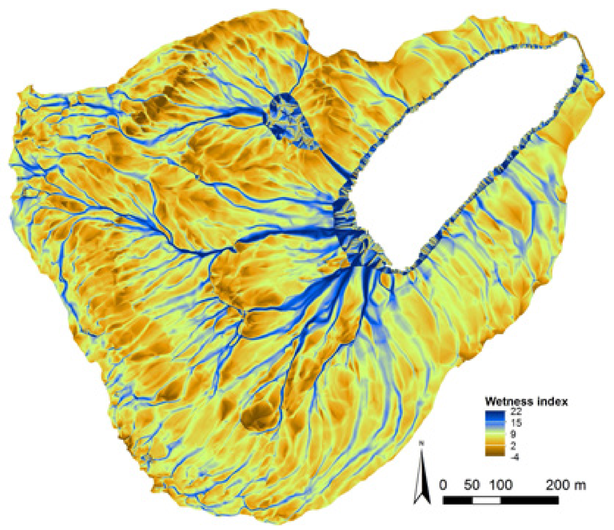
This study aims to describe the gradual decline of the mountain spruce forests after bark beetle attack. The area of interest has been monitored since 2000, four years before the bark beetle onset. The impact of forest decay on microclimate conditions (temperature, energy balance, water cycle), the water and soil chemistry and balance of selected nutrients (especially N, P, K, Mg) is monitored in the basin. We estimate the total aboveground biomass and nutrient pool of trees and rates of biochemical nutrient exchange between soil and trees.



Methods

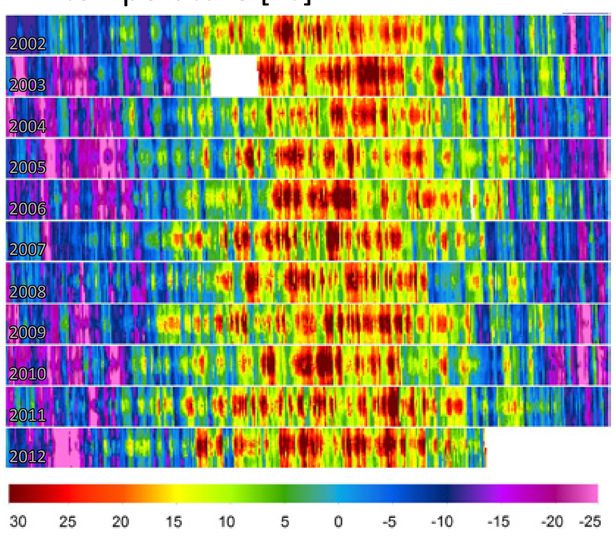
- Creation of forest decay geodatabase (manual counting based on aerial photographs 2000 - 2011)
- Estimation of biomass (nutrient store in wood)
- Estimation of solar radiation input (Area solar energy analysis refined with analysis of semi-hemispherical photography)
- Estimation of changes in air temperature and humidity and their impact on biochemical process rates
- Measurement of litter amount and composition
- Defining of soil and water chemistry
- Determination of new subcatchments





Results

Air temperature [°C]

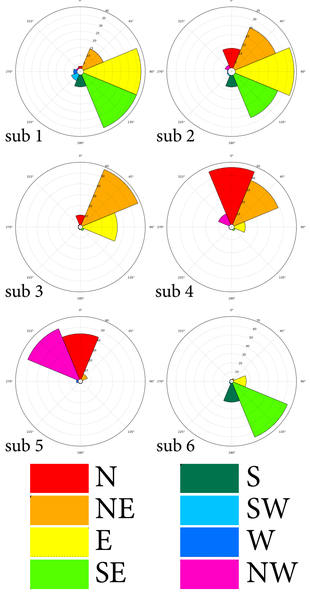


Air temperature:
From left to the right strips show timeline from January to Dececember, down-up they show timeline from morning to evening. Forest decaying at this site started in 2004.

Slope [°]

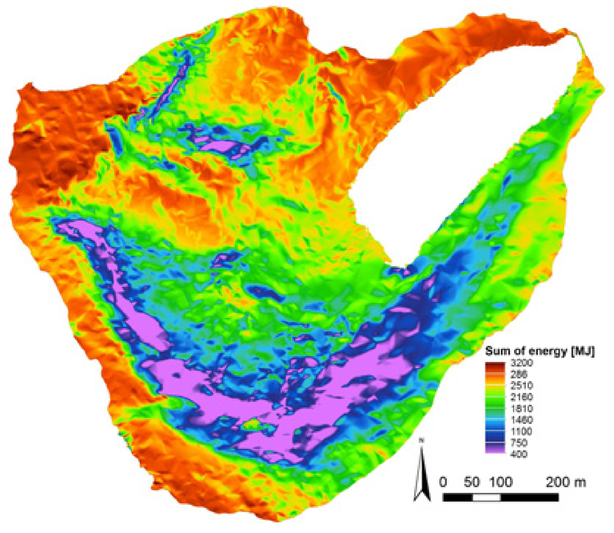
subcatchment	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-90
1	16,0	16,0	30,4	23,7	8,6	2,8	1,7	0,9
2	22,4	13,4	26,0	23,0	7,5	4,9	2,3	0,6
3	15,6	17,2	20,6	25,9	9,2	7,3	4,0	0,2
4	6,3	16,2	27,2	32,2	14,2	3,8	0,1	0,0
5	12,3	41,6	35,2	10,6	0,2	0,0	0,0	0,0
6	11,7	28,8	36,9	20,7	1,8	0,1	0,0	0,0

Aspect [degree]



Amount of tree per hectar

tree condition	2000	2005	2008	2011
small tree	0,7	10,2	19,4	132,9
low living	55,8	54,2	49,9	70,6
tall living	283,9	200,9	91	46,7
low dead	0,2	1,8	4,5	7,1
tall dead	21	95,4	160,4	136,3
stump	0,2	8,8	55,4	134,2
lying wood [m]	3291	20214	57395	143186



Conclusions

Forest started to decay in 2004 and this process has continued untill now. Forest decay resultes in higher air temperature maxima during the vegetation season and extending vegetation season itself. The water chemistry has been significantly altered.

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