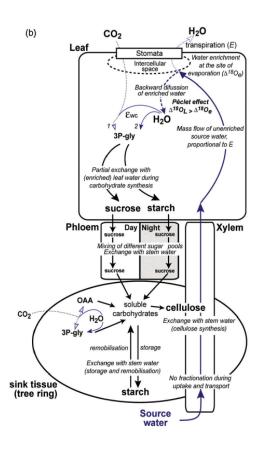


Ecosystem services under pressure



- 1) Temperature (McDowell, pers. Comm.) and precipitation are two of the key drivers of ecosystem processes (Luyssaert et al., 2010)
- Drought is assumed to be a major driver of tree 2) mortality and C metabolism (Allen et al., 2010)
- Under current climate projections drought will be an 3) important factor that determines the performance of particular tree species (Brandes et al., 2007) and of ecosystem services for society (Hanewinkel et al., 2013; Lindner *et al.*, 2014).

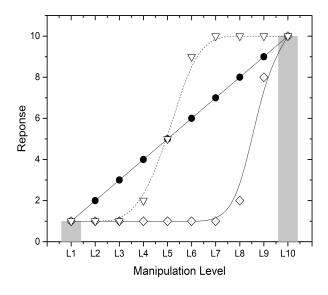
As a consequence, we need more mechanistic information to better predict the trajectories of forest ecosystem functioning and services in a changing climate.



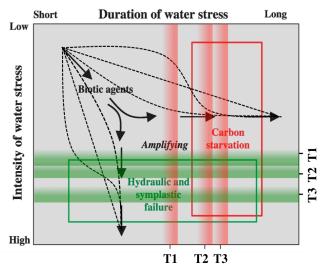


Principle challenges





Linearity or non-linearity?



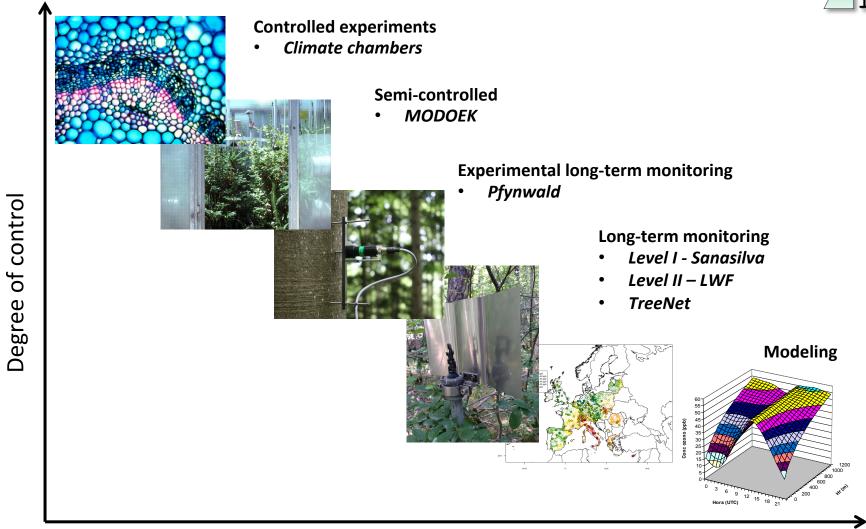
Different thresholds and tipping points?

(adapted figure from McDowell et al., 2008)



Analytical chain of LWF program





Spatial scale



Degree of control

Analytical chain



Controlled experiments

Climate chambers

Semi-controlled

MODOEK

Experimental monitoring

Pfynwald

Long-term monitoring

- Level I Sanasilva
- Level II LWF
- **TreeNet**

Modeling

Experiments

- + Mechanistic understanding
- + Allows for model parameterization
- + Extreme manipulations possible
- +/- Controlled conditions
- Young trees
- Low relevance for ecosystems

monitoring Allows for improved

mechanistic understanding under

Experimental long-term

natural, gradual conditions

+ Different ecosystems + Long-term trends

+ Mature trees

Long-term Monitoring

- + High number of trees
- + From regional to global scale
- + retrospective analyses
- + Allows for model validation
- Mechanistic understanding

Gradient studies

- + Ecologically high relevance
- + Natural/gradual conditions
- + Allows for threshold studies
- Limited number of ecosystems
- Labor intensive



The Swiss LWF program



