

Workshop 2.2. A The future of Mountain forests



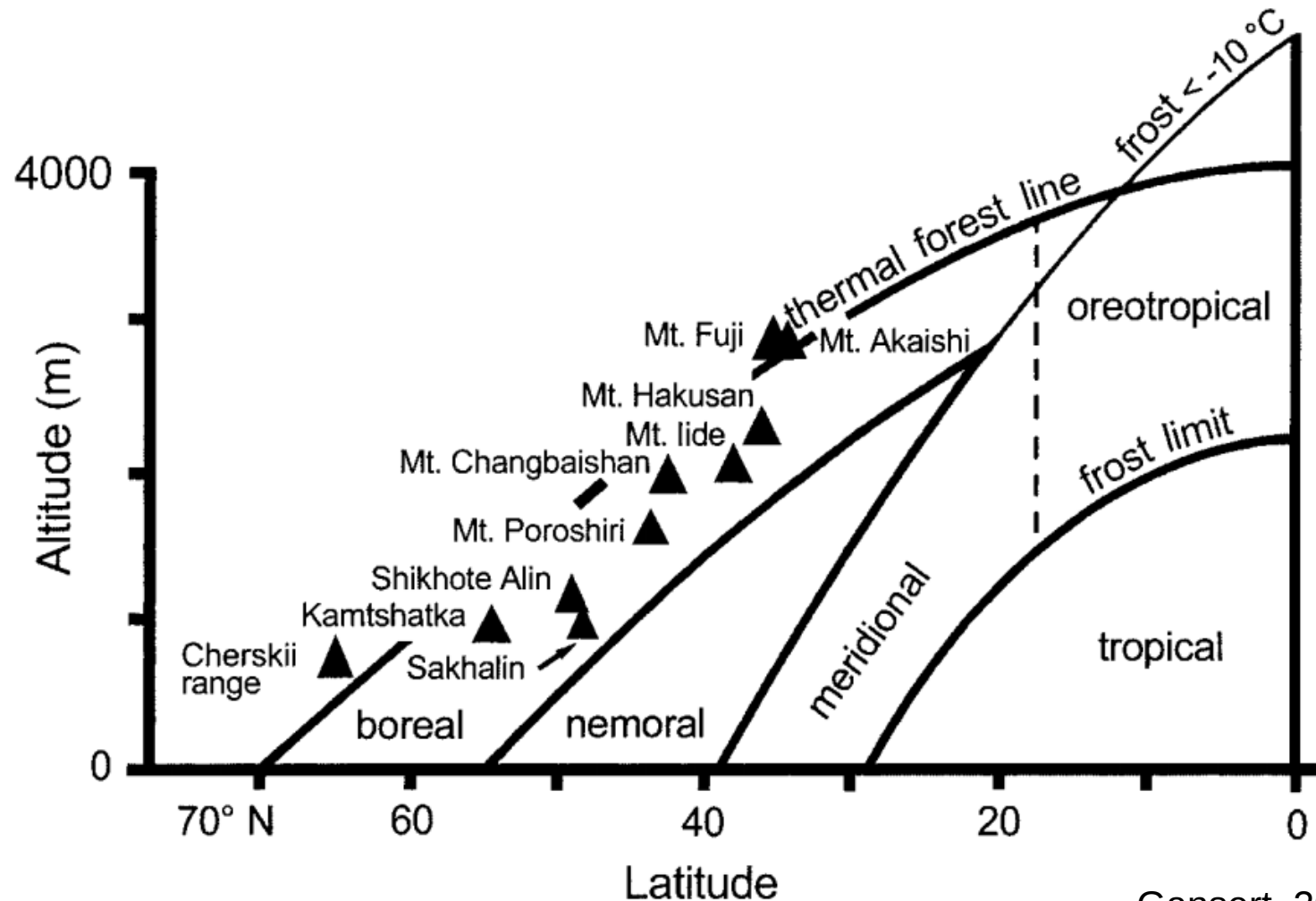
Predicting frost risks in plants



Guillaume Charrier



Temperature & distribution

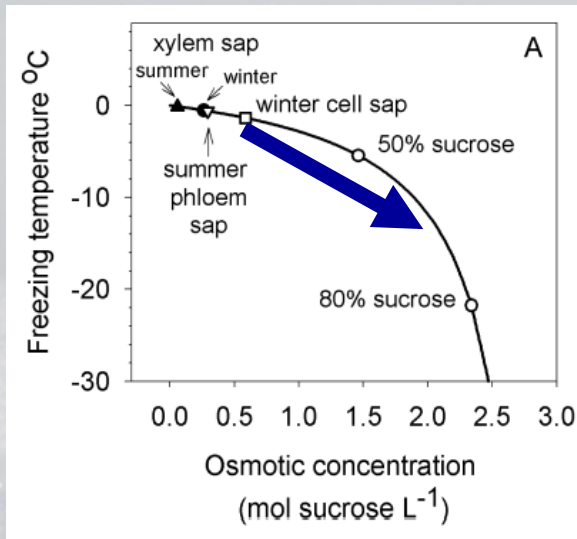
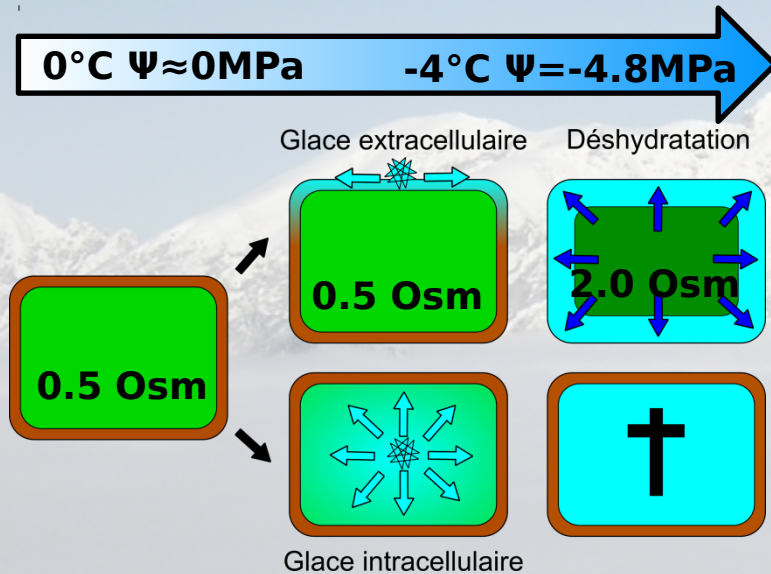


Gansert, 2004

Temperature and especially frost are key limiting factors

Frost damages in trees : two main compartments

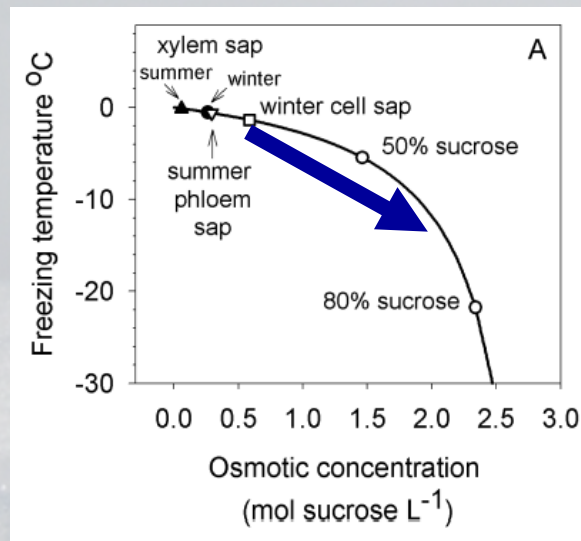
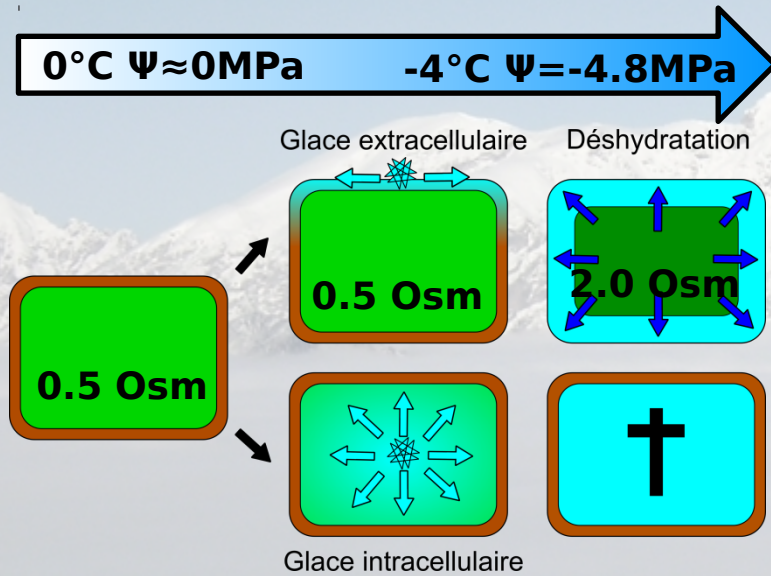
Living cells



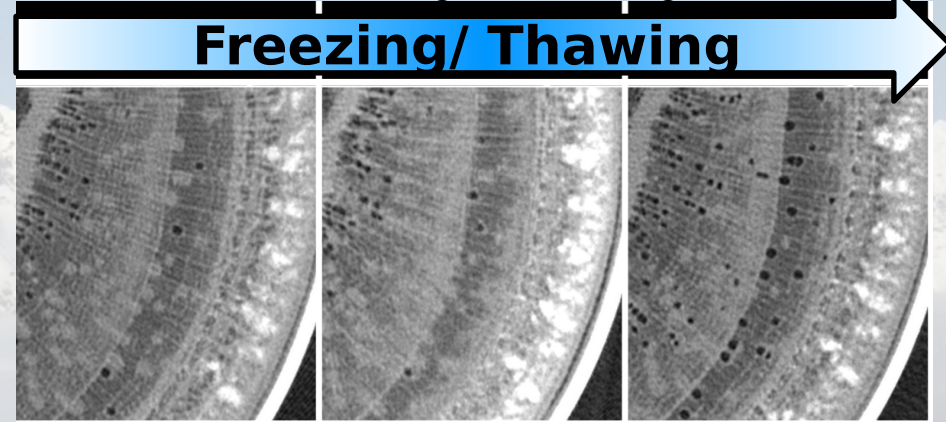
(Cavender-Bares, 2005)

Frost damages in trees : two main compartments

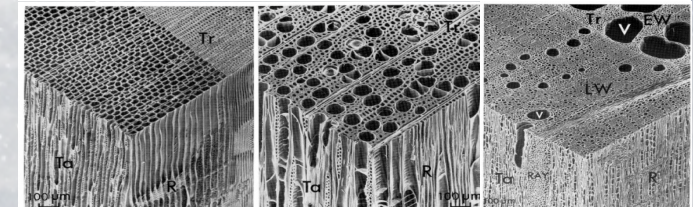
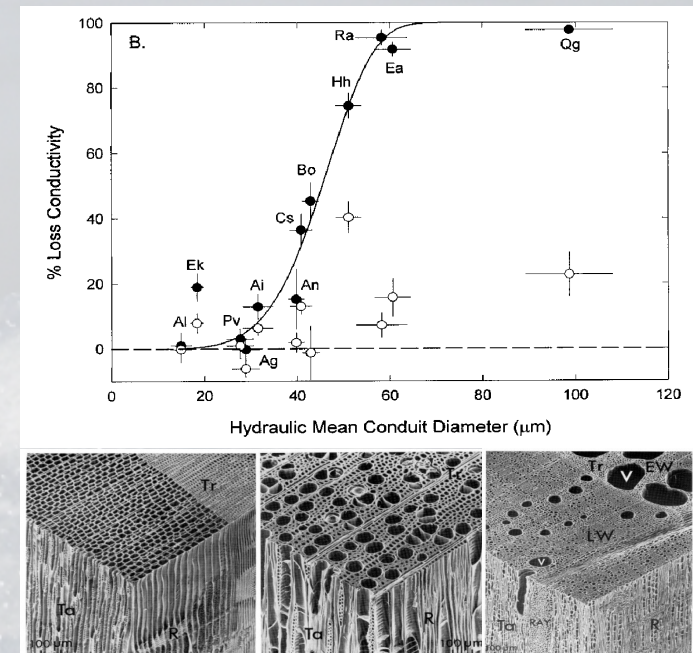
Living cells



Hydraulic system



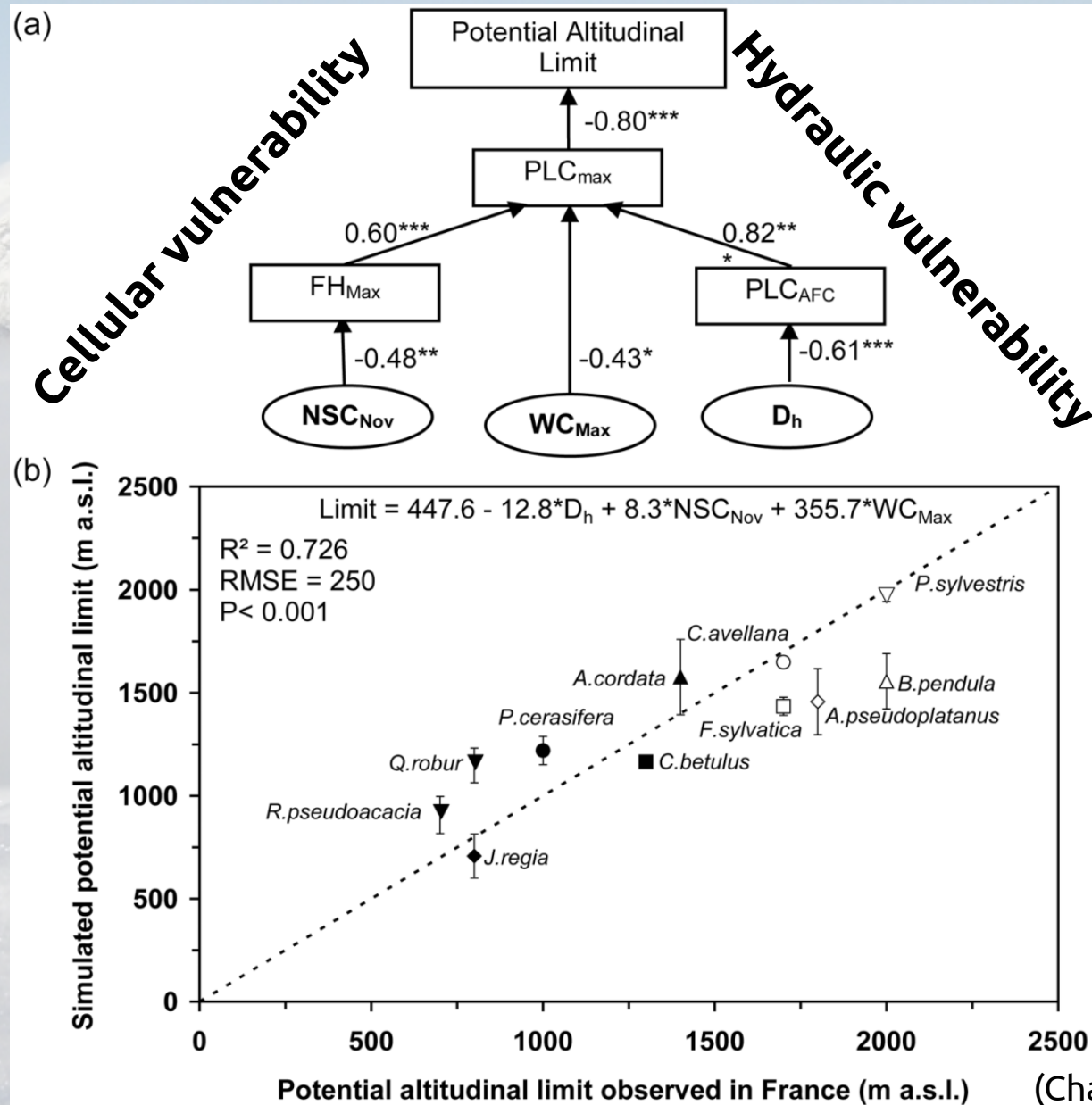
(Charra-Vaskou *et al.*, 2016)



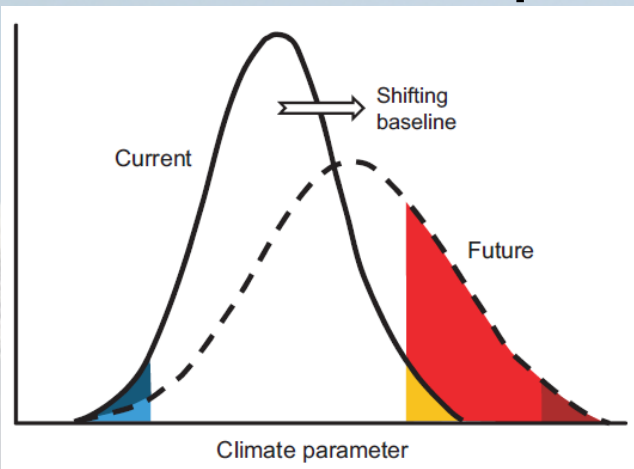
(Davis *et al.*, 1999)

(Cavender-Bares, 2005)

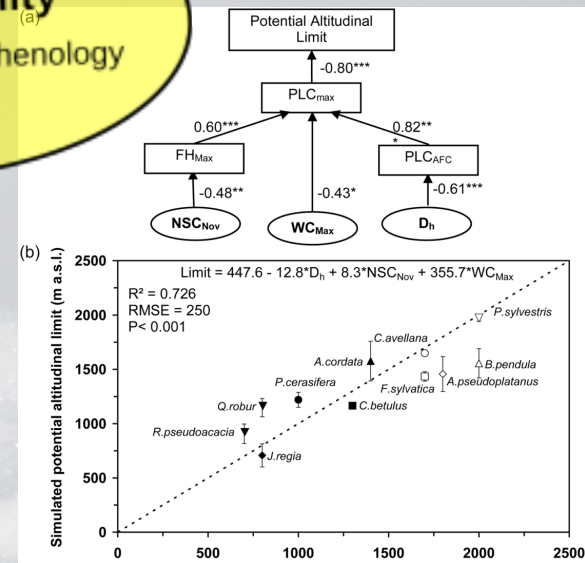
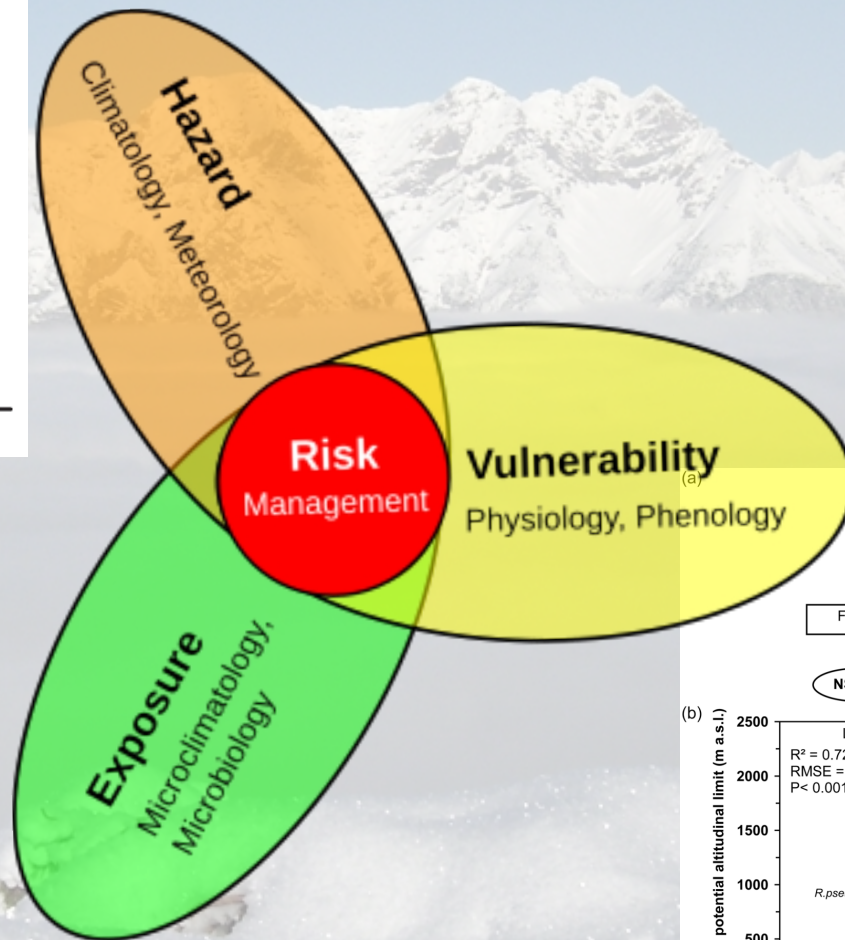
Frost damages in trees : two main compartments



The future of mountain forests : a multidisciplinary approach of risk assessment

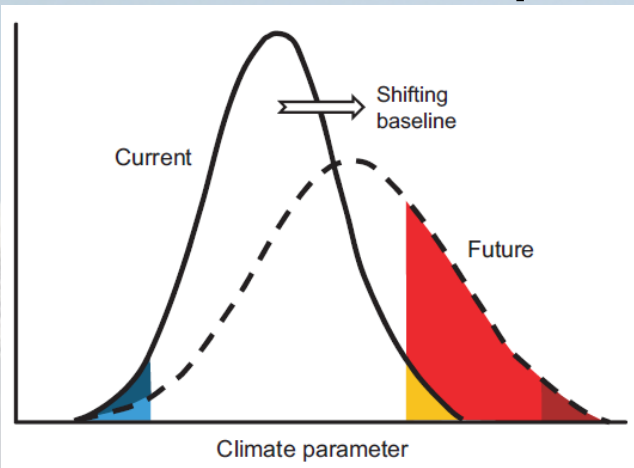


(Smith, 2011)

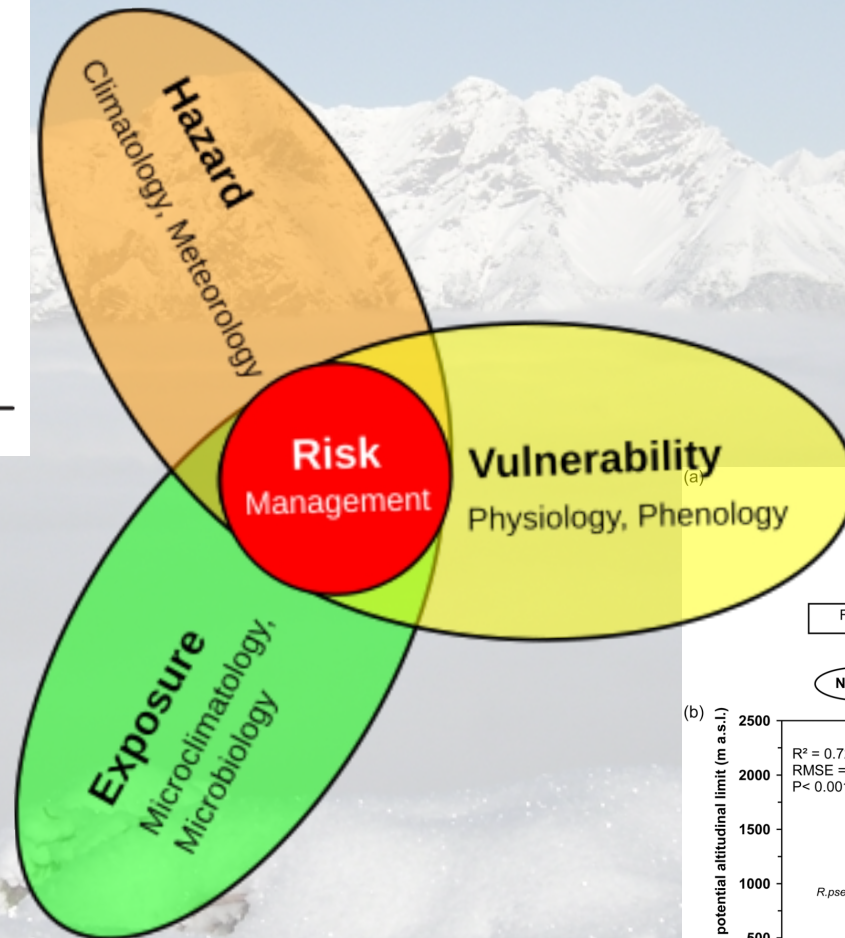
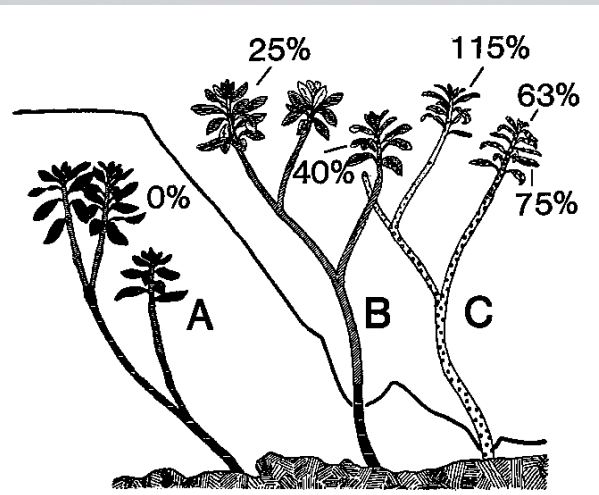


(Charrier *et al.*, 2013)

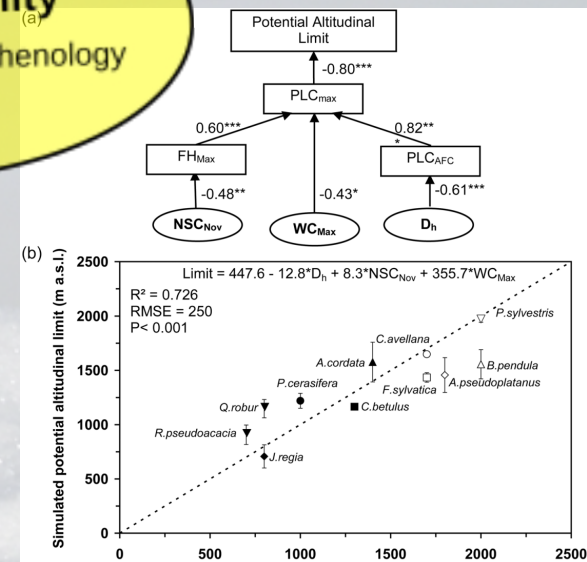
The future of mountain forests : a multidisciplinary approach of risk assessment



(Smith, 2011)



(Larcher, 1963)

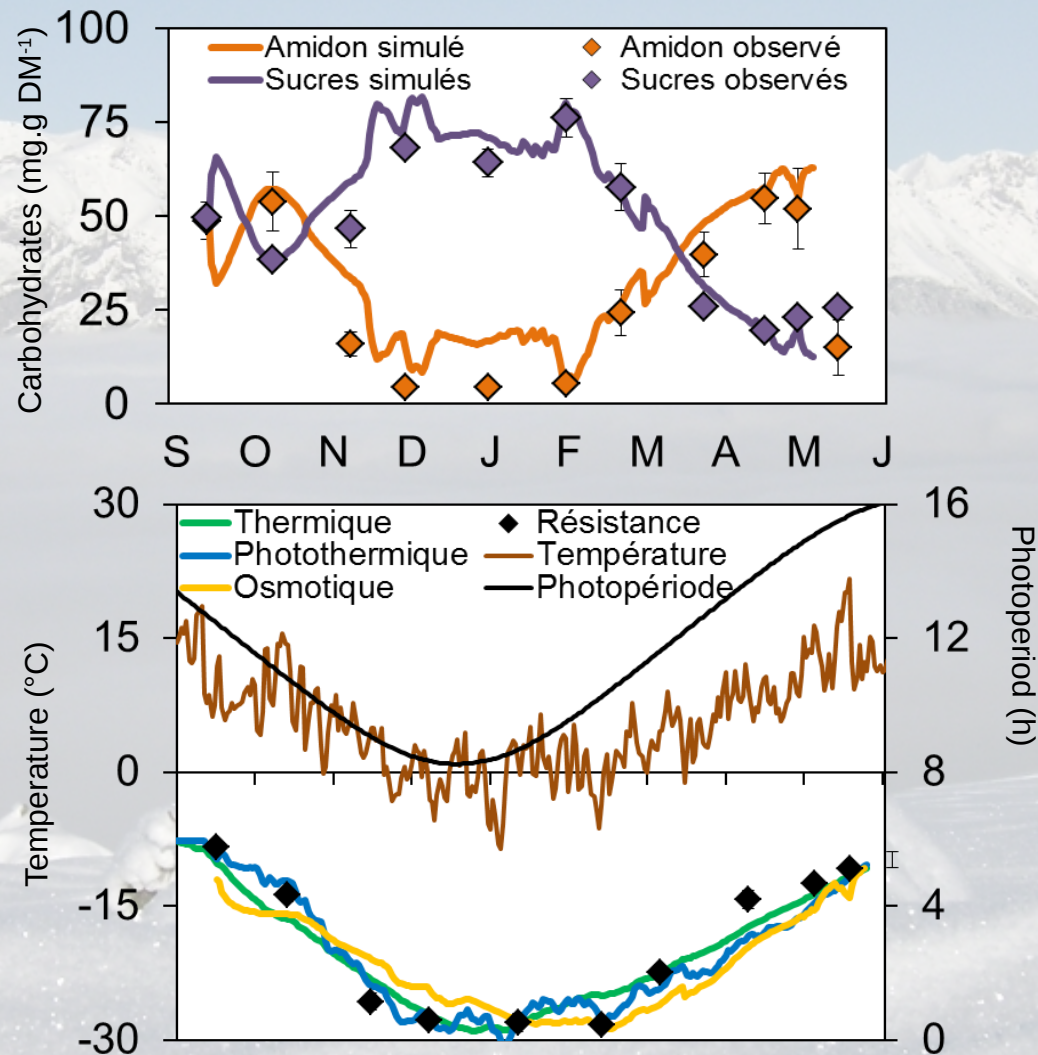


(Charrier *et al.*, 2013)

Biological Ice Nucleators

<https://bioice.wordpress.com/>

Bringing processes into vulnerability models



Extreme stress at the treeline: winter drought

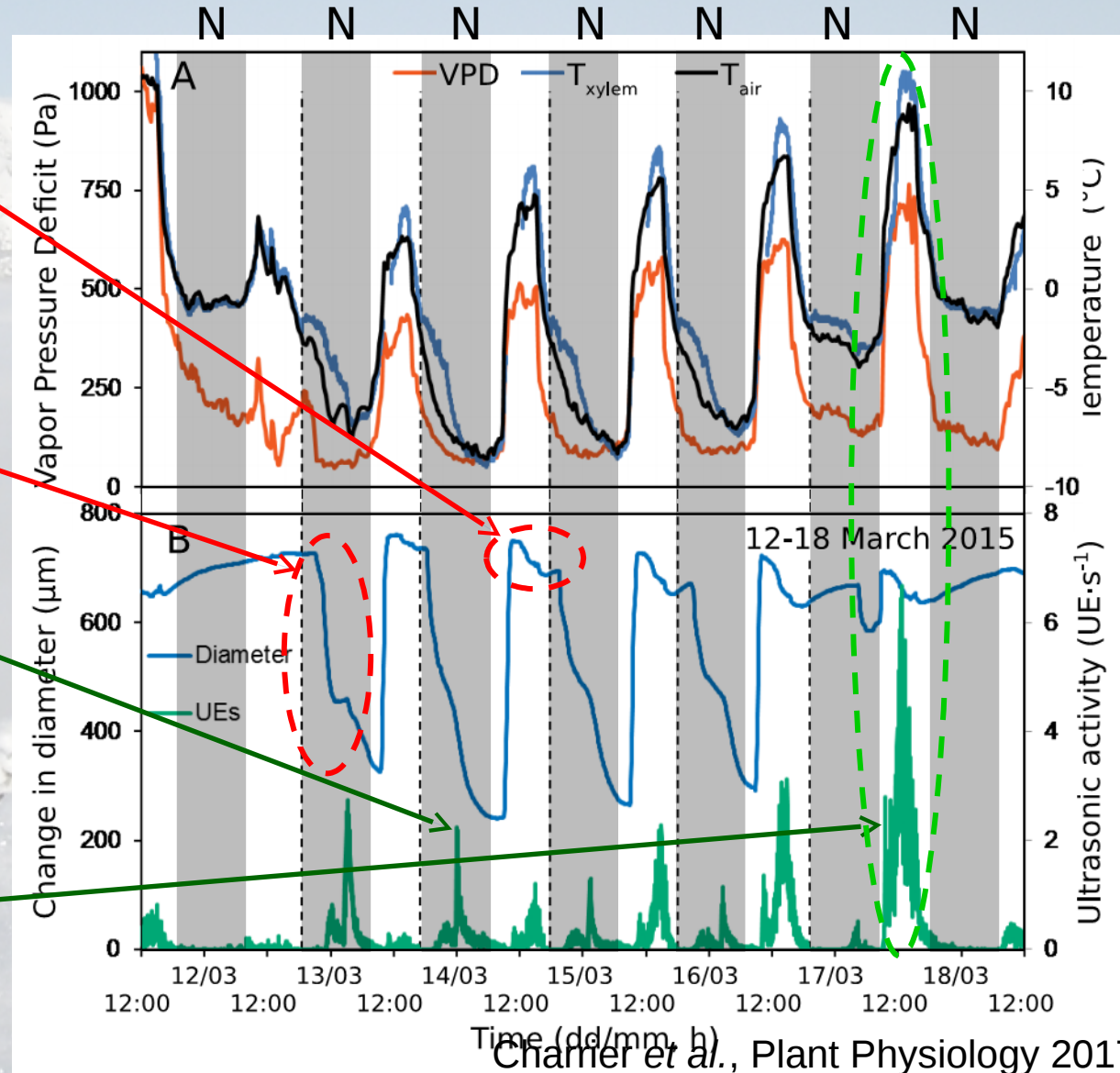
Daytime shrinkage
(E)

Nighttime shrinkage (Ψ_{ice})

Nighttime AEs:
Freezing-cavitation
= bubbles formation

Daytime AEs:
Embolism
development due to
transpiration

Ψ_{stem}



Extreme stress at the treeline: winter drought

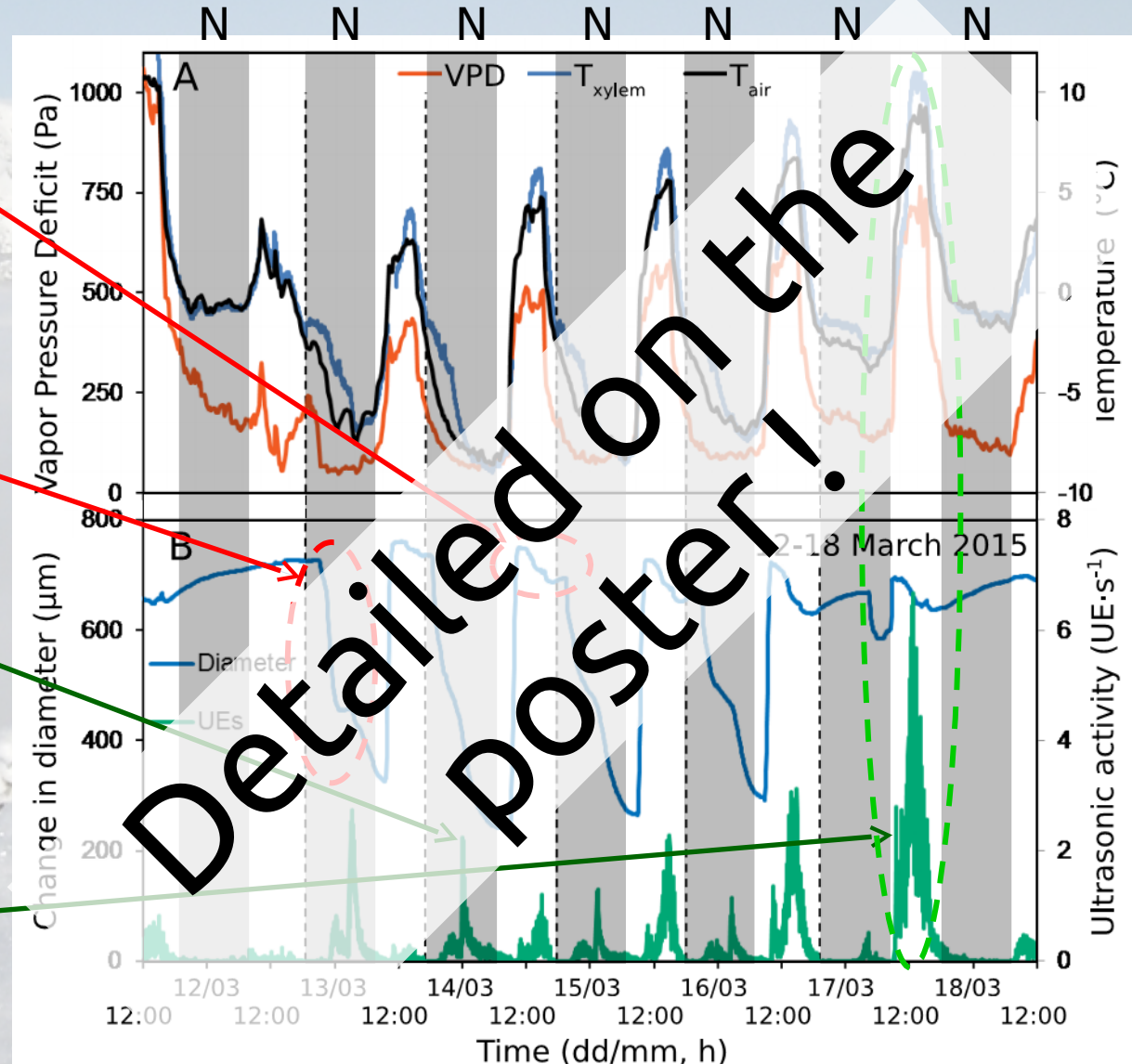
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What about resilience following damages?

