

Introduction to Ecology, Biodiversity, Adaptation and the Environment

Plant Ecology in a Changing World

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<http://plantecology.net>





“Plant Ecology in a Changing World” encompasses

Traditional topics

- Physiological ecology
- Functional and evolutionary ecology
- Ecology of regional landscapes

Topics central to humankind and our future

- Ecology of urban landscape
- Appreciation of the many global changes
- Understanding man’s impacts on landscapes
- A solutions approach to sustainability



Everything is on the web and in Canvas!

- All lectures
- Old exams (including answers)
- All assignments - already spelled out
- No printed handouts . . . yeah, go electronic
- All assignments must be submitted as PDFs
- E-mail and SKYPE are easier forms of communications that sometimes better fit into your schedule



We instruct using several approaches

- lectures (including online recordings)
- discussions
- slide shows

We evaluate using several approaches

- analysis projects
- examinations
- peer-to-peer reviews
- student presentations



Explore topics of regional interest

- hanging gardens of Utah
- impacts of El Nino and La Nina
- biological crusts in Utah's deserts
- biodiversity and invasive species
- conservation and fragmentation
- how has Utah changed
- what are ecological consequences of policies
- biological invasions and what they mean
- urban forests

As citizens of the world consider topics of global interest

- impacts of El Nino and La Nina
- climate change
- loss of biodiversity
- fragmentation of habitats
- atmospheric changes
- disturbance and human impacts in ecology
- ecology and human health issues
- is there a cost for ecosystem services





You will instruct using several approaches:

Debate Discussions - Pro and Con, such as

- fire ecology and fire prevention
- riparian ecosystems
- invasive species
- biodiversity

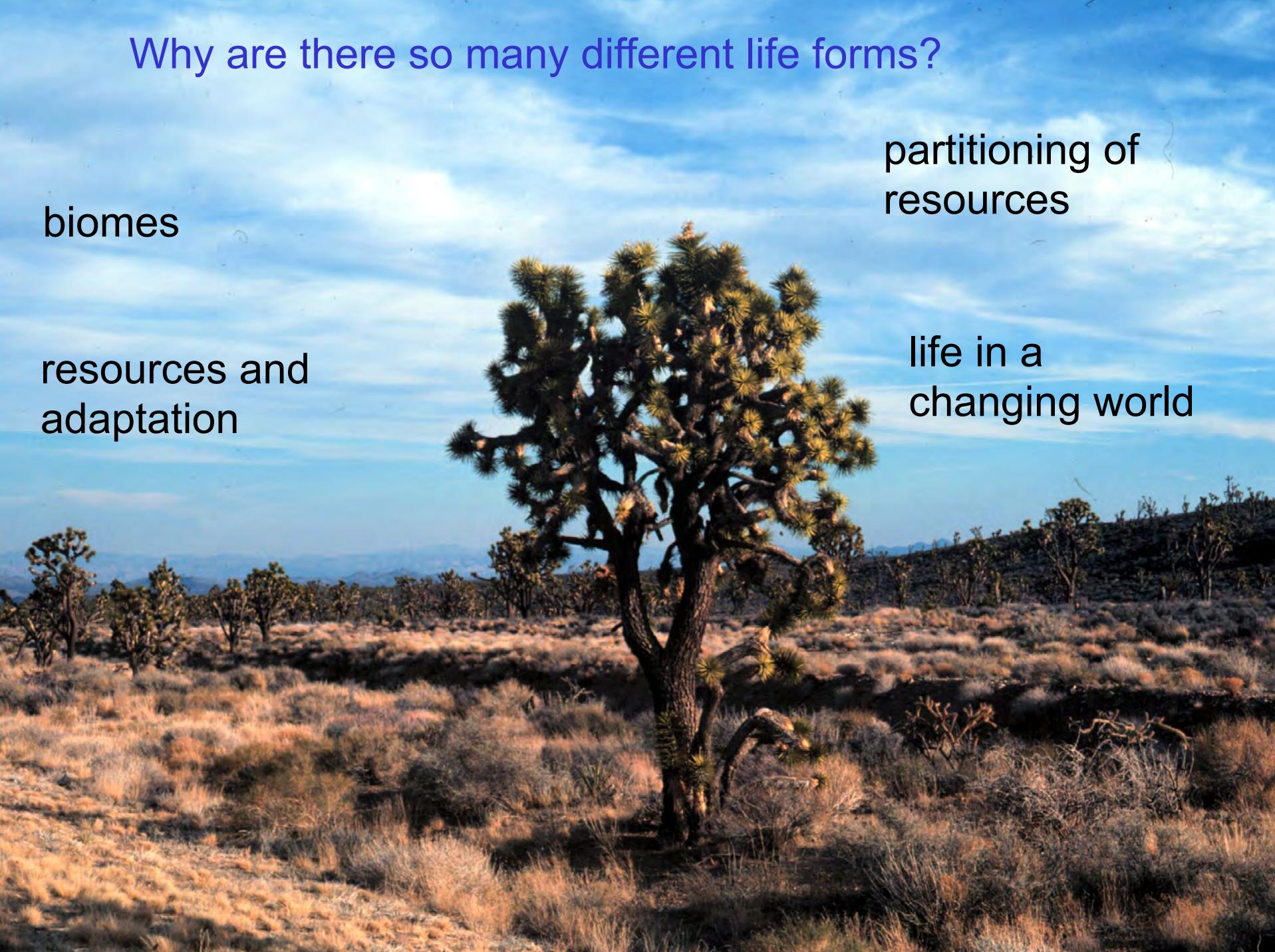
Peer-to-peer reviews

Policy papers



Approaches to the science of plant ecology

- Descriptive - observational or analytical
- Experimental - physiology and biochemistry
- Economics - with gains, losses, and tradeoffs
- Consideration of how processes scale
- A genetics approach
- A comparative approach



Why are there so many different life forms?

biomes

resources and
adaptation

partitioning of
resources

life in a
changing world

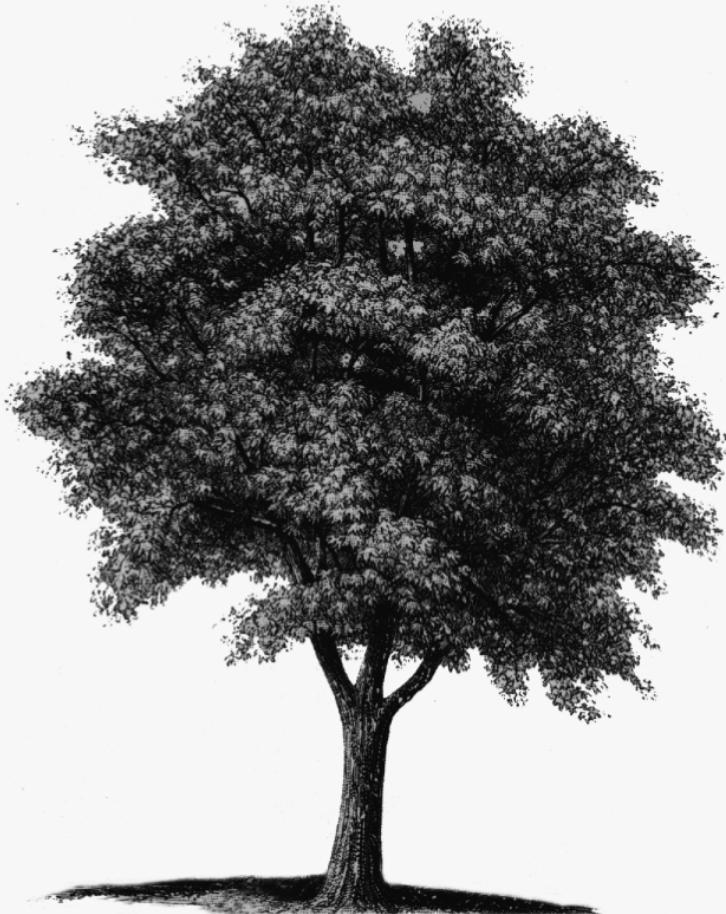


Eriogonum inflatum



Ramalina menziesii

How do plants work at the individual and community levels?



Consider plants as

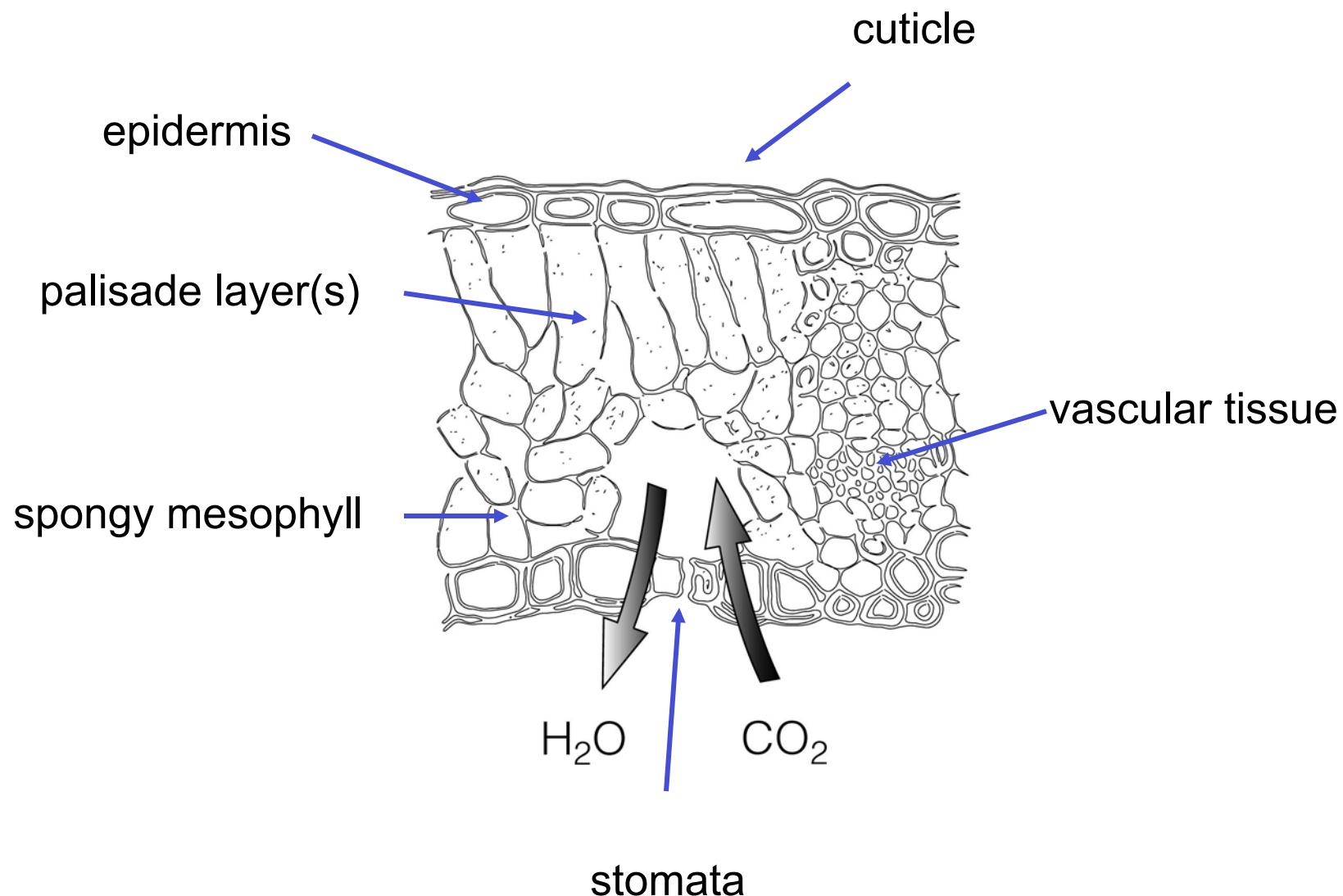
- integrated systems
- a series of repeating, and semi-independent modules



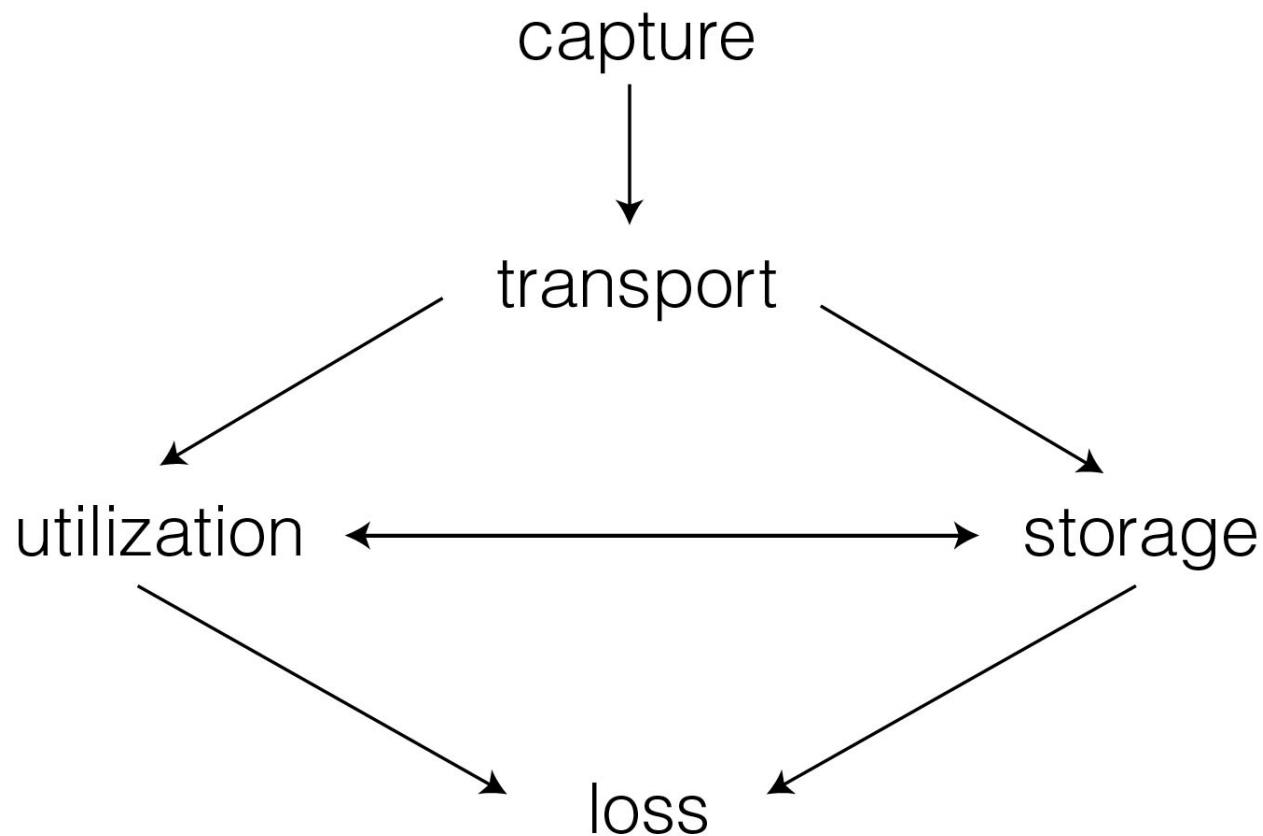
We will consider economic analogies:
costs and benefits

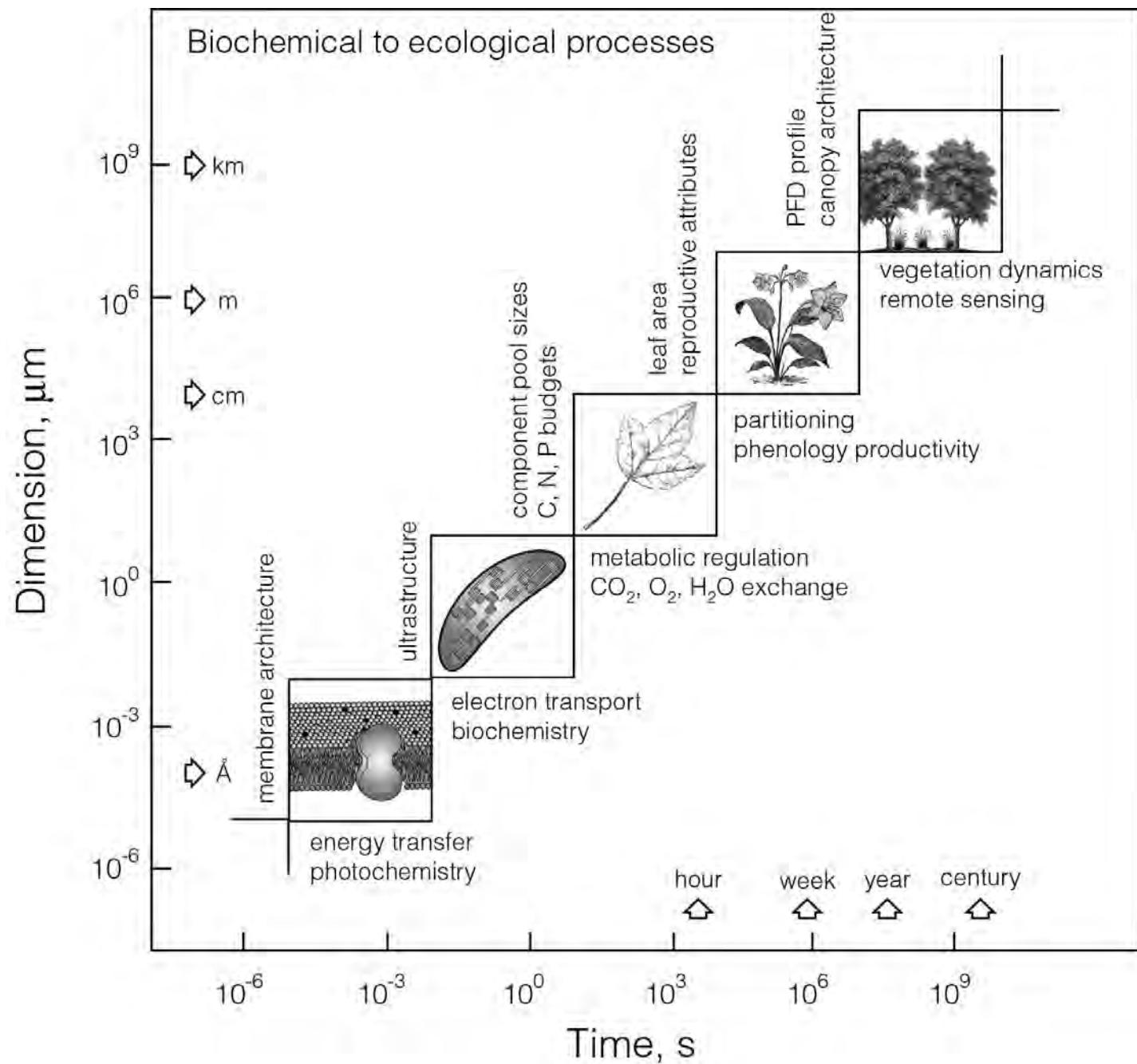
- energy and nutrition costs
- lost opportunity costs
- tradeoffs
- net carbon gain approach

Life is a series of tradeoffs

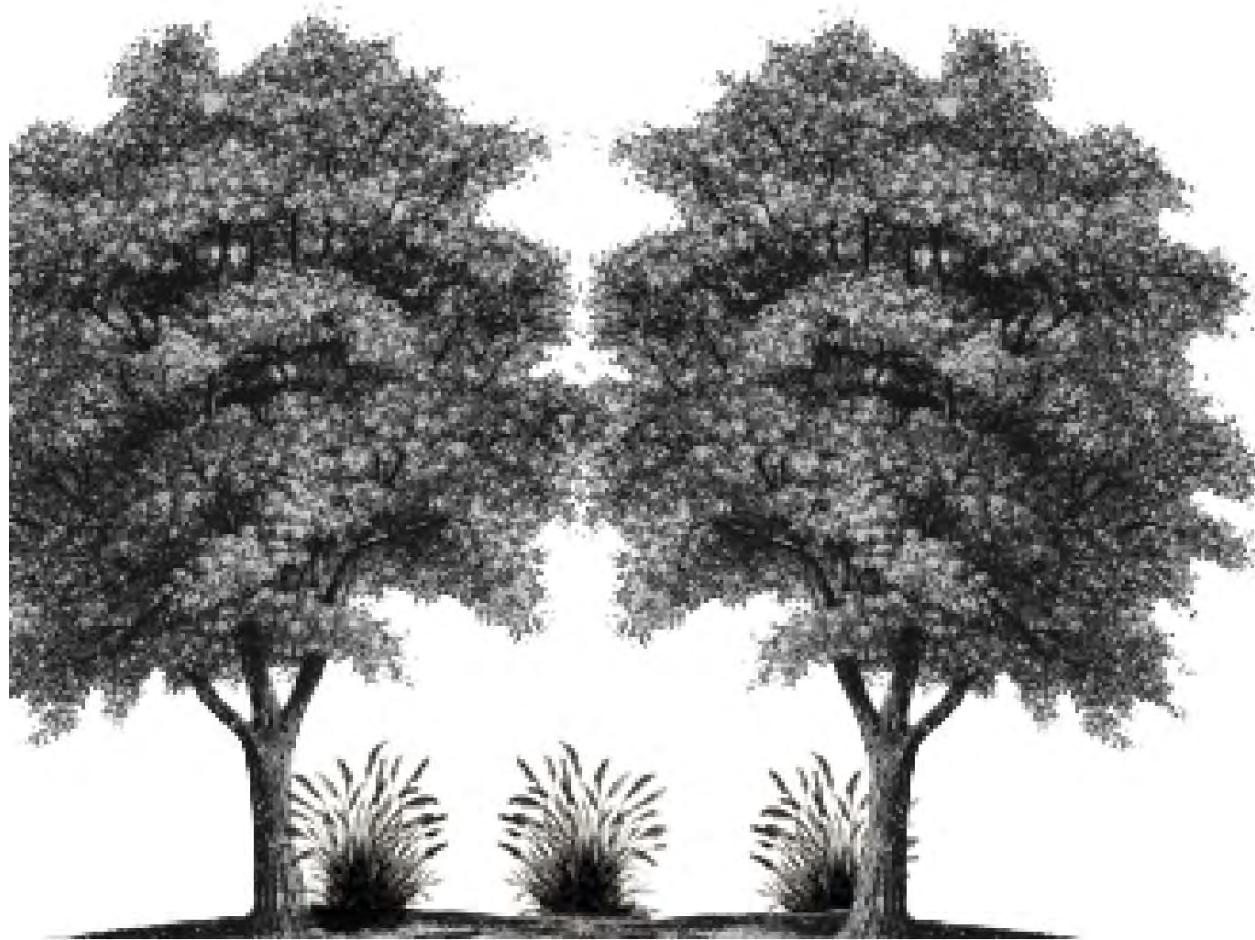


Consideration of whole plant as an integrated system: how are resources used?

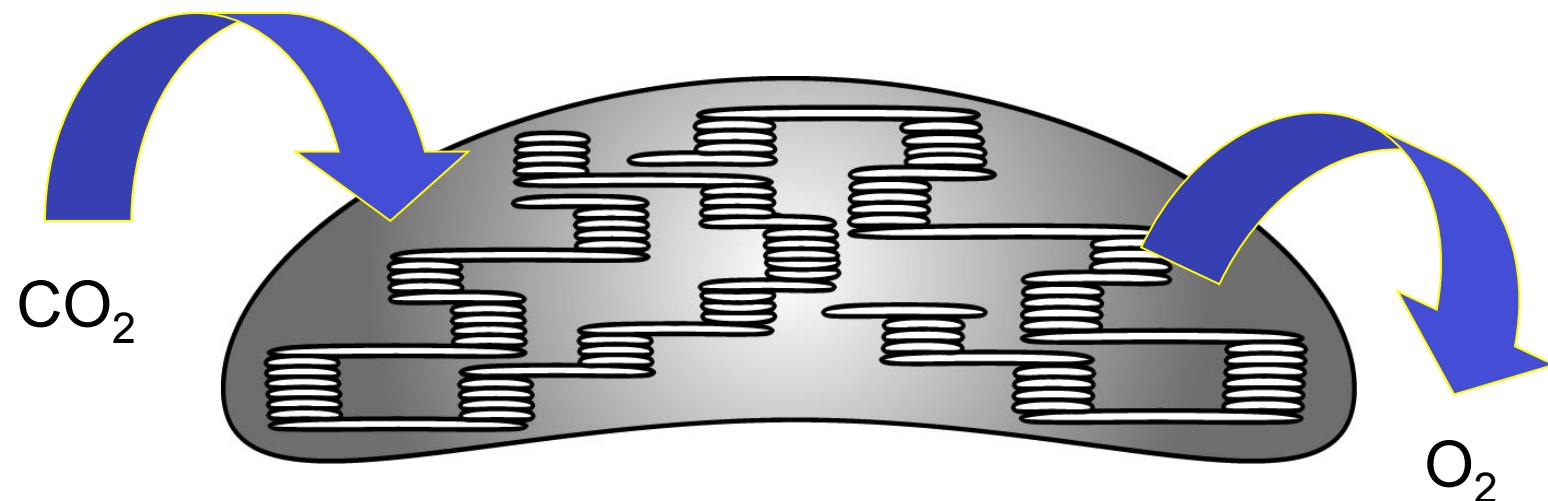




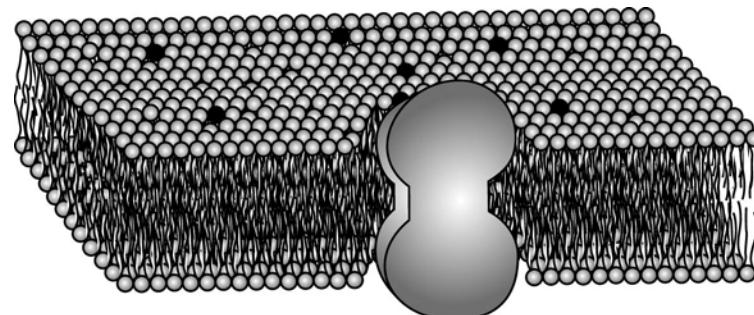
Trees consist of many leaves, which in turn consist of many chloroplasts.



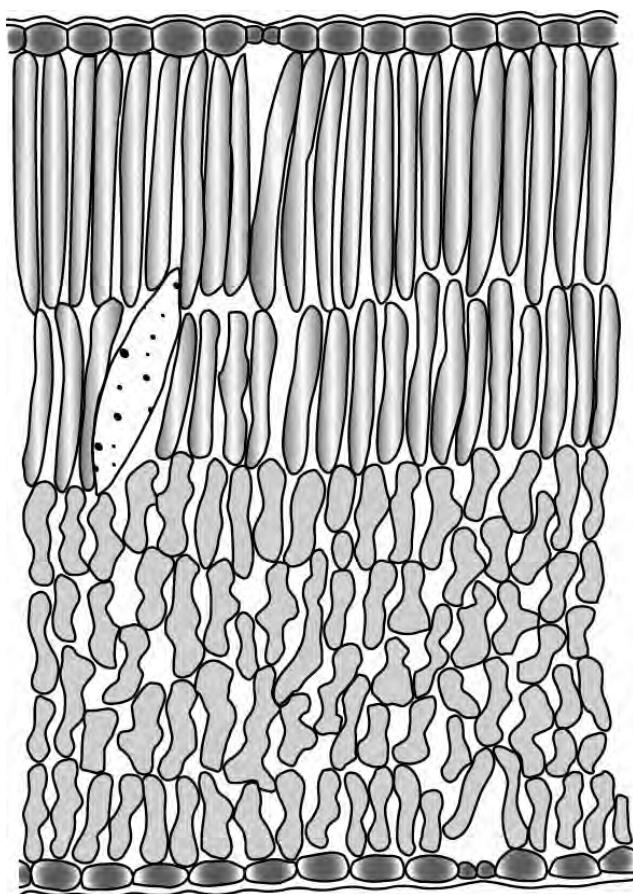
Is what happens at the chloroplast level relevant to higher scales?



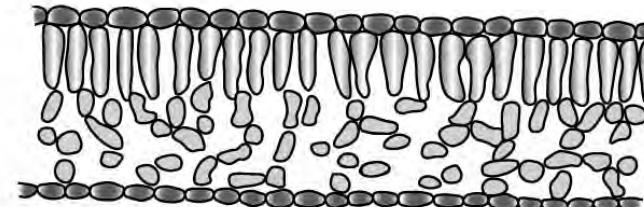
Yes, the scale at which you address your question does matter



Within each of those leaves, acclimation occurs with respect to leaf size, cell size, and chloroplast size.

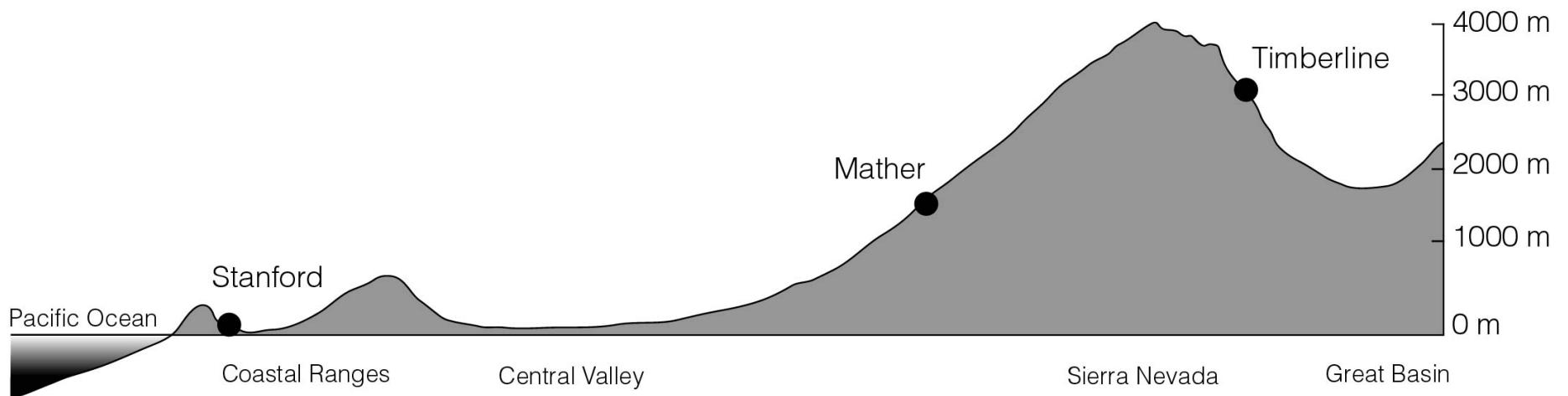


Full sunlight



Deep shade

Genetics matter:
Consider *Potentilla glandulosa*,
a common herb in California

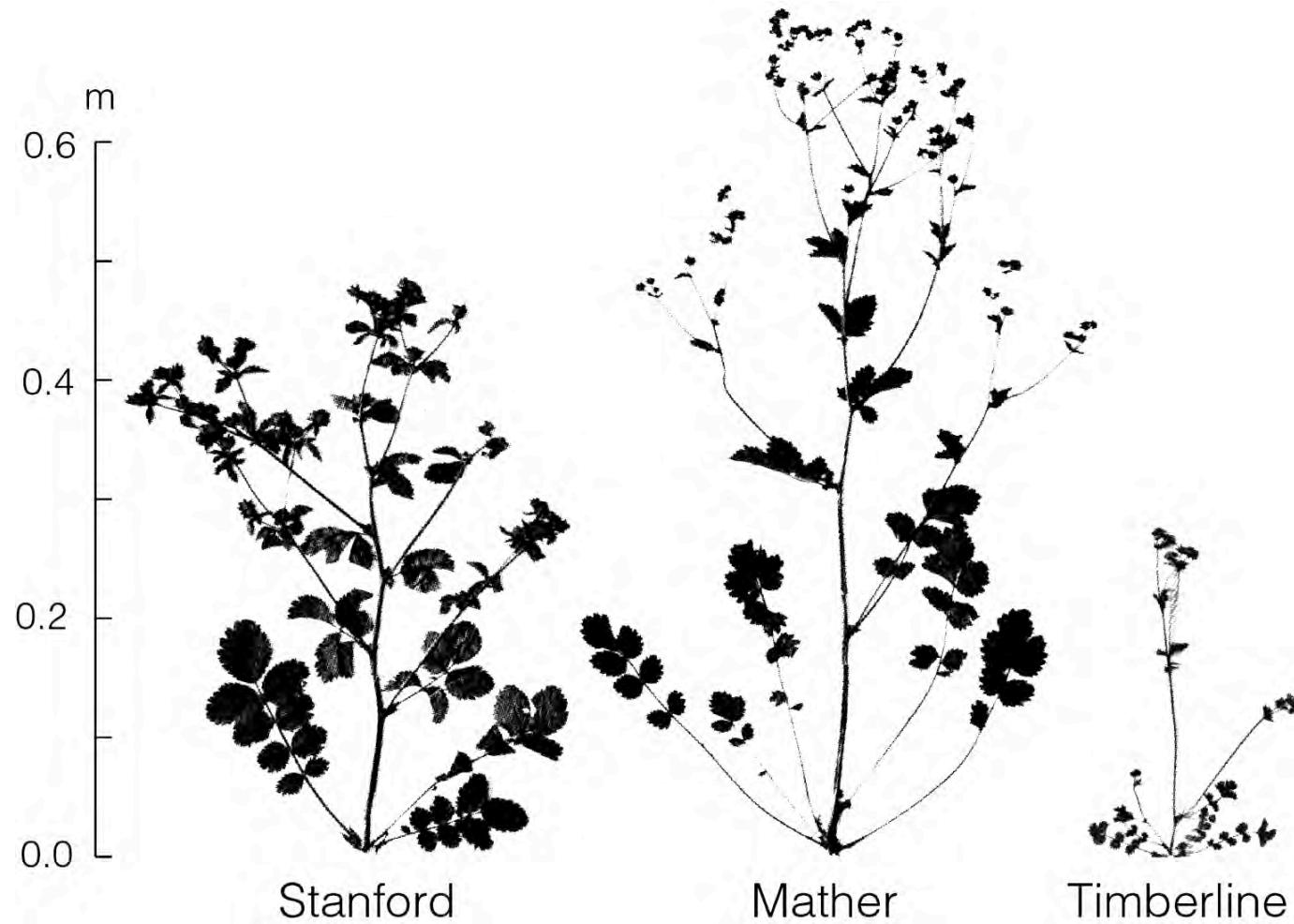


A cross-section through central California

Studies conducted by Clausen, Keck, and Hiesey at the Carnegie Institution of Washington at Stanford University

photo from http://www.wildutah.us/images/plants_scenery/potentilla_glandulosa_guardman_pass_001.jpg

Growth performance of *Potentilla glandulosa* - a common herb in three different habitats

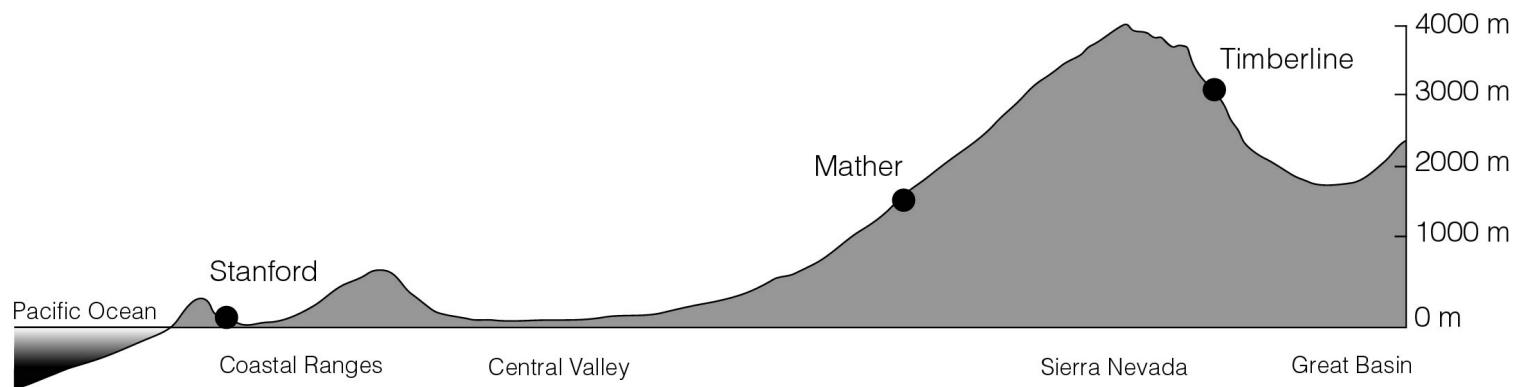


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Growth of *Potentilla glandulosa* ecotypes

Common garden location

Ecotype	Stanford	Mather	Timberline
Stanford	55 cm	35 cm	died
Mather	50 cm	69 cm	11 cm
Timberline	23 cm	44 cm	25 cm

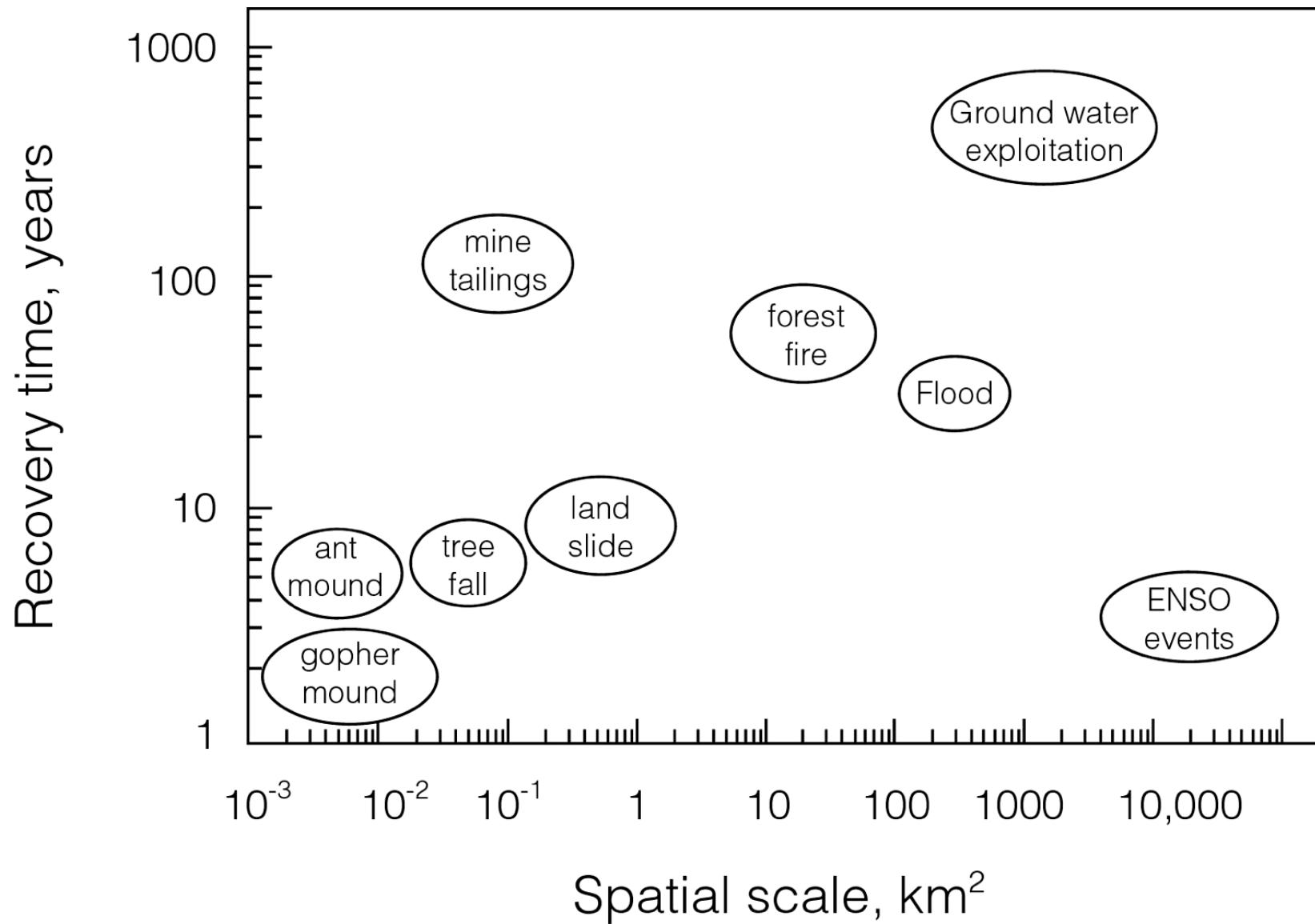


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Comparative approaches are common in ecology

- ecotypes and transplants
- environmentally induced changes
- genetic differences and tools
- environmental gradients
- controlled environments
- convergent forms

Equilibrium is a fallacy - the history of a site is relevant



Climate Change

- Warming
- Precipitation change
- Extreme weather events

- ## Atmospheric Composition Change
- CO_2 and other GHG
 - Stratospheric ozone

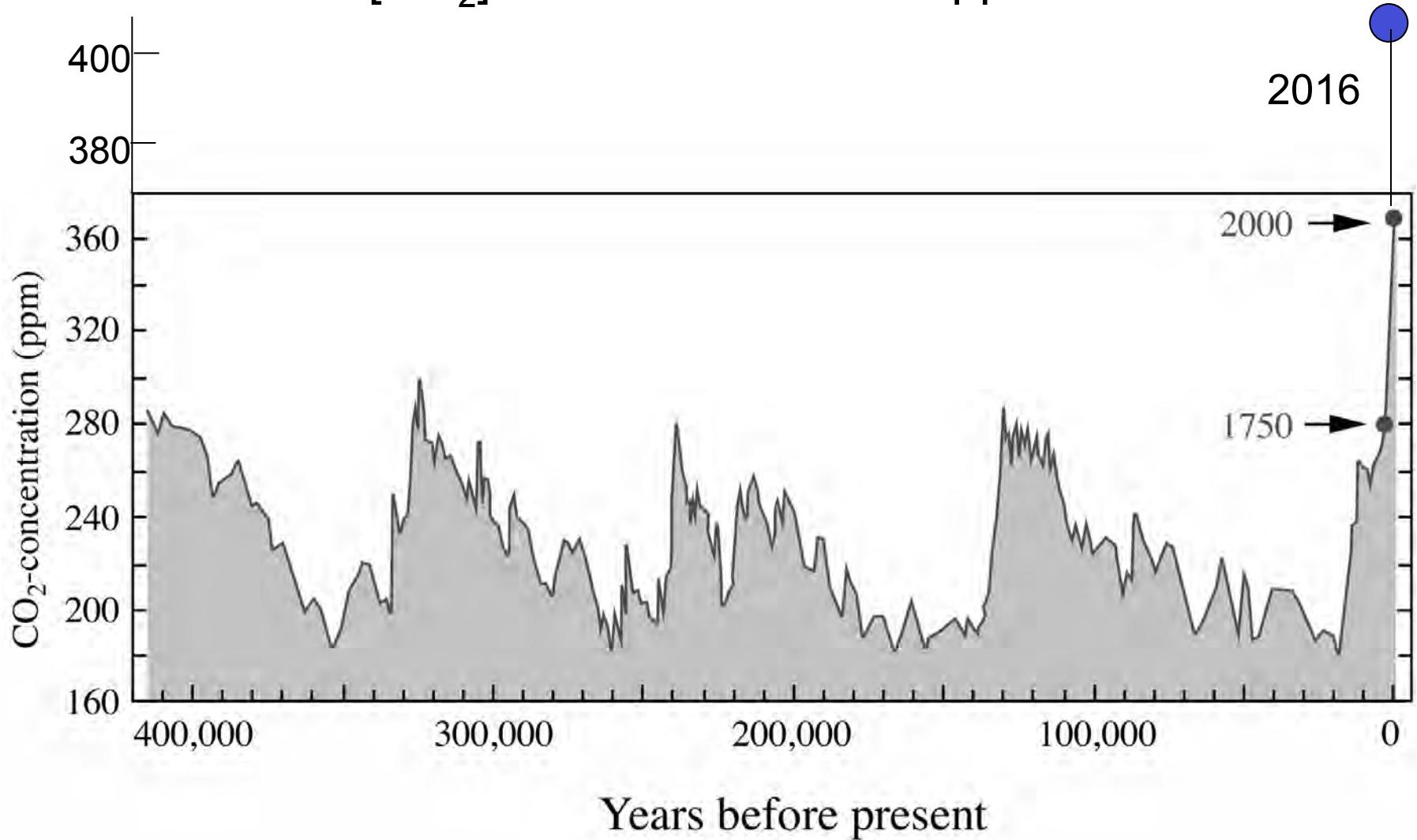


Global Changes
are occurring

Land Use and
Cover Change

Biological Invasions

Over the past 400,000 years (prior to the Industrial Revolution),
[CO₂] has varied 180-280 ppm



Implications for evolutionary aspects: adaptation, acclimation, exaptation, adaptive radiation

Things to do today after class:

- get to know your classmates
- check out our home page <http://plantecology.net>
- consider signing up for a debate
- consider forming a group for your upcoming project
[once decided, send Jim an e-mail with group list]