ECOLOGICAL THEORIES PROVIDE STRONG SUPPORT TO GRASSLAND RECOVERY

PÉTER TÖRÖK[1] & AVELIINA HELM[2]

[1]University of Debrecen, Hungary

[2]University of Tartu, Estonia

NEW FRONTIERS IN RESTORATION

NEED OF GREEN INFRASTRUCTURE

- In the last century the degradation of natural ecosystems became very dramatic
  - Land use changes
  - Agricultural intensification
  - Urbanisation
  - Climate change
- The formerly dominant static and habitat-based conservation paradigm cannot be held

NEED OF GREEN INFRASTRUCTURE

- Green infrastructure is a **strategically planned network of natural and semi-natural areas** with other environmental features designed and managed **to deliver a wide range of ecosystem services** such as water purification, air quality, space for recreation and climate mitigation and adaptation.
- This **network of green (land) and blue (water) spaces** can improve environmental conditions and therefore citizens' health and quality of life.

CONSERVATION AND RESTORATION

- Key element of developing green infrastructure is to apply in conservation and restoration a new paradigm, which is
  - Holistic
  - Focus on the conservation and restoration of processes and functions and not exclusively on composition
  - Focus on sustainability
  - Consider also landscape-scale processes

NEED OF THEORY

- It is necessary to have strong theoretical basis of conservation and restoration actions.
- Theoretical research advanced much in the last few decades
- Theoretical framework for restoration - > *SER Primer on Ecological Restoration* – definitions

The SER Primer on Ecological Restoration[1]

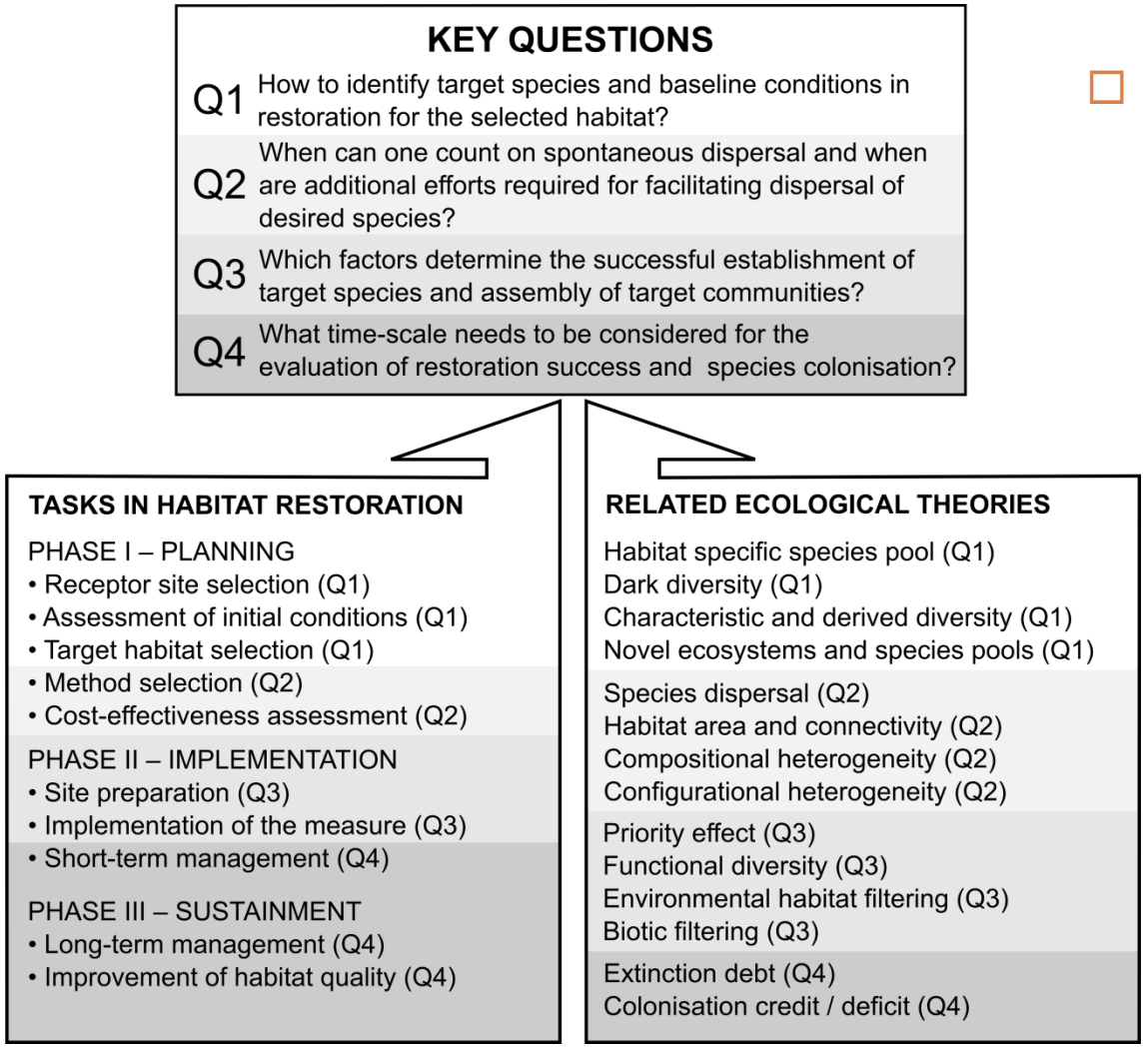
A Publication of the Science & Policy Working Group[2]
April 2002 (First Edition)[3]

THEORY VS. PRACTICE

- Both theoretical ecology and restoration ecology became strong in its playground but rather week is the communication between the disciplines

- Experiences gained during practical restoration rarely reach theory
- Complicated theories are rarely translated for practitioners

THEORY VS. PRACTICE



- Key topics
  - Identification of target vegetation
  - Spontaneous dispersal capacity
  - Establishment limitations
  - Time scale and sustainability

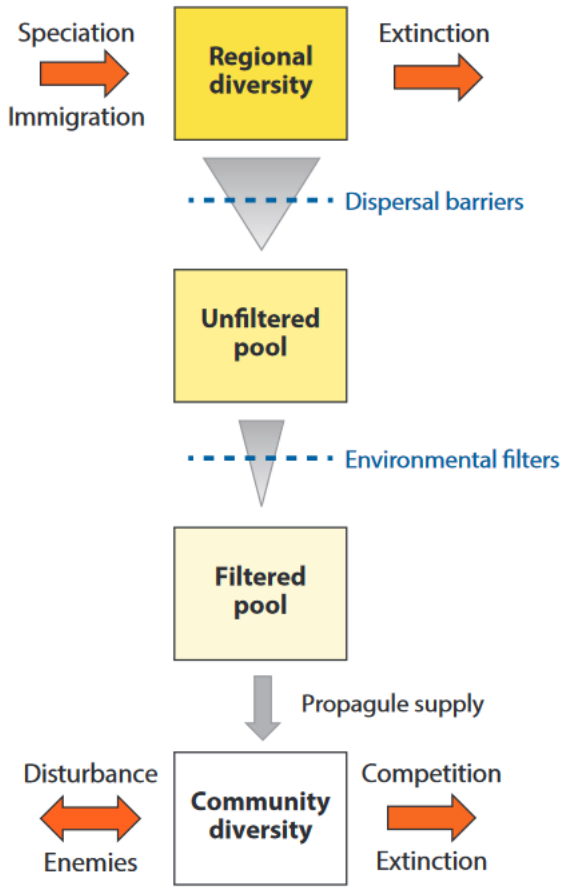
Török & Helm (2017)
Biological Conservation

TARGET COMMUNITY SELECTION

- What is the restoration target?
  - Self sustaining community with high resistance and resilience to disturbance
  - Community which can be managed in a sustainable way
- Target to reach a community composition and richness similar to a natural or semi-natural community
- Difficult task to identify the restoration target

TARGET COMMUNITY SELECTION

- Species pool concept (Zobel et al. 1998)
- Habitat specific species pool (Zobel 2016)
- The size of the species pool is strongly habitat dependent



TARGET COMMUNITY SELECTION

- Dark diversity – Which species of habitat specific species pool are missing in a respective stand? (Pärtel 2014)
- Which species are, which can spontaneously immigrate into a respective site?
- Community completeness theory

TARGET COMMUNITY SELECTION

- Realistic restoration target can be set
- Helps in method selection
- Helps to select species which need an active diaspore transfer to restoration site
- Restoration target also changes in time - > Climate change

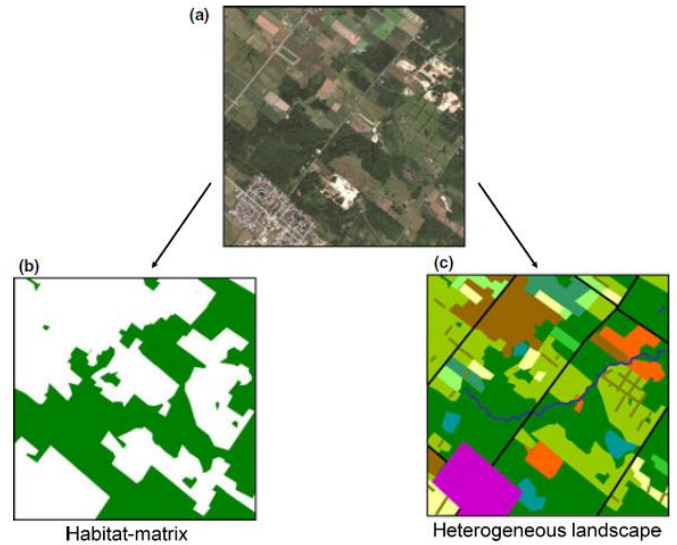
SPONTANEOUS DISPERSAL

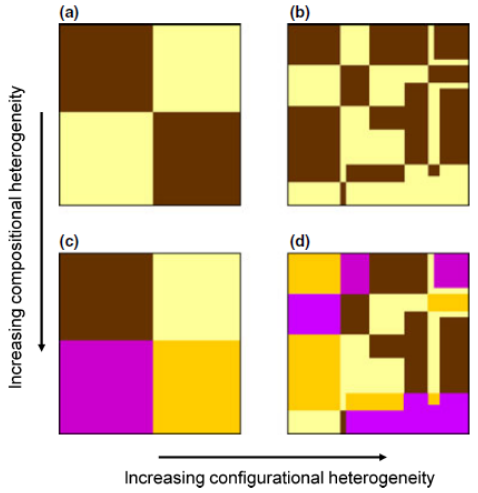
- Crucial point in restoration the cost-effectiveness
- The propagule providing capacity of the landscape has a crucial role in community conservation and restoration
- The integration of landscape context in the habitat conservation and restoration is relatively novel – Brudvig (2011) Am J. Bot.

SPONTANEOUS DISPERSAL

- Crucial patterns
  - Availability and connectivity of target habitats
  - Landscape-scale habitat complexity
  - Landscape scale habitat configuration

Fahrig et al. (2011)



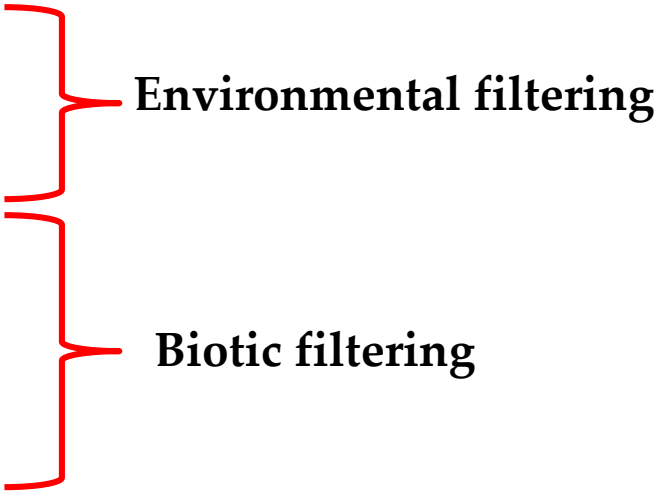


SPONTANEOUS DISPERSAL

- Differences in specific dispersal capacity - The habitat matrix is not similarly affect species
  - Grassland species dispersal (20- /50/m- 1km)
  - Long distance dispersal
  - Trade-off between dispersal and establishment
  - Role of vectors – i.e. abiotic vs. Biotic dispersal
  - Matrix species – mass effect

ESTABLISHMENT LIMITATIONS

- Factors in establishment
  - Site history
  - Local abiotic factors
  - Site species composition
  - Assembly rules
  - Priority effect v.s. mass effect)



- Functional diversity and „Trait-based heaven”
- Trait-based ecosystem engineering in restoration

TIME SCALE AND SUSTAINABILITY

- The species composition of target habitats are not in agreement with the current species pool of the landscape
  - Extinction debt
- Spontaneous colonisation is a slow process
  - Colonisation credit vagy deficit
- Restoration and fate of established species
- How fast can restored communities reach target?

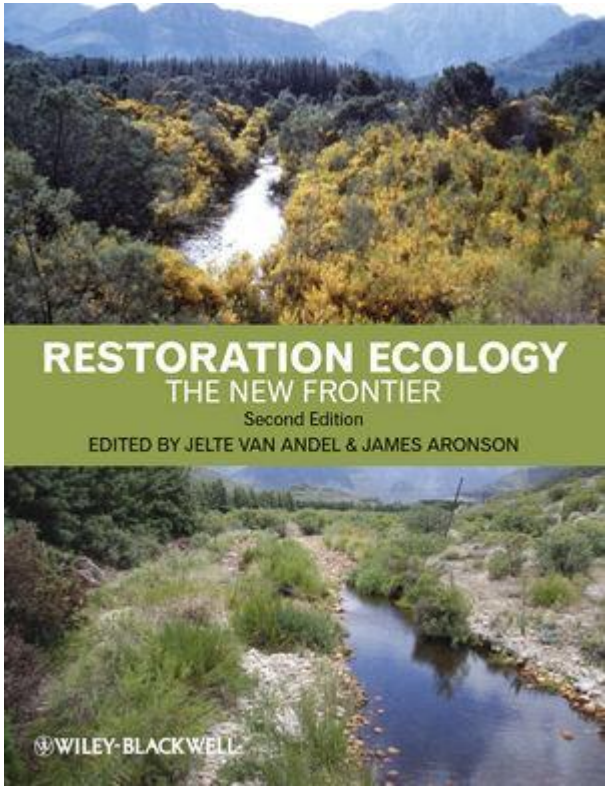
OTHER SIDE OF THE COIN

- How can practical conservation and restoration support theory?
- Restoration can be the playground of theory (Restoration is the acid test of ecological theory – Bradshaw 1987)

Török & Helm (2017)
Biological Conservation

OTHER SIDE OF THE COIN

- What type of data are available?
  - Starting conditions
  - Species transfer rates
  - Problem species and their dispersal
  - Conservation and restoration methodology
  - Conditions at the reference sites
- SER Knowledge Base



OTHER SIDE OF THE COIN

- In which fields can practical conservation and restoration support theory?
  - **Temporal changes of communities** (succession theory, state-transitions, convergent or divergent vegetation development, delayed processes)
  - **Community assembly** (assembly rules, ecosystem stability, functional diversity components, key species, link between structure and function)
  - **Dispersal dynamics** (spatial dispersal, establishment and seed banks)
  - **Landscape scale dynamics of biodiversity**

OTHER SIDE OF THE COIN

- It would be important…
  - Translate rather complicated theories for conservation and restoration planning and request the help of theoretical ecologists
  - Summarise the practical needs of conservation and restoration and formulate research questions for targeted theoretical research