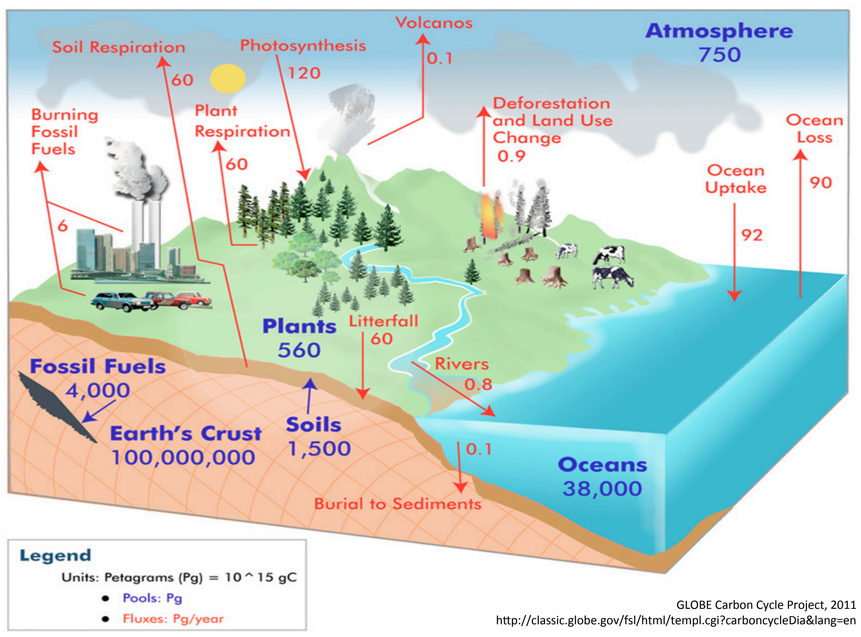
Environmental controls on forest growth in Switzerland

Erin.gleeson@usys.ethz.ch **Erin Gleeson** Institute of Agricultural Sciences
Supervised by Prof. Dr. Nina Buchmann

Background

In 1997, the global community made its first concerted attempt to reduce the flow of carbon from fossil fuels into the atmosphere by signing the Kyoto Protocol. One of the potential measures for reducing greenhouse gas emissions under the Protocol is the sequestration of CO_2 in terrestrial ecosystems (Articles 3.3 and 3.4). Signatory countries such as Switzerland can therefore help **meet their reduction targets** by managing their forests and other highly productive ecosystems such that they act as biological scrubbers by removing CO_2 from the atmosphere. With some of the most densely monitored forests in the world, Switzerland has the potential to not only **accurately estimate forest growth and carbon uptake** in relation to environmental drivers on the annual scale, but also to identify general growth relationships that can be applied to similar environments and similar species elsewhere.

Global Carbon Cycle



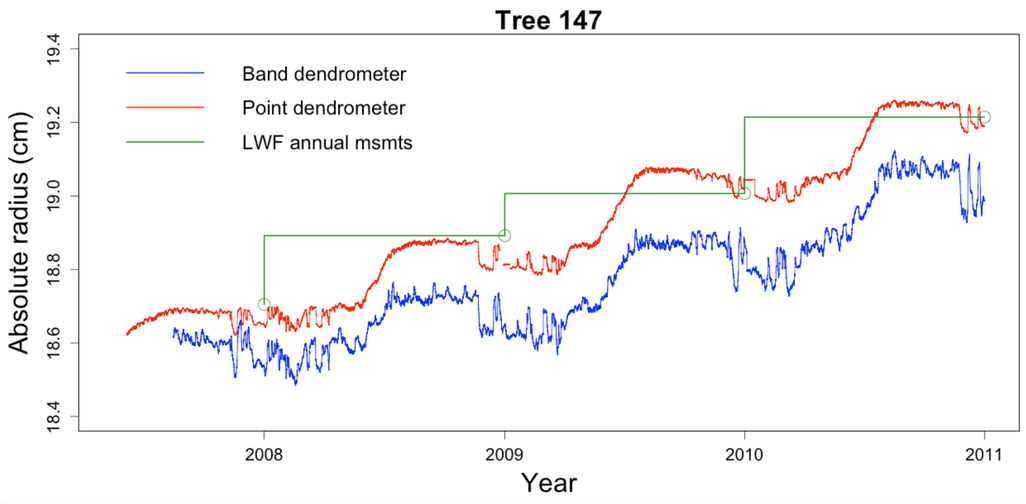
GLOBE Carbon Cycle Project, 2011
http://classic.globe.gov/fsl/html/templ.cgi?carboncycleDia&lang=en

Motivation

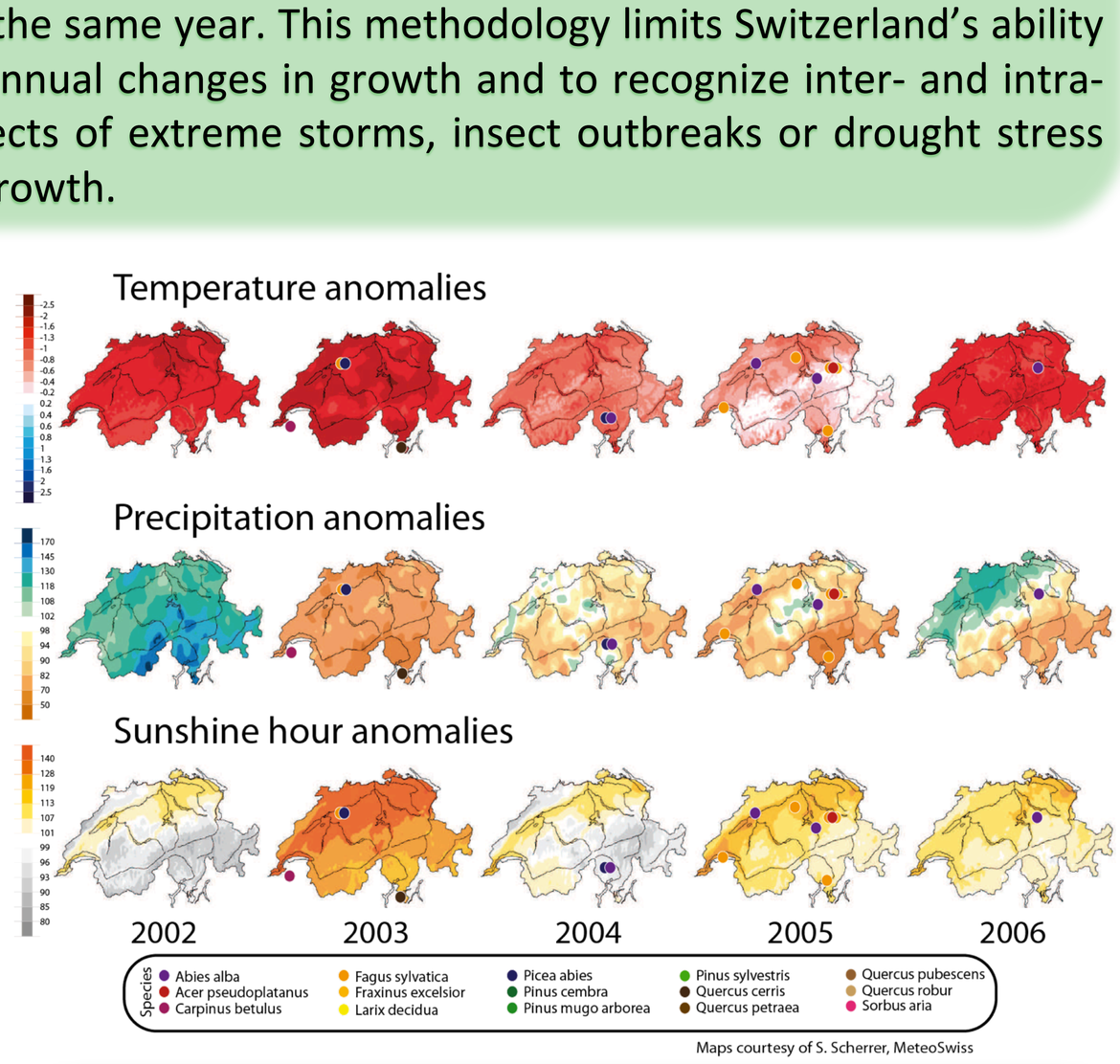
As an Annex-I party to the Kyoto protocol, Switzerland (30% forested) is obliged to supply detailed information regarding changes in its carbon pools. Swiss forest growth is currently assessed by sampling a different subset of forest plots every year over a ten-year cycle. Thus, every subplot is measured once every ten years, but not all plots are measured the same year. This methodology limits Switzerland's ability to report annual changes in growth and to recognize inter- and intra-annual effects of extreme storms, insect outbreaks or drought stress on forest growth.

Visualizing growth patterns.

The maps to the right show climate anomalies with respect to the period 1961-1990. Colored dots indicate the strongest growth year for each species at each of the 18 long-term research sites (LWF). Such maps, upscaled for all of Switzerland at a seasonal resolution, would help forest managers respond better to environmental changes.



One story, different storytellers. Growth data collected using different techniques (dendrometers, cores and girth measurements) and varying time resolutions exist for several key sites. The challenge is to use these data in conjunction with less well resolved data to provide **a regional picture of forest growth**.



Maps courtesy of S. Scherrer, MeteoSwiss

Key questions

- How can we integrate growth data of various resolutions to derive **accurate region- and species-specific estimates** of forest growth and carbon uptake?
- How do **extreme weather events** affect net ecosystem productivity (carbon uptake and release)?
- What role will future climate play in forest productivity, and **how vulnerable are Swiss forests** to future climatic and environmental changes?

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Eidgenössische Technische Hochschule Zürich
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