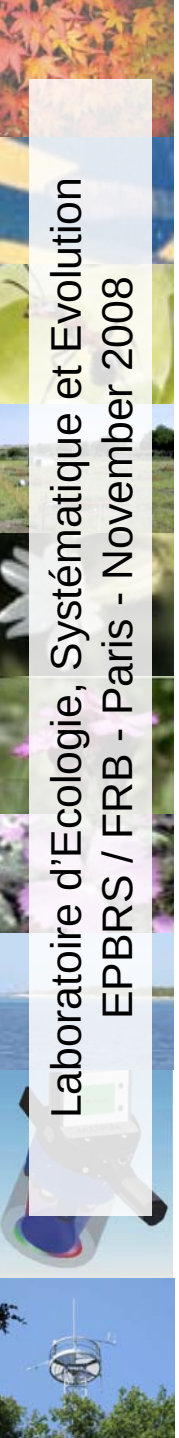

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Ingénierie et biodiversité

Biodiversity and Ecological Engineering

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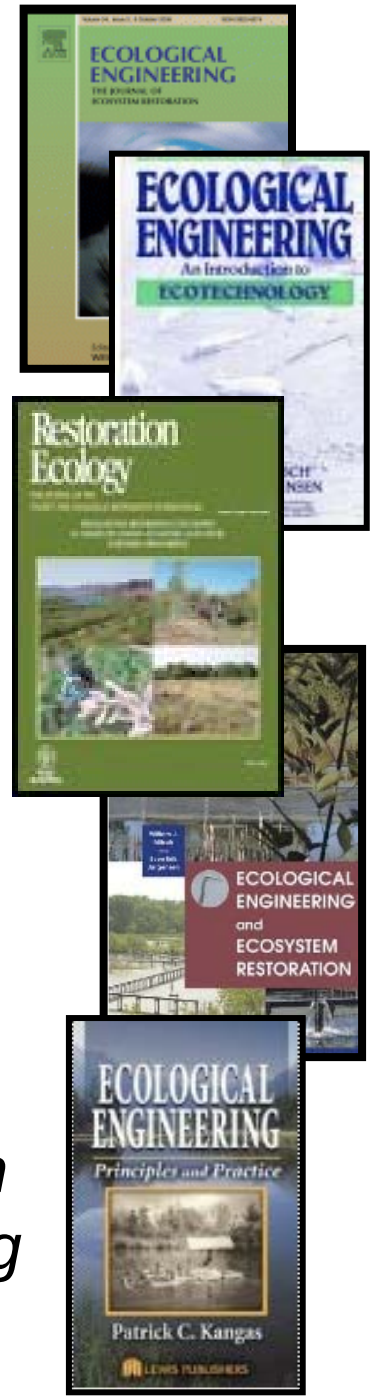
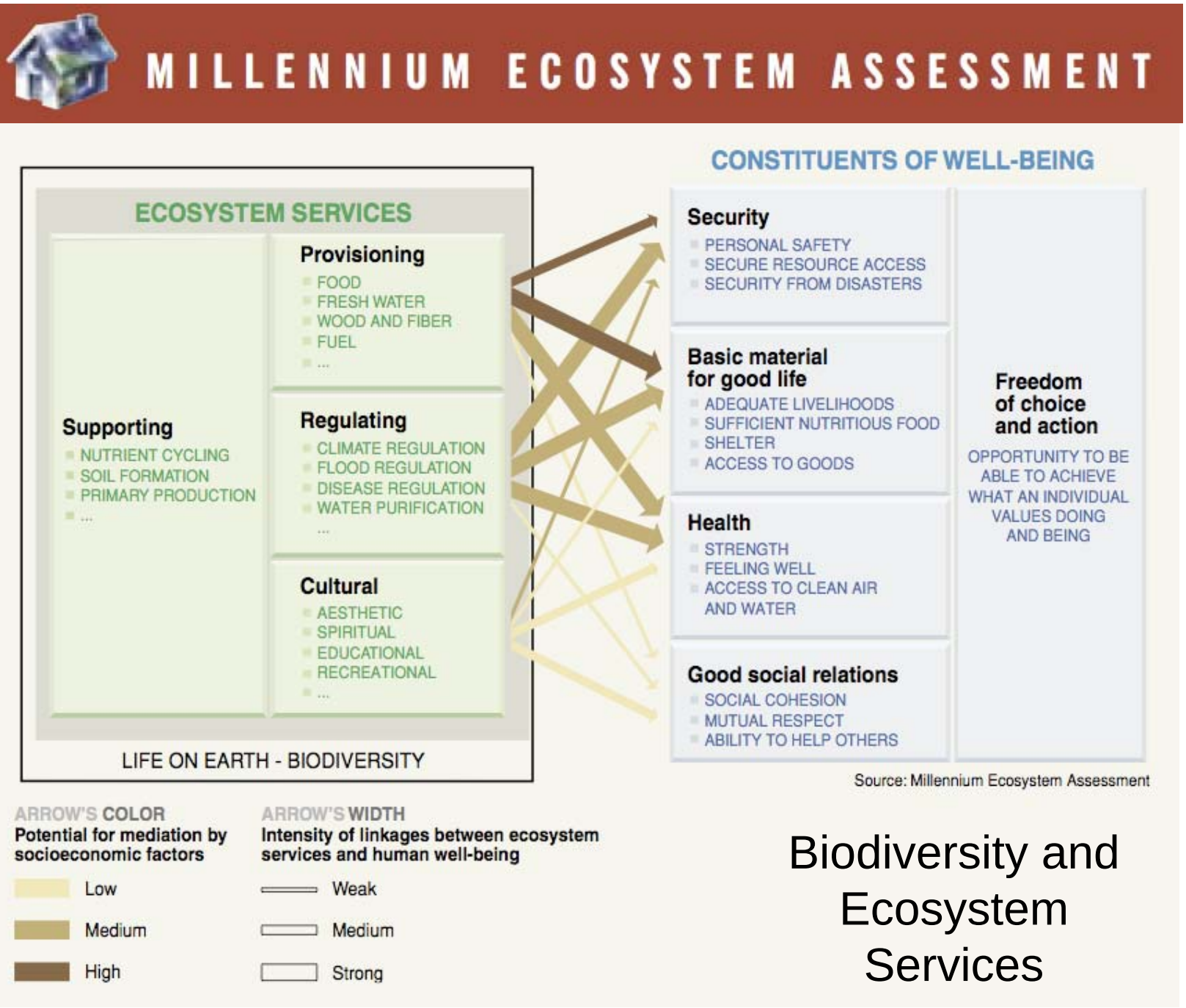
Biodiversity and Ecological Engineering - What is it?

- **Ecosystem Restoration and Creation**
- **Management of natural, semi-natural and cultivated systems**
- **Use of ecosystem services for engineering purposes**; e.g., bioremediation, waste water treatement, etc.

Ecological Engineering typically focuses on both biodiversity and ecosystem functioning





Biodiversity and Ecosystem Services

Some reasons why biodiversity matters

- **Species differ in their functions and in response to their environment**

Deschampsia cespitosa (Hegi, 1997)

Bromus erectus (Schröter, 1888)

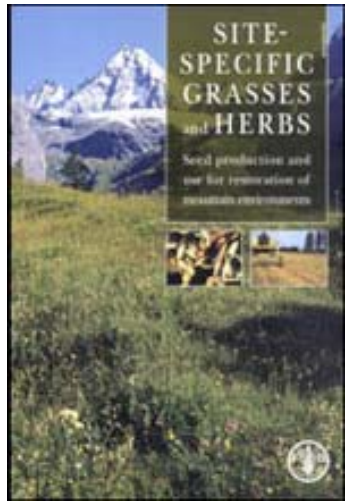
These two grasses are similar, but don't grow on the same types of soils

Trifolium alpinum (Schröter, 1888)

This forb fixes Nitrogen

Leontodon hispidus s.l. (Schröter, 1888)

This forb does not



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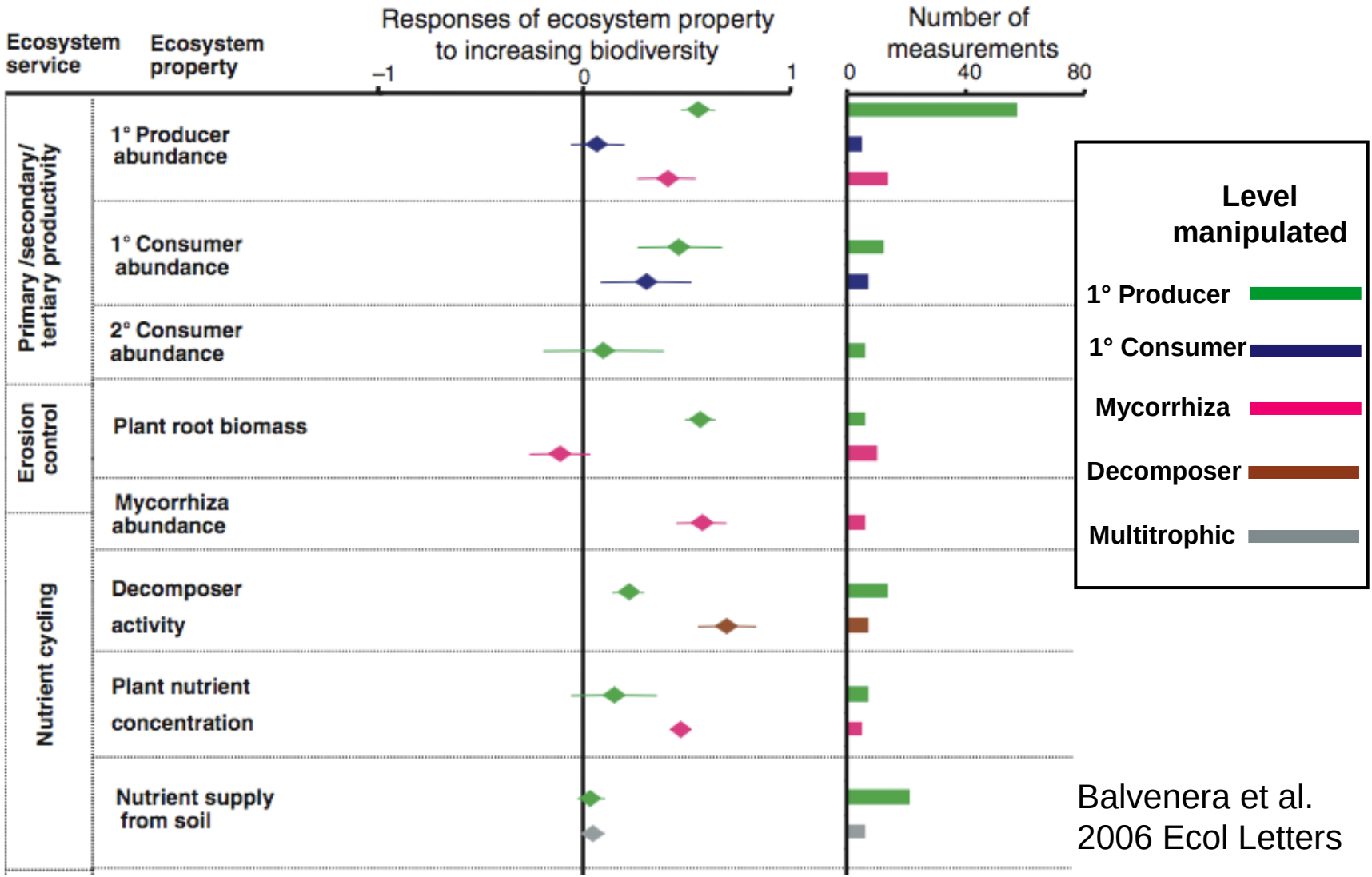
Some reasons why biodiversity matters:

Ecosystems tend to function better with more plant species



Balvenera et al. 2006 Ecol Letters

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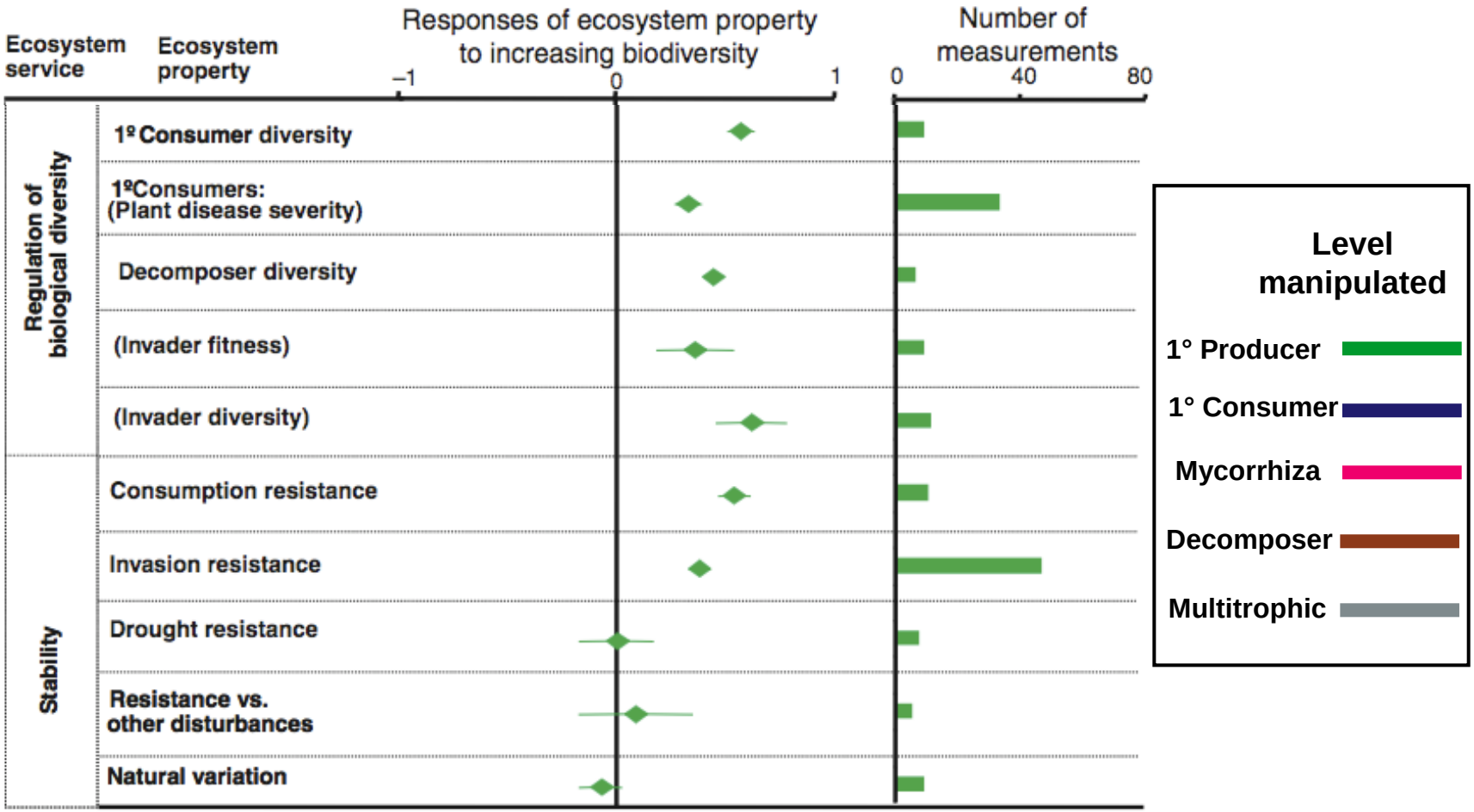

Balvenera et al. 2006
Ecol Letters

Ecosystem Restoration, Enhancement and Creation

Restoration of degraded or destroyed ecosystems

- *Extraction - mining, quarries, etc.*
- *Construction*
- *Draining or filling of wetlands*
- *Channeling, damming, extraction of water from rivers & streams*
- *Etc.*

Marsh restoration: Vancouver Island

Creation of new ecosystems

- *Wildflower meadows*
- *Green spaces*
- *Etc.*

Management of natural, semi-natural and cultivated systems

Managing:

- Grasslands by haying, grazing, minimizing fertilizer use, etc.
- Forests by selective cutting, leaving dead wood, etc.
- Agroecosystems by greenveining, minimizing pesticide & herbicide use, restoring hedgerows, etc.
- Corridors by mowing, seeding, avoiding herbicide use, etc. (roadside verges, railway right of ways, power line corridors, etc.)
- Lakes and rivers by minimizing nutrient loading, managing water extraction, fish harvest, etc…….

Orchids: PNR Brenne

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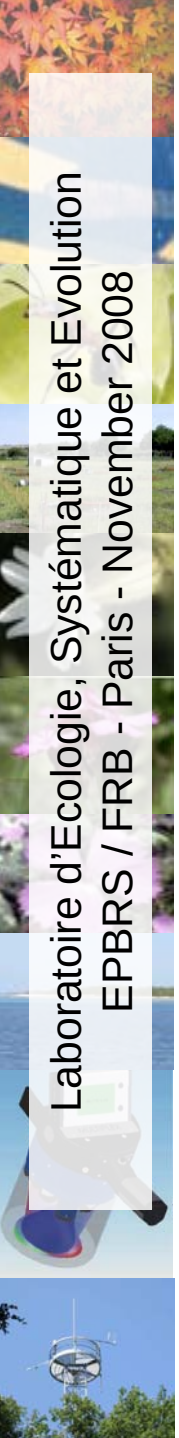
Use of ecosystems for engineering purposes

- **Waste water treatment** - using ecosystems as filters
- **Watershed management** - controlling runoff and water quality through ecosystem management
- **Soil and water depollution** - letting plants or microorganisms absorb or transform toxic substances = bioremediation
- **Carbon storage** - by planting forests or through soil management
- **Green roofs -** using turf for insulation and decoration
- **etc.**

Depollution: Owens Lake, California

Green roof: California Academy of Science



Challenges

Understanding mechanisms

- **Experimentation is a key to determining causal mechanisms**
- **Syntheses of previous experience is vital**

Assessing success

- Robust, multicriteria methods are needed for assessments,
- Long-term monitoring is required &
- Assessments must include large spatial scales

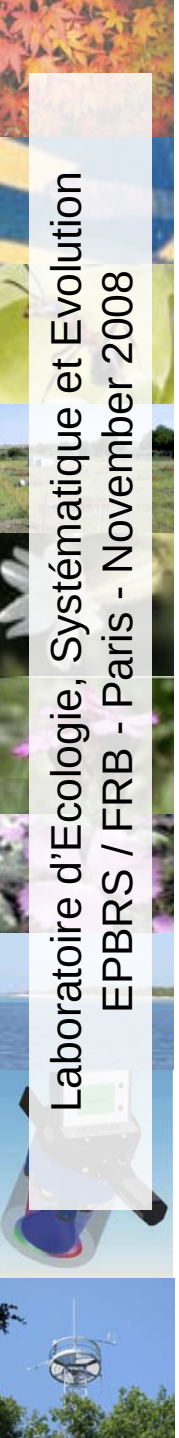
Therefore, rapid monitoring methods are needed; i.e., remote sensing, development of indicators, etc.

Modeling

Mathematical models of ecosystem dynamics are essential aids for understanding mechanisms, testing alternate hypotheses and predicting long-term success

Linking ecological theory to application

Ecological theory can provide insights into engineering methods
Real applications can point out weaknesses in ecological theory



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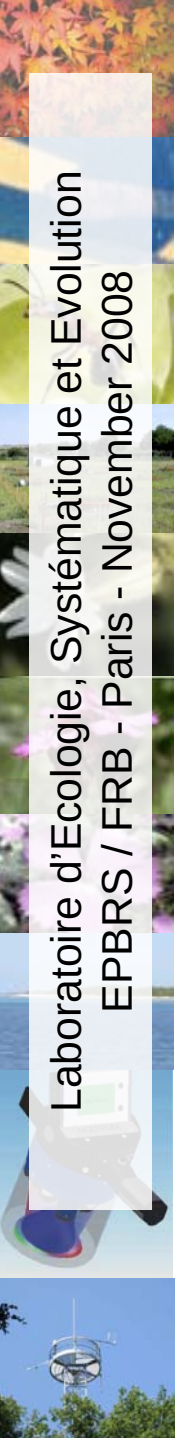

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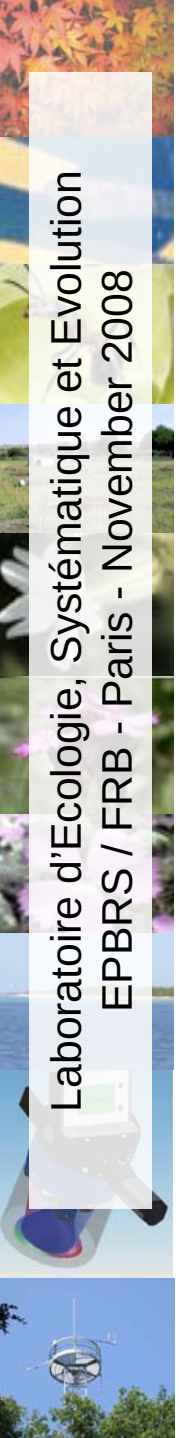

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