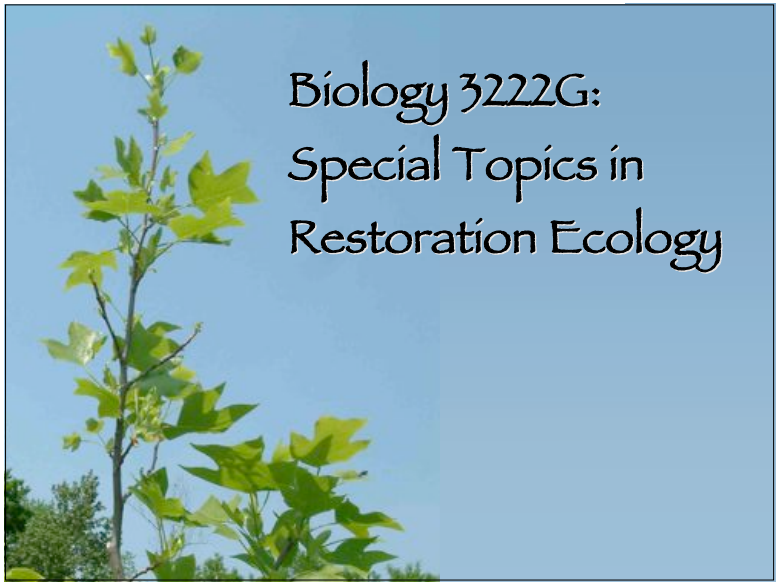


Restoration Ecology

- Instructor: Dr. Daria Koscinski
- Email: Daria.Koscinski@uwo.ca
- Office: BGS 3045
- Office hours by appointment only (email)

Community Service Learning

- This is a CSL course!
- You will learn:
  - science of *restoration ecology*
  - practice of *ecological restoration*

Community Service Learning

- Our partner: Lower Thames Valley Conservation Authority
  - http://www.lowerthames-conservation.on.ca/
- Longwoods Road Conservation Area
  - 63 hectare property
  - Forest, wetlands, meadows
  - Invasive species!

Community Service Learning

- Research Projects:
  1. Effect of *Alliaria petiolata* (garlic mustard) on Carolinian forest ecosystems
  2. Factors affecting the spread of *Alliaria petiolata* (garlic mustard)
  3. Factors affecting the spread of *Phragmites australis*
  4. Factors affecting the spread of *Lythrum salicaria* (purple loosestrife)
  5. Management options for *Alliaria petiolata* (garlic mustard)

Classes & Tutorials

- Lectures & Tutorials Thur 3:30-6:30
- TA: Sonja Teichert (steiche@uwo.ca)
- Lecture slides available on WebCT
  - Partial, need to fill in the blanks in class

Classes & Tutorials

- Required reading: “Restoration Ecology” by J. Van Andel & J. Aronson, available at UWO book store
- Schedule of lecture topics and associated readings posted on WebCT

Evaluation

- Final exam = 30%
  - During April exam period
  - Exams are short and long answer style questions

Evaluation

- Group Seminar Presentation = 20%
  - Sign up for various topics in WebCT
- Tutorials/Participation = 5%

Evaluation

- CSL LTVCA project:
  - Group Report (due April 5th) 25%
  - Group evaluation (due April 9th) 10%
  - Self-reflection 10%

Absence, Illness, Conflicts

- Please notify me in advance if possible of any absences or missed deadlines
- All documentation must be taken to Dean's office for accommodation
- Late assignments penalized 10% per day
  - After 5 days unexcused late assignments will not be accepted and a grade of 0 awarded

Scholastic Offenses

- Plagiarism is the submission of the work of someone else without giving credit to the author, and presenting the work as your own
- Your paper will be assessed using Turn-it-in.com

Accessibility

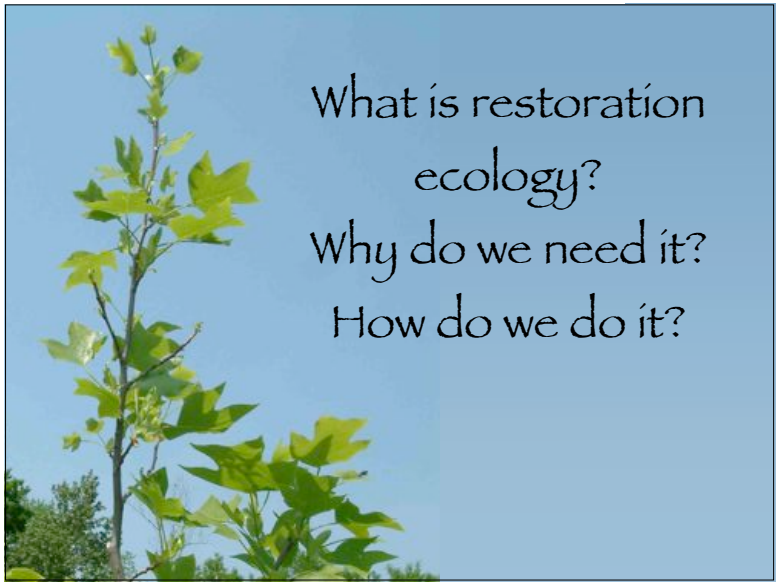
- Please let me know if you require material in an alternate format or any other arrangements
- Contact Services for Students with Disabilities for additional questions or assistance
  - 519-661-2111 x 82147

Goals of this course

- Understanding of ecological theory relevant to restoration of ecosystems
- Experience applying science to ecological restoration projects
- Familiarity with social, global and economic issues related to ecosystem restoration

Course structure

- Lectures on theory related to restoration ecology
  - Parts 1 & 2 of text book
- Guest lecturers highlighting local issues & projects
- Student seminars on restoration of specific ecosystems
  - Can use Part 3 of text book as guide



Restoration Ecology

- "Ecological restoration is the process of assisting recovery of an ecosystem that has been degraded, damaged or destroyed"
- Ecological restoration = practice
- Restoration ecology = fundamental science upon which actions should be based

Why do we need it?

- Many adverse effects of humans on ecosystems
  - Especially since Industrial Revolutio

Why do we need it?

- But we rely on ecosystems to support human life
  - Ecosystem services

Sustainability

Societal aspects

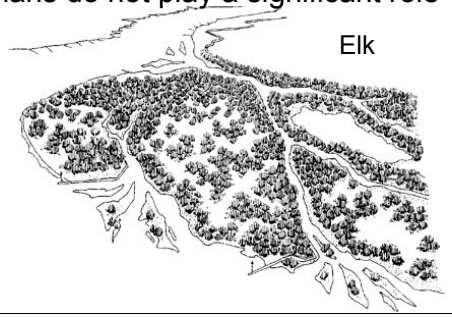
- Success of restoration projects depends on:
  - Good technical expertise
  - AND community support of projects
- Community involvement can include:
  - Volunteer time planting
  - Providing historical input
  - Helping design projects that improve quality of life

Humans: In or Out?

- Concepts of nature vary
  - Are humans part of it or external?
- Affects choice of targets for restoration efforts

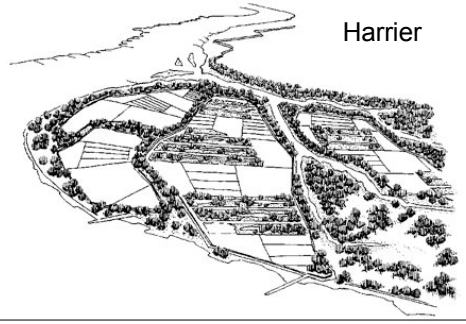
Wilderness

- "Natural landscapes"
- Nature regulates itself
  - Humans do not play a significant role



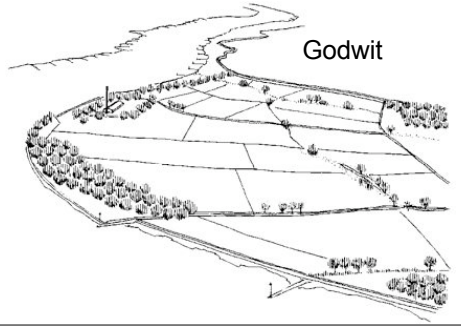
Arcadian

- "Semi-natural landscapes"
- Humans are part of nature and play active role



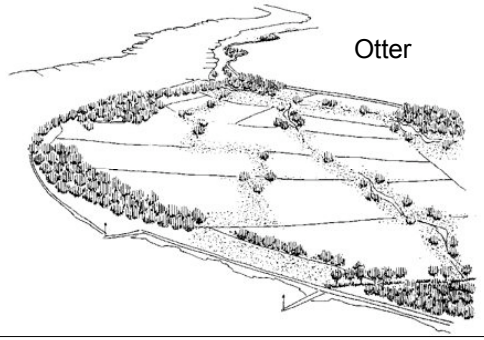
Functional

- "Rural landscapes"
- Nature is something to be used by humans



Mixture

- Could have a mixture of all
  - E.g. "Otter" improves connectivity



Choosing targets

- What components do we want to restore?
- For what purpose are we restoring them?

Targets

- Species
- Ecosystem functions
- Ecosystem services

Species

- Restoring species can include:
  - Keystone species
  - Endangered species
  - Assemblages
- Approach may rescue species, increase biodiversity
- Landscape and ecosystem interactions may be ignored

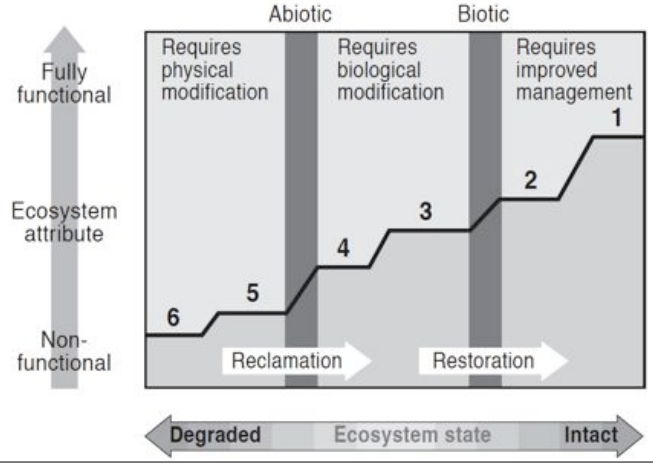
Ecosystem Functions

- Focus on interactions between components of ecosystem
  - Material and energy flows
  - Biotic components (e.g. trophic connections)
  - Abiotic components (e.g. nutrient cycling)
  - Ecosystem architecture

Ecosystem Services

- Mixture of species and function

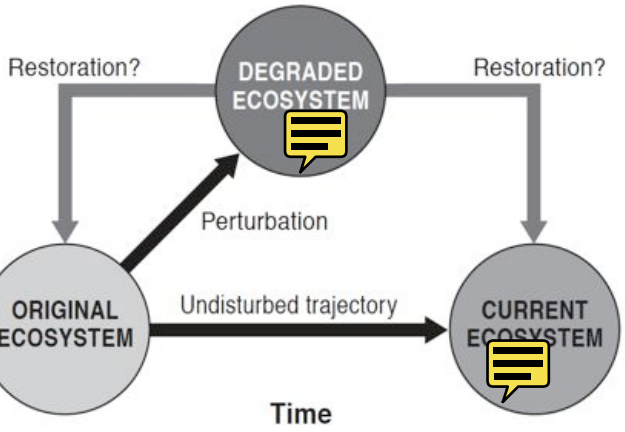
Choosing targets



Choosing targets

- Historical reference
  - Re-instate ecosystem prior to degradation
  - On-site remnants, historic photography, similar sites, museum collections, palaeoecological evidence
- How far back in time?
- "Moving-target syndrome"

Choosing targets



Choosing targets

- Modern reference
  - What would be here if degradation had not happened?
- Are current ecosystems at their optimum?

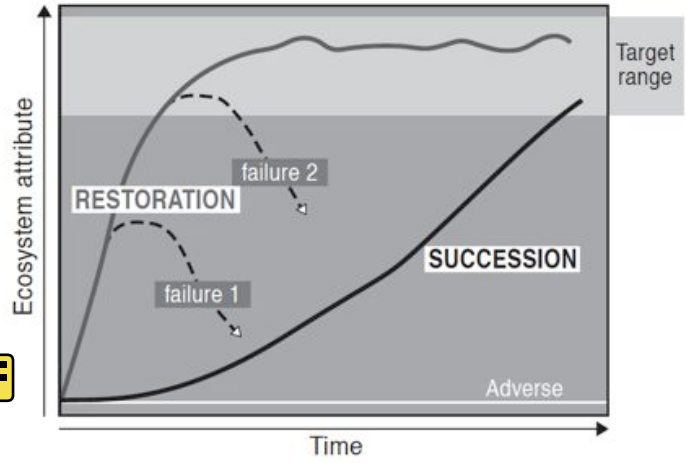
Choosing Targets

- Functional
  - Gives us something to measure, but not something to manipulate
- Ecosystem Services to Society
  - Incorporates societal aspects of restoration

Choosing Targets

- Need to address all types of targets to set achievable goals
- Targets should be set in context of historical and current land use, size of area, and community support

Measuring success

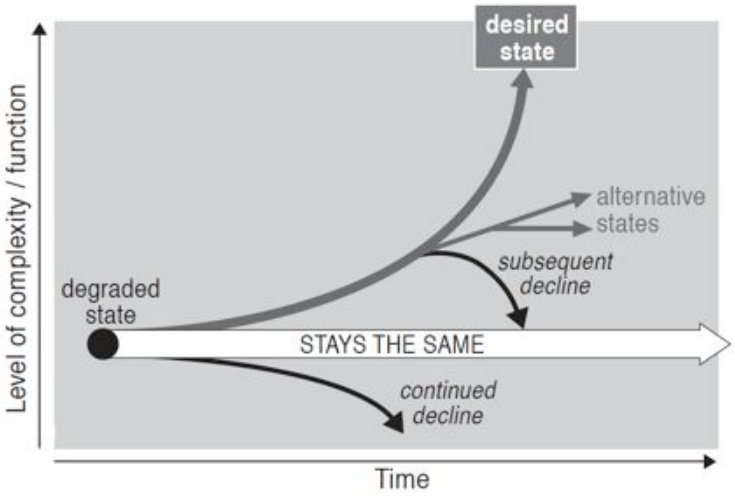


Measuring Success

- Must measure and monitor restoration projects to:
  - Evaluate success
  - Address problems before a large failure occurs

Measuring Success

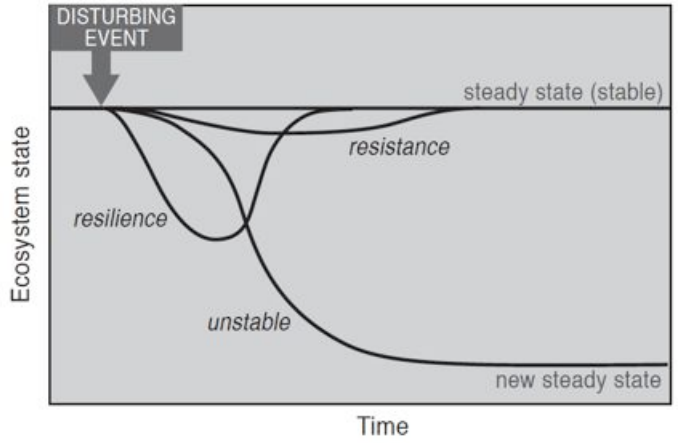
- Potential measures:
  - Characteristic assemblage of species
  - All functional trophic groups
  - Normal functioning of cycles
  - Resilience to perturbation
  - More in Table 1.2, page 15



Disturbance

- Long-term disordering of a constant or steady state, due to an external event to which the system is not capable of responding through resistance or resilience

Disturbance



Disturbance

- How do we measure it?
- Usually relative to a reference system

Disturbance

- Kind: environmental factors (biotic or abiotic)
- Degree: difference between new condition and previous study state or reference
- Frequency: isolated, recurrent, continuous, irregular, regular, duration
- Scale: spatial and temporal, ecosystem, community, population or individual

Stability

- The capacity of a system to return – in spite of changes of environmental conditions – to a certain starting value, which is considered a steady state.
- This steady state is a dynamic equilibrium, not at stasis, and is kept within boundaries through resistance and/or resilience.

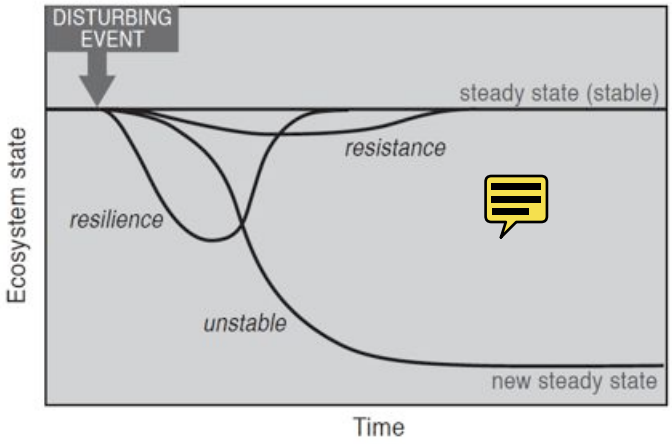
Resistance

- Systems that show relatively little response to a sudden change in environmental conditions are said to be resistant; they maintain their structural and functional attributes.
- It is often the case that resistant systems will take a long time to return to their initial state after an external change that is strong enough to alter the state temporarily.

Resilience

- Resilient systems can be altered relatively easily but will return to the initial state more rapidly. They regain structural and functional attributes that have been damaged due to changes in environmental conditions.
- The length of time taken to return to the steady state is inversely related to resilience; the faster the system returns, the more resilient it is.

Stability, Resistance & Resilience

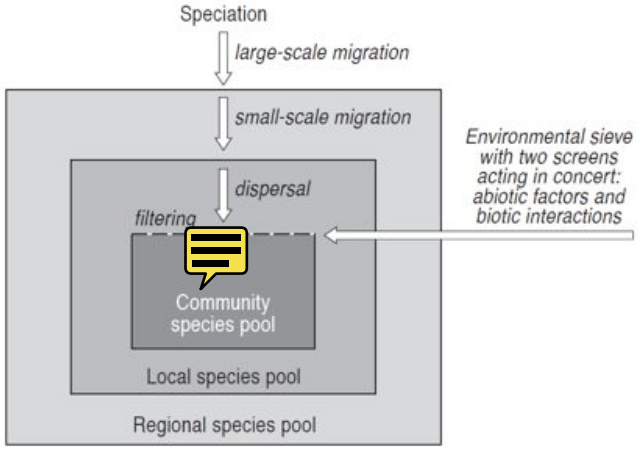


Biodiversity

- Variety of life on Earth

1. Taxonomic diversity at community level
2. Genetic diversity at species level

Biodiversity: Community Level



Biodiversity: Community Level

- Functional Groups
  - Groups of species with similar structure or function in an ecosystem
  - E.g. resource use, nitrogen fixation, annuals vs. perennials, Raunkiaer plant life forms

Biodiversity: Community Level

- Keystone species
  - Have a key function in controlling the structure of a food web or the functioning of an ecosystem
  - Changes in keystone species have dramatic effects on ecosystems
    - In food webs: trophic cascades
  - E.g. Lesser snow geese

Biodiversity: Community Level

- Indicator species
  - Species which are indicative of certain abiotic ecosystem conditions (e.g. moisture, pH)
  - Very useful in tracking restoration trajectories
  - Not necessarily critical to ecosystem function

Biodiversity: Species Level

- Focused on genetic diversity among individuals and populations
- Important for conserving or restoring species at risk of extinction

Biodiversity: Species Level

- Dispersal abilities of many species are lower than required in a fragmented landscape
- Intentional re-introductions often necessary


Biodiversity: Species Level

- Invasive species or invaders
  - Species that establish a new range in which they proliferate, spread and persist
- Alien species or exotics
  - Species living outside of their native range
  - Often introduced by human activity


Biodiversity: Species Level

- Introductions
  - Does the species still belong to the community?
  - Genetic variation of source populations
  - Suitability of environment
  - Potential for becoming an invasive species

Summary

- Introduction to the many aspects of ecological restoration
- Definitions and terms relevant to restoration ecology