Invasive Plants in Belgium:
Patterns, Processes and Monitoring
INVASIVE SPECIES: 2 criteria
1. Alien (exotic): taxon introduced outside its natural distribution
2. Reproduces and increases its range in its new environment

SECOND LARGEST CAUSE OF BIODIVERSITY LOST
(competition, predation, habitat modification,…)

INTERNATIONAL PRIORITY:
CBD, IGBP_GCTE, Diversitas, E.U. 5th and 6th Framework Programme

NO CLEAR SCIENTIFIC STRATEGY IN BELGIUM:
Lack of scientific basis for monitoring and management
OBJECTIVES

- Multifunctional and multi-level analysis of exotic plant invasion in Belgium

- Specifically:
  - Provide a **structured list of exotic** and their success of invasion
  - Detailed analysis of interactions between **species dispersal traits and landscape** characteristics
  - Identification of universally valid principles of biological invasions: **species and communities traits**
  - Analysis of the **consequences of plant invasion** on ecosystems

- Basic framework for threat evaluation, policies development, management strategy and further research programs
PARTNERS

- Laboratoire d’Ecologie – Faculté universitaire des Sciences agronomiques de Gembloux (FUSAGx) (G. Mahy) - coordinator
- Belgian National Botanic Garden (L. Vanhecke)
- Laboratoire de Génétique et Ecologie végétales – Université Libre de Bruxelles (ULB) (P. Meerts)
- Research Group Plant and Vegetation Ecology – University of Antwerp (UIA) (I. Nijs)
METHODS : Biological models

- All exotics for basic information
- 3 set of target species for detailed analysis
  - Set I : Invaders or potential invaders of natural or semi natural habitats of interest for biodiversity
  - Set II : Species from man made communities (tropical C4 grasses in maize fields)
  - Set III : Exotics that failed to become invasive or with different level of success
Methods: Biological models

- Impatiens glandulifera
- Polemonium cearuleum
- Prunus serotina
- Heracleum mantegazzianum
- Fallopia japonica
- Rosa rugosa
- Solidago gigantea
- Senecio inaequidens
WP I : List and invasion succes

- Compilation of a list of exotics species present or historically found in Belgium
  - Compilation of data from herbarium/litterature

- For set 1 and set 3 : estimation of invasive success as expansion rate (area increase/time units)
  - Compilation of data from herbarium/litterature

- For all current exotic species : evaluation of invasive risk
  - Compilation of data from adjacent or ecologically similar regions : litterature and case study
WP 2: Dispersal/landscape

- Dispersal features of species (set I)
  - Seed/vegetative
  - Seed production
  - Seed bank
  - Seed dispersal curves

- Landscapes monitoring of populations (set I et II)
  - Interpretation:
    - Communities
    - Patch-matrix-corridors
    - Human-use level

- Habitat selection and metapopulation dynamics

Basic knowledge

Relative importance of dispersal features and landscape characteristics in invasion dynamics
WP 3: Trait analysis

- Traits of species with different invasive success (<=WP1)
  - Ecophysiological traits
    - Relative growth rate, photosynthetic rate, light compensation point, dark respiration rate
    - [P,K,Mg,Ca, micronutiments]_{leaf}
    - Reproductive features (<=WP2)

- Traits of representative invaded ecosystems (<=WP2)
  - Ecophysiological traits
    - Soil cover
    - Active radiation, red: far red ratio – humidity
    - Soil characteristics and soil elements concentrations (<=WP4)

- Multiple regression of invasive success simultaneously on one invader trait and one invaded system trait for all combinations
  - Significant traits of species – ecosystems AND interactions
WP 4 : Impact on ecosystems

Selection of invaded and non-invaded patches within homogeneous sites

Comparisons of ecosystem traits

Variance analysis :
- systematic differences in traits between invaded and non-invaded patches across sites
- differences among species in the effect on soils

Multiple regression (path analysis)
- relative importance of site conditions and species traits for determining ecosystems changes (<= WP3)

Net primary production and above ground nutrient stock
- Dried standing phytomass, mineral nutrient composition.

Topsoil chemicals properties
- PH, C total, C/N ratio,
- Cation exchange capacity,
- extractable P and cations,
- nitrogen mineralisation
Expected results and valorisation

- List of exotic species with classification in risk class
- Key traits of species correlated to invasion
- Key traits of ecosystems correlated to invasibility
- Habitat preference for target species
- Historical and current dynamics of invasion for target species
- Landscape compartments prone to invasion in relation to human land use
- Evaluation of level of impact on ecosystem for target species
- Early detection of problematic species
- Early detection of sensible ecosystems
- Developing strategy for monitoring
- Guidelines for Land-use planning
- Feasibility of site restoration
Valorisation and user comittee

- Network for monitoring invasive species
  - In nature reserve (warning system) : RNOB, Ardenne & Gaume, Natuurpunt
  - At larger scale : AEF, FloWer

- Increasing awareness of policy makers (land-use and environment)
  - Aminal, DGRNE, CRNFB, IBGE

- Increasing awareness of belgian scientific community :
  - Biodiversity platform and National Focal point