Andrea Ganthaler*, Wolfgang Stöggl, Ilse Kranner & Stefan Mayr

University of Innsbruck, Department of Botany, Innsbruck, Austria

Silvio Schüler, Carlos Trujillo-Moya & Jan-Peter George

Federal Research Centre for Forests, Landscape and Natural Hazards, Dpmt. of Forest Genetics & Dpmt. of Forest Growth and Silviculture, Vienna, Austria

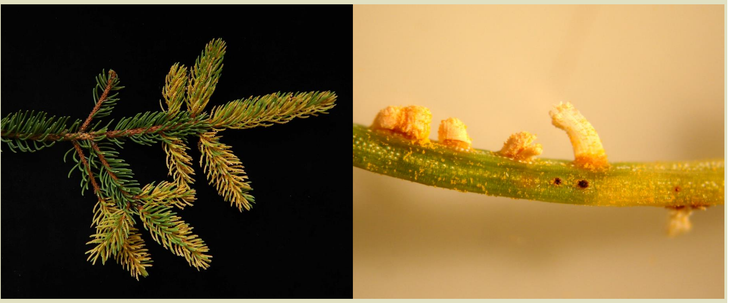
*contact: andrea.ganthaler@uibk.ac.at

PEST DAMAGES IN MOUNTAIN FORESTS:

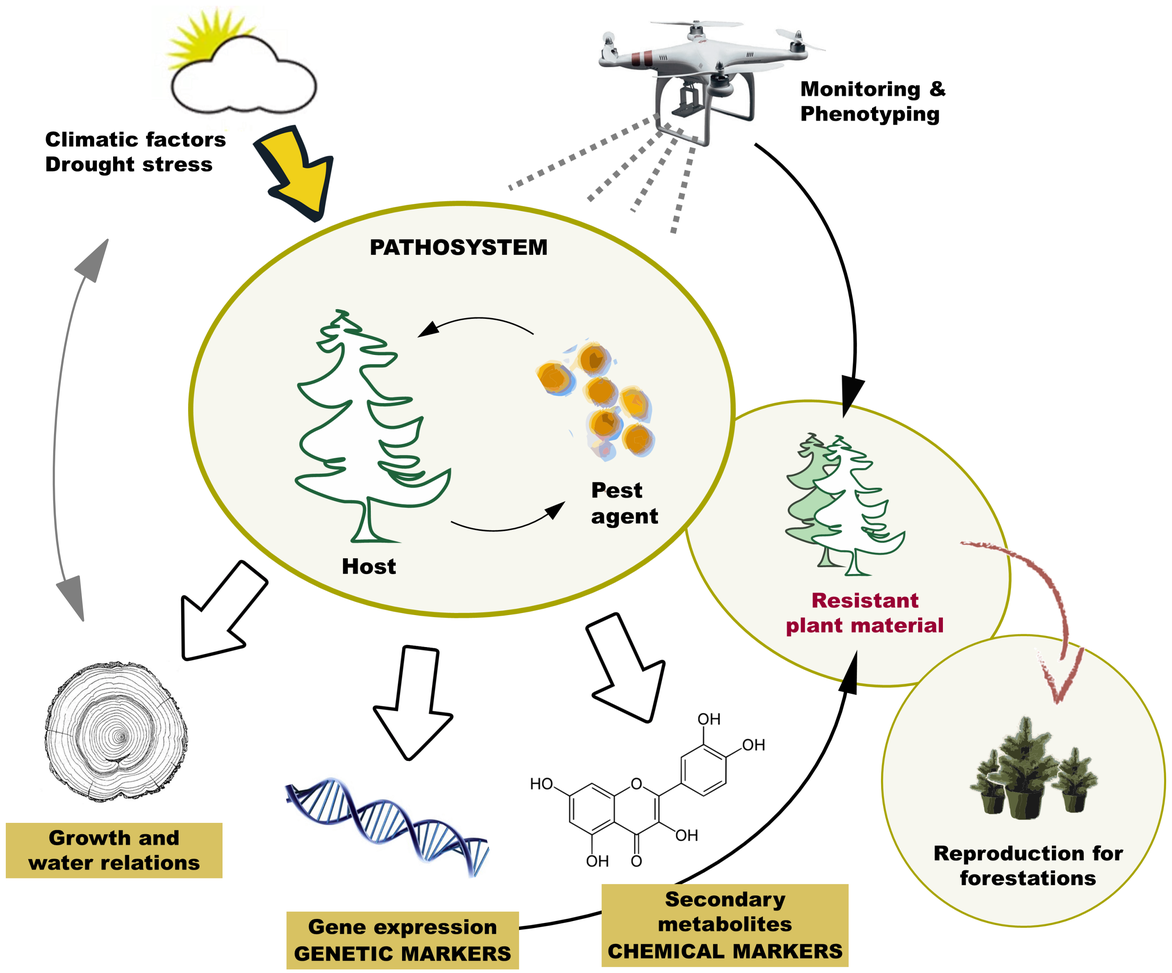
Analysis of tree resistance mechanisms and development of new tools for sustainable afforestation

Background

- Climate change will affect pest caused forest damages directly due to more favourable **conditions for pest agents**, and indirectly by altering **tree defence responses**.
- For example, **Norway spruce** trees in subalpine forests of the European Alps are increasingly infested by the **needle rust** *Chrysomyxa rhododendri*.
- The susceptibility to infection varies between individual trees, and rarely specimens with distinct **enhanced resistance** can be found.
- We aim to develop new tools to analyse the underlying resistance mechanisms and to obtain and **use resistant plant material** for afforestations.



Norway spruce infected with needle rust showing characteristic needle yellowing and fungal spore stocks



Methods

- **Quantification of infection degree and tree resistance** on unmanned aerial vehicle (UAV) gained images.
- Quantification of benefits of resistant trees in terms of better **growth, survival, and reproduction.**
- **Analysis of interactive effects** of pest infestation and drought stress.
- Detailed analysis of the **biochemical defence response.**
- Identification of **gene expression patterns and allelic variants** associated with tree resistance.

Results & Conclusions

- Project outcomes help to better understand physiological implications of infection and the **genetic and biochemical mechanisms underlying pest resistance.**
- The defence reaction of Norway spruce to rust infection is based on a **hypersensitive response** associated with phenolic compound accumulation.
- Based on this knowledge, diagnosis tools are developed to **select and reproduce resistant plant material**, which is able to defend pathogen attack but is also adapted to the extreme alpine environment. Approaches include vegetative reproduction and growth of seedlings.

References:

Ganthaler et al. 2014. *Eur J Forest Res* 133, Ganthaler et al. 2017. *Plant Mol Biol* 94, Ganthaler et al. 2018. *Plant Pathol* 67.

The project is supported by the Austrian Science Fund (FWF) P29896-B22.