Alien invasive species : impacts on ecosystems

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&

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Alien invasive species have impacts on ecosystems

- pools and fluxes of carbon, water and nutrients
- Other attributes

3 questions

Q1. Impacts predictable based on invasion theory?

Q2. Impacts different for alien and native species?

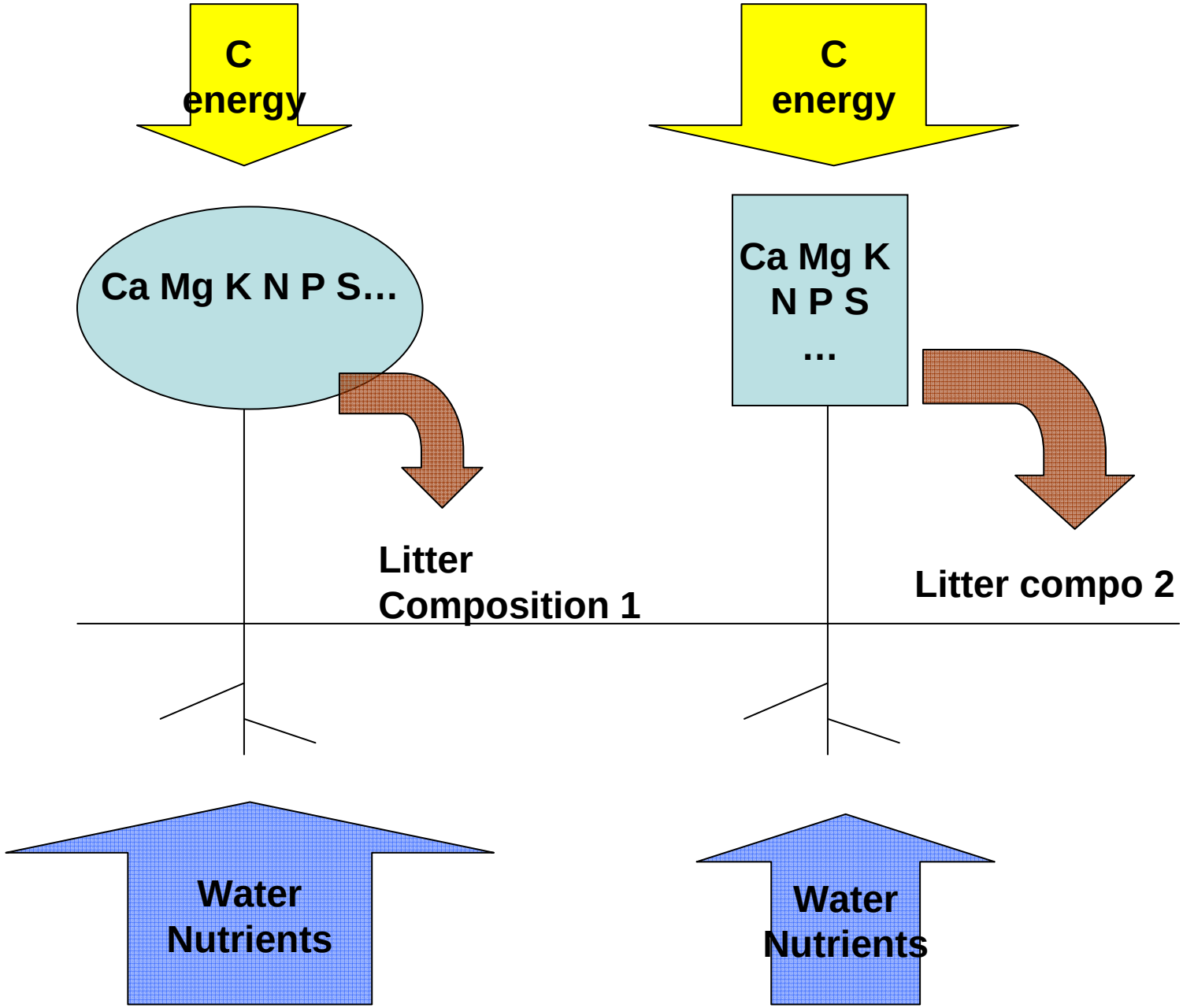
Q3. Impacts relevant to management?

- Plant-focused

Q1. Impacts predictable?

Impacts = Species effects

- Species-specific resource use


C
energy
C
energy
Ca Mg K N P S…
Ca Mg K
N P S
…
Litter
Composition 1
Litter compo 2
Water
Nutrients
Water
Nutrients

Strong impacts if:

- Invasive species very different
  - Phenology
  - Growth form
  - Resource use strategy
  - …

Fallopia japonica : shrub-like geophyte

Robinia pseudoacacia : N-fixator

- $\Rightarrow$ Impacts idiosyncratic?
- Specific interactions between species and ecosystems

- But : more general predictions possible

Invasion theory:
a framework to predict impacts

Invasion =

candidate species

+

susceptible ecosystem

- Species invasiveness
- Ecosystem invasibility

Species invasiveness

- High-risk species: often
  - High relative growth rate
  - High specific leaf area
  - High-quality litter
  - …

$\Rightarrow$ **High resource fluxes**

Ecosystem invasibility

- Highly invasible ecosystems share traits:
  - High soil resource availability
  - Disturbance

    Eutrophicated, man-disturbed

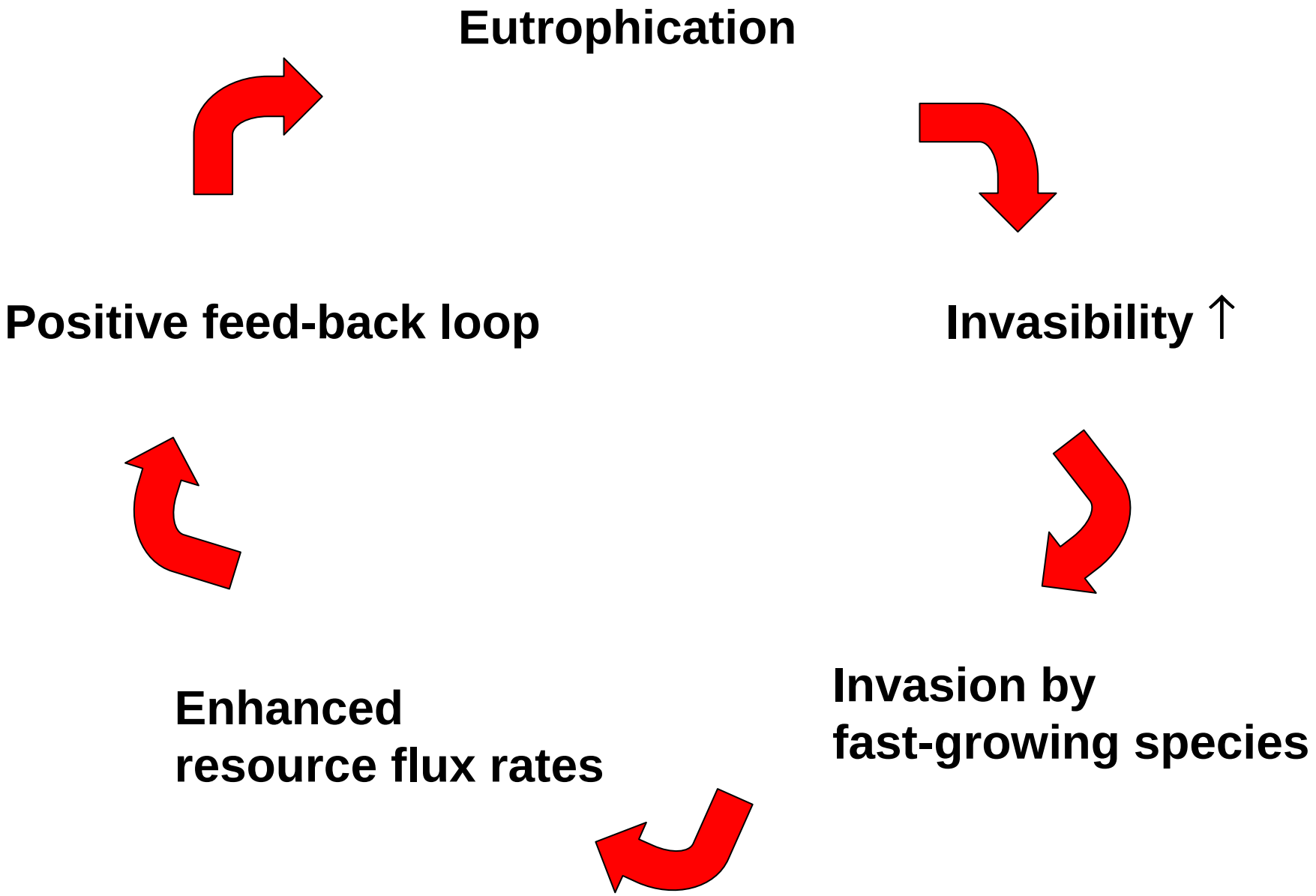
High resource habitats

+

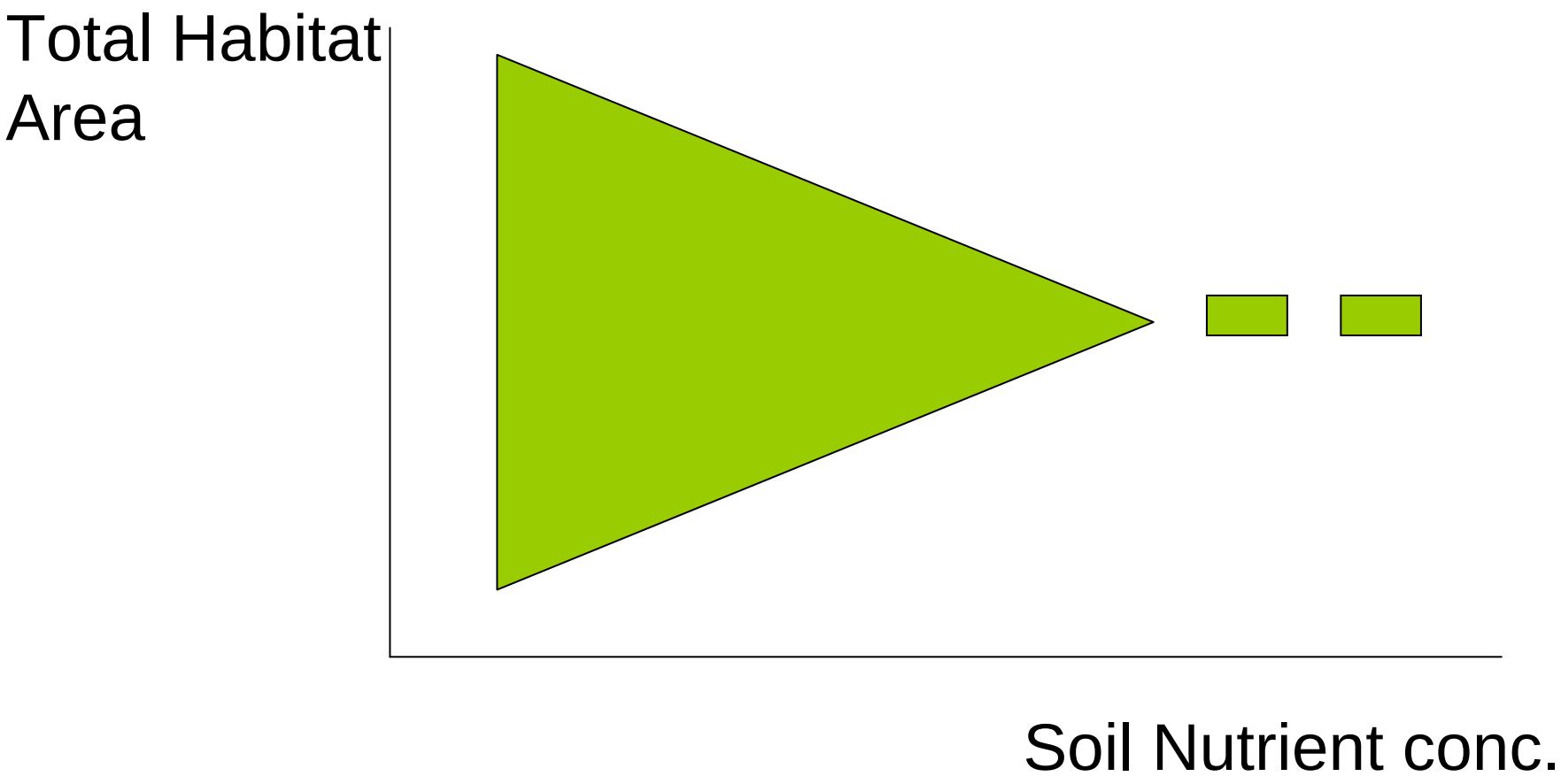
species with high resource requirements

⇒

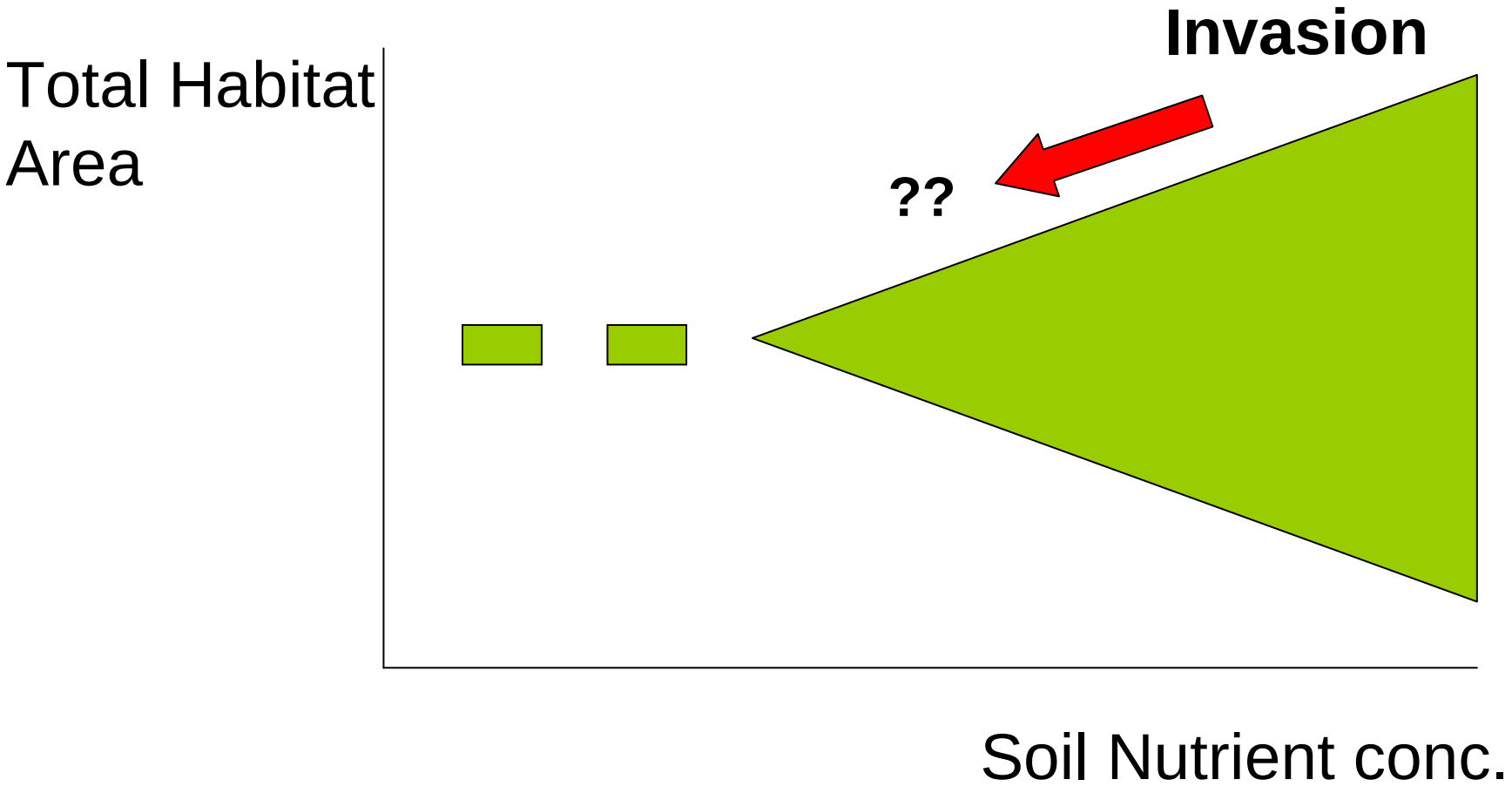
« Eutrophication vortex »


Eutrophication
Invasibility ↑
Invasion by
fast-growing species
Enhanced
resource flux rates
Positive feed-back loop

<< 1900



after 1950



Q2. Impacts: Different for native and alien species?

- Abiotic impacts
- Biotic impacts

Impacts mediated by resource use: not different (?)

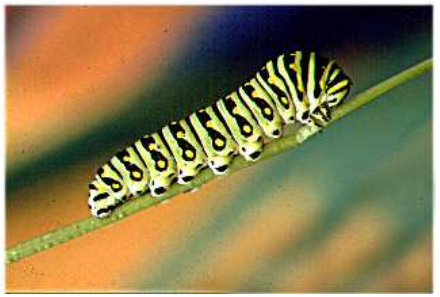
- alien and native invasive species share many functional traits

Impacts mediated by biotic interactions

- Herbivory
- Allelopathy
- Resistance to pathogens
- Mutualistic interactions in soil

Competitors

herbivores



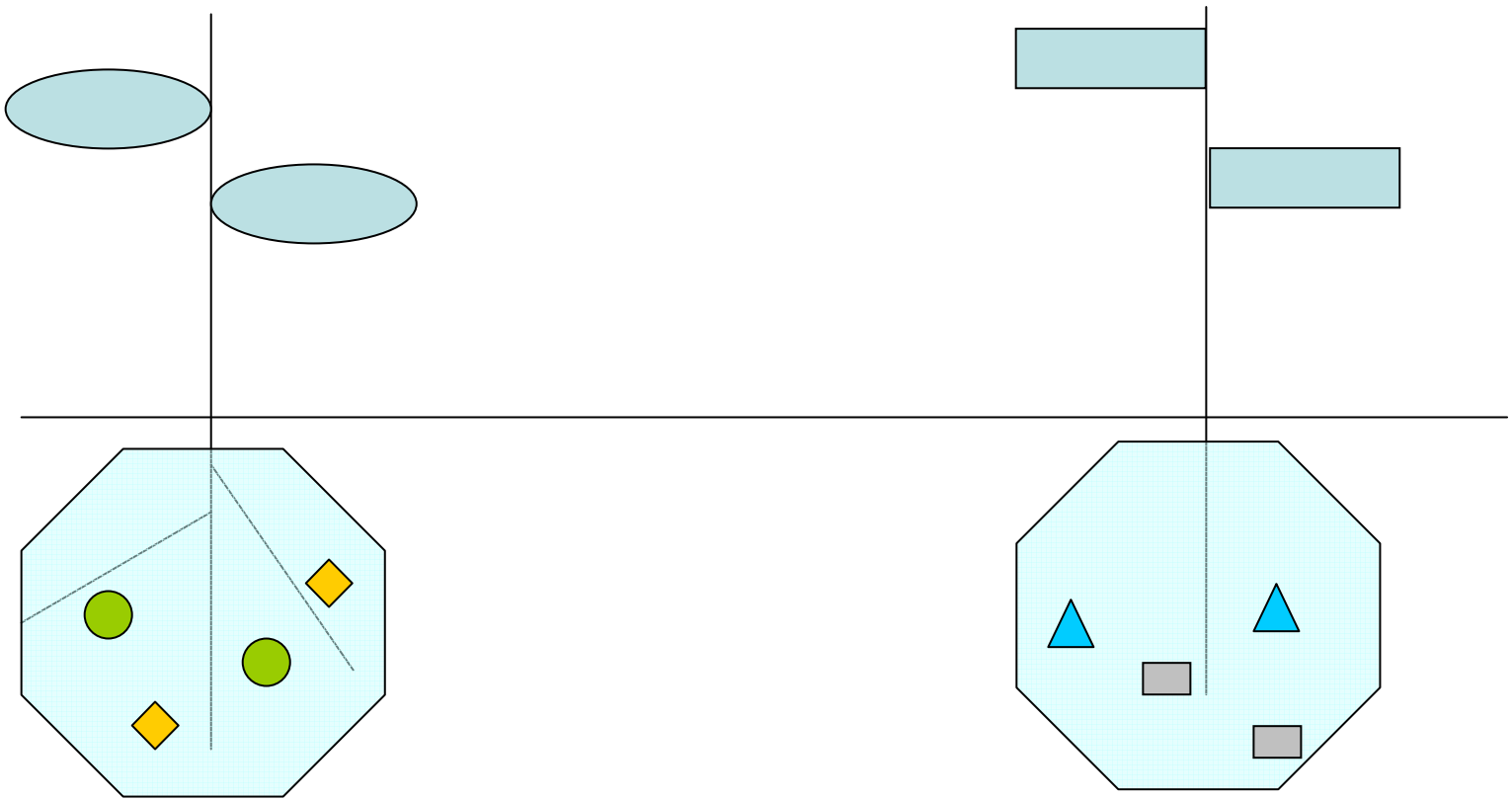
mutualistic microorganisms

pathogens

Invasion theory: Enemy release hypothesis (ERH)

- Disrupted coevolution networks

interactions
with soil biota



Soil community 1

Soil community 2

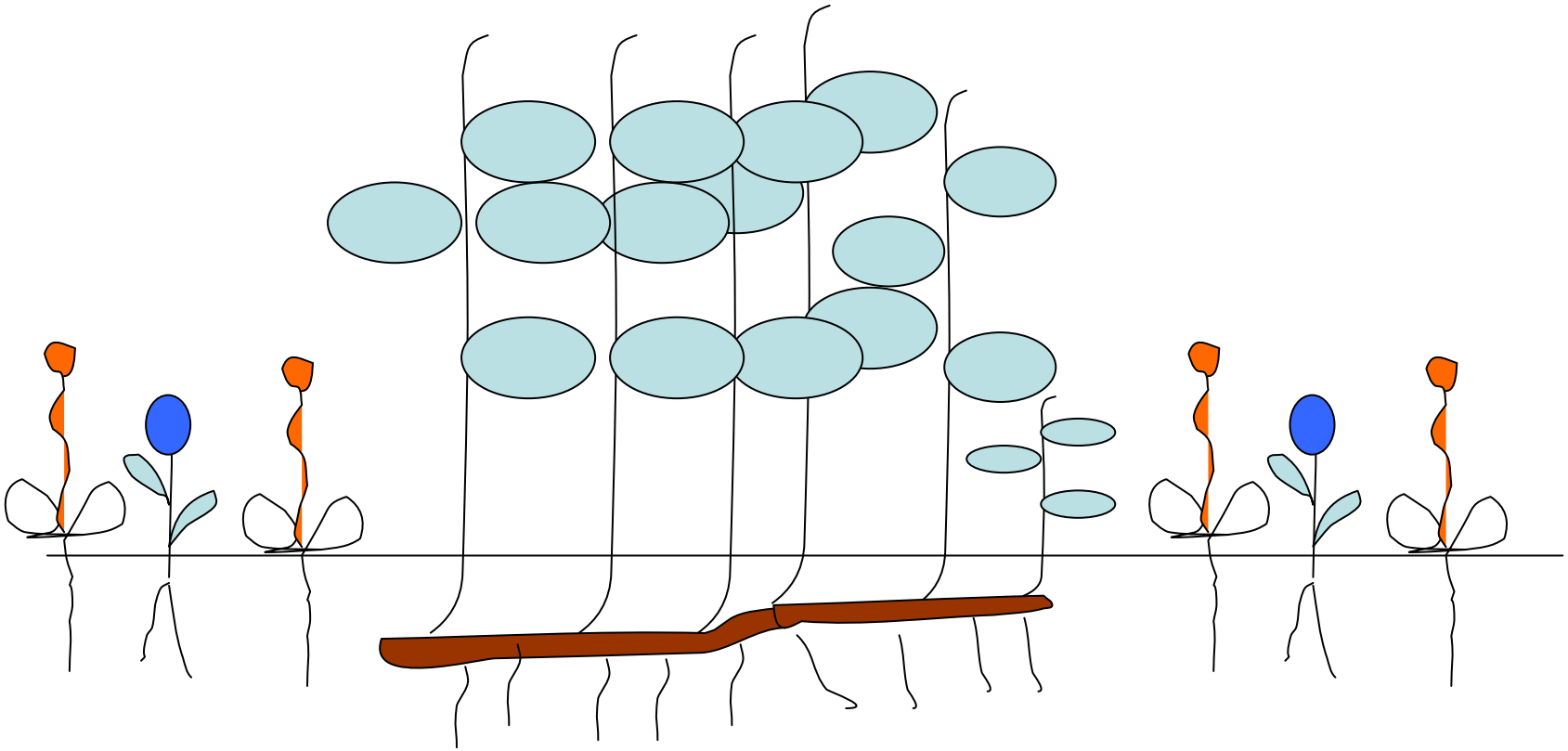
- Functional consequences poorly studied

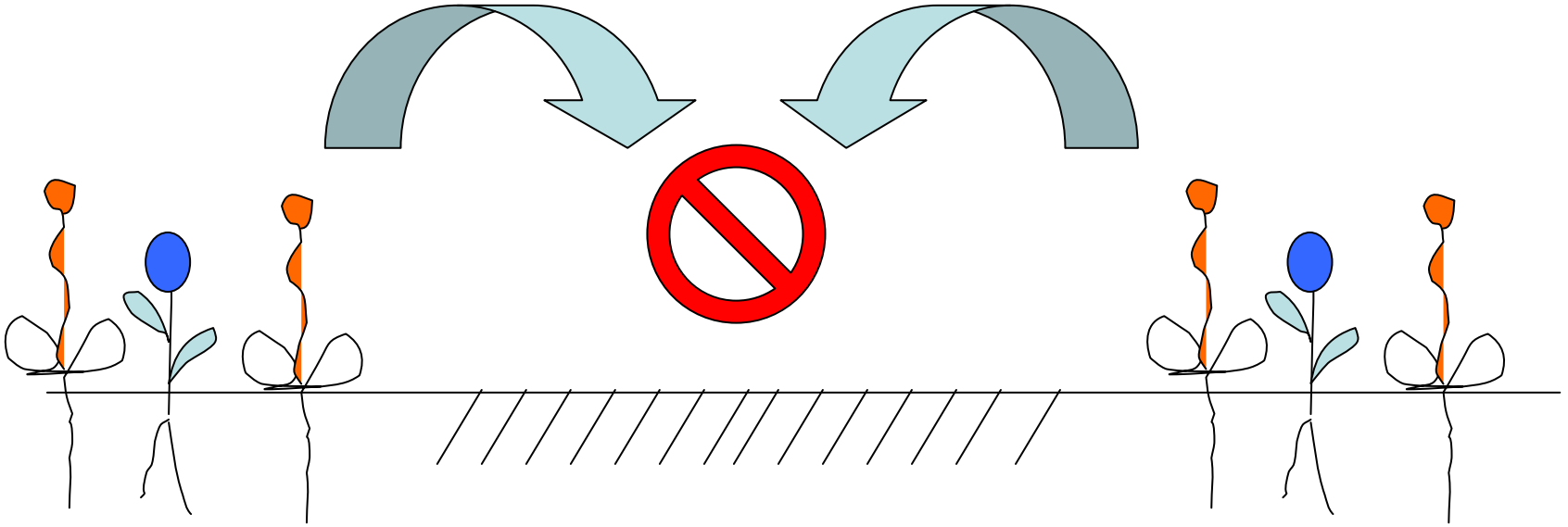
Centaurea maculosa (US)


Solidago gigantea

Q3. Impacts relevant to management?

- Little studied





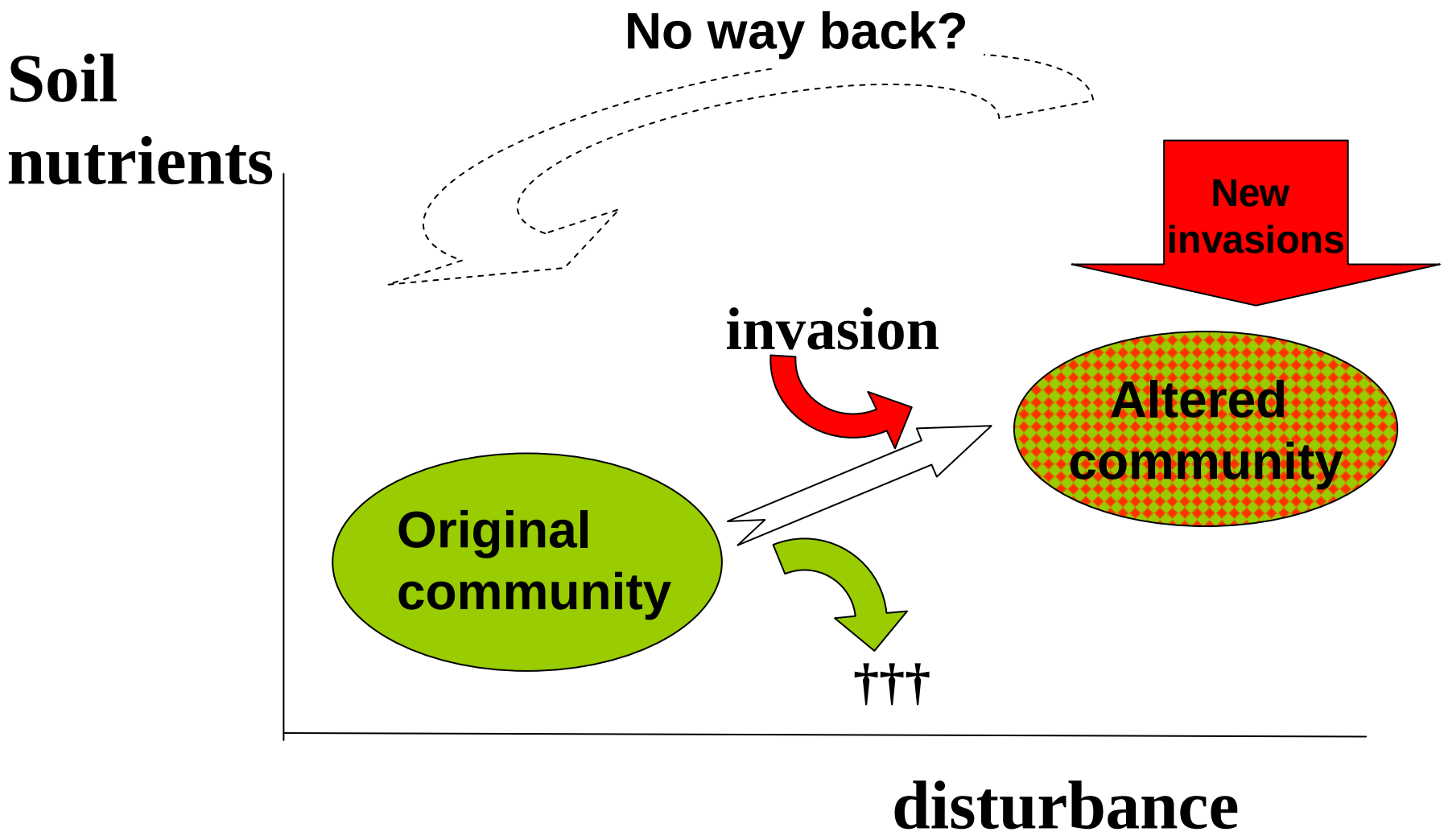
Soil transformed ⇒ « carry over » effects?

⇒

Restoration compromised?

« Invasional meltdown »

- Invasion facilitating invasions by other aliens


Soil nutrients
No way back?
New invasions
invasion
Altered community
Original community
†††
disturbance

Conclusions

- Invasion theory: a framework for impact prediction
- Impacts may aggravate global change (eutrophication)
- Impacts mediated by biotic interactions not well studied
- Need for long-term monitoring of consequences on restoration

- Thanks to INPLANBEL team
  - Especially Sonia Vanderhoeven and Nicolas Dassonville