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DR2 CNRS section 30

Advancing process-based understanding & modelling of forest ecology in the Earth system at long time scales

ERC-stg CATES

Long-term consequences of altered tree growth and physiology in the Earth System (2020-27)

Adjustments to a changing environment

(Phenotypical) Plasticity

The ability of an organism to **alter its traits** in response to environmental changes during its lifetime.

Acclimation

Short-term, reversible adjustment in a trait in response to a change in environmental conditions.

Increase of tolerance to stress levels from an environmental factor.

Adaptation

Long-term, evolutionary changes in a population to adjust to environmental changes.

Impact on how ecosystems track the pace in climate change

Ecosystem acclimation



Impact on ecosystem function

Ecosystem acclimation



Acclimation is poorly represented in LSMs because parameters are fixed

Focus on physiological acclimation of **GPP** and respiration (temperature, drought) [ORCHIDEE, PhD C. Abadie]



Growth processes and climate **σ**

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2. Rural-to-urban gradients in megacities



Environmental factors		Effects on plants	
 ↓ Temperature ↑ Air humidity ↓ CO₂ ↓ Nitrogen deposition (NOx) ↓ Ozone deposition (O₃) 	 ↑ Temperature ↓ Air humidity ↑ CO₂ ↑ Nitrogen deposition (NOx) ↑ Ozone deposition (O₃) 		Earlier growing season Higher evaporative demand Higher drought and heat stress
Rural (control)			Urban (experiment)
Fontainebleau Forest (60 km)	Vincennes Park (UHI=0.8°C)	Montsouris Park (UHI=2°C)	Fondacion Cartier (UHI=2.8°C)

3. Acclimation of leaf function in ancient trees

Wax plug stomatal occlusion





Fitzroya cupressoides, transmission electronic microscopy (TEM)



Cold-adapted conifer: climate drying neutralises effect+ of CO2 increase



Adding dendrometers to monitor growth, allocation and stress: whole tree perspective





Adding dendrometers to monitor growth, allocation and stress: whole tree perspective





Stem-root allocation framework



20+ supersites worldwide

Tree rings FLUXNET towers CATES supersites

+ (dendrometers only)

CL-ACF



