Eidgenössische Technische Hochschule Zürich
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Master Thesis

The effects of drought on resin production of *Pinus sylvestris* in a long-term irrigation experiment in Pfynwald in the canton of Valais

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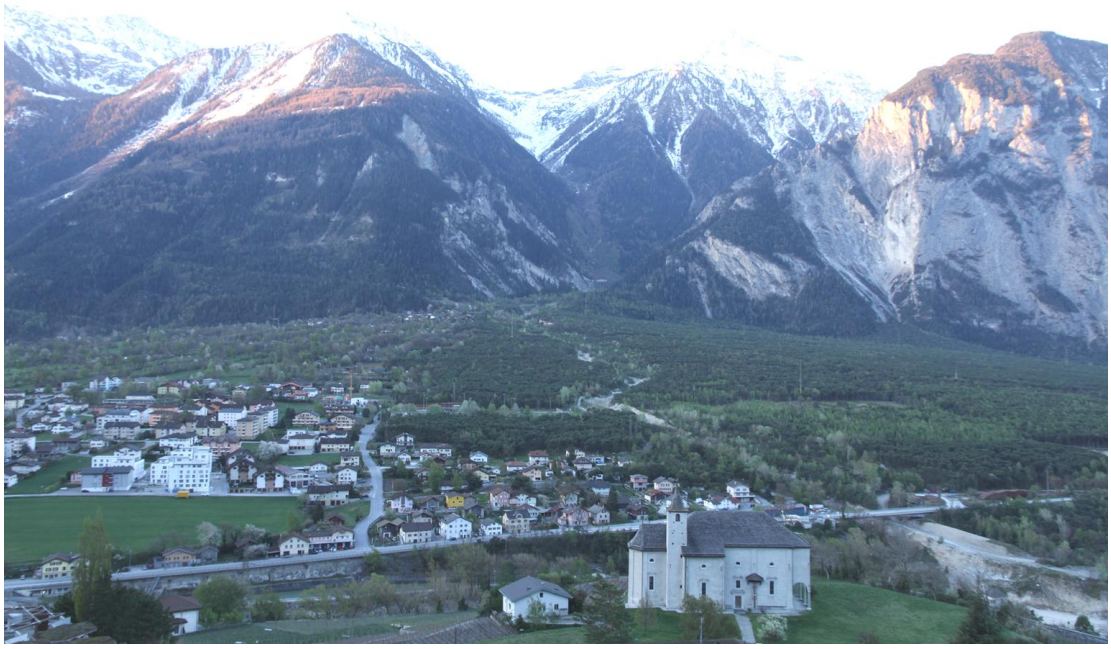
February 2015



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Abstract

Resin flow is an imminent defense mechanism of conifer trees. Stressors such as drought and pathogens can reduce resin flow, thus leaving species such as *Pinus sylvestris* more susceptible to tree killing beetles. Trees growing in the dry inner-alpine valley of Valais, Switzerland grow under dry conditions, are regularly exposed to additional stressors, such as mistletoe, and are thus susceptible to the phloeophagous beetles *Tomicus piniperda*, *Tomicus minor* and *Phaenops cyanea*. In Valais, resin flow can be evaluated on pines growing under limiting conditions. Resin exudation of 102 trees on irrigated and control plots were measured at two occasions over a period of 24 hours in April and in August of 2014. Trees were selected randomly on a gradient from 0 to 100% crown transparency. From a subsample of 40 trees, tree cores were taken for the analysis of growth rates and sapwood area. A total of 17 variables containing tree, environmental and biological-stress factors were tested for their influence on resin flow through linear mixed effects-models (LMM). The sampling team and the tree number were used as random effects in the model, in order to account for a bias due to the sampling team or the individual tree. Tree size and mean temperature during sampling both positively affected resin flow. The combined effects of low competition and high temperature, high growth rate and high mistletoe infestation, and high growth rate and irrigation each had an effect on resin flow. There was no substantial difference between resin flow in irrigated and control plots in 2014, possibly because the above average rainfall diminished the difference of the irrigation effect. Mistletoe infestation and competition reduce the defense capacity of *P. sylvestris,* especially in trees already stressed through drought. The findings suggest that larger trees with dense crowns that express high growth rates potentially have more resin flow and are thus more resistant to invading beetles. Resin flow of *P. sylvestris* is dependent on the tree's vitality as well as on environmental factors and stressors acting upon the tree.