www.emysr.cnrs.fr

Daugavpils, Latvia, 8 May 2024

Emys-R: A socio-ecological evaluation of wetlands restoration and reintroduction programs in favour of the emblematic European pond turtle and associated biodiversity: a pan-European approach

Jean-Yves Georges[1] & the Emys-R Consortium[2]

[1] Université de Strasbourg, CNRS, IPHC, UMR 7178, Strasbourg, France
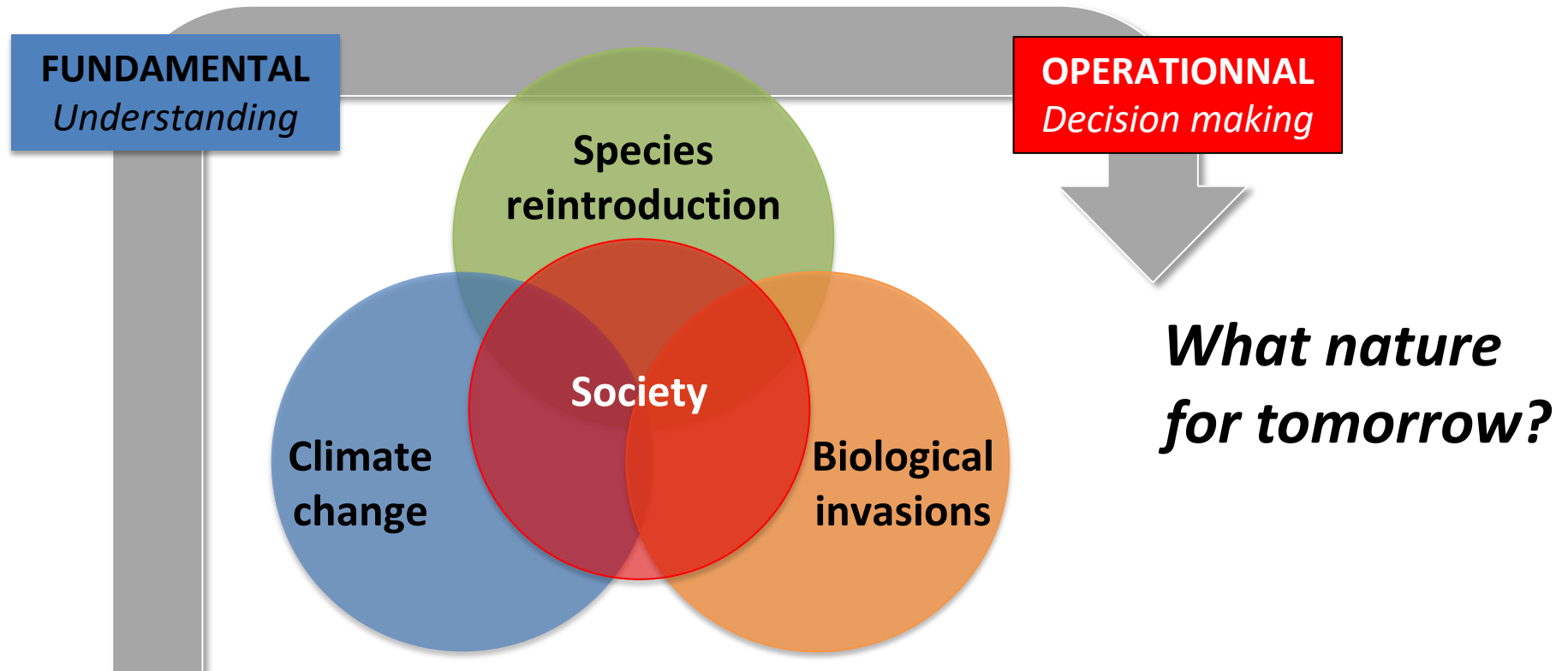
[2] https://emysr.cnrs.fr/

Research topics

- How do animals adapt to a changing world?

- From behavioural ecology…
  - Life history theory
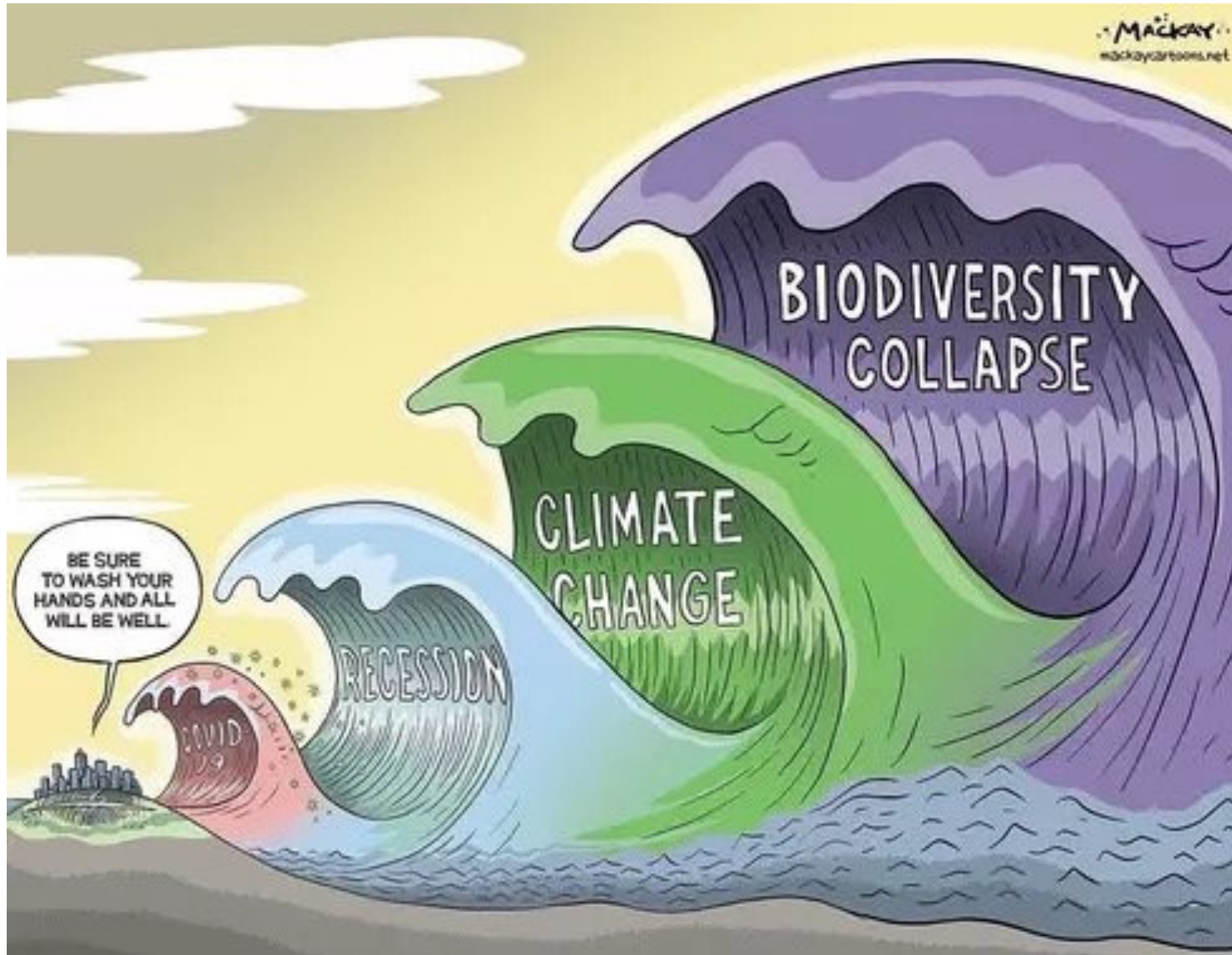 - Reproductive strategies
  - Optimal foraging theory
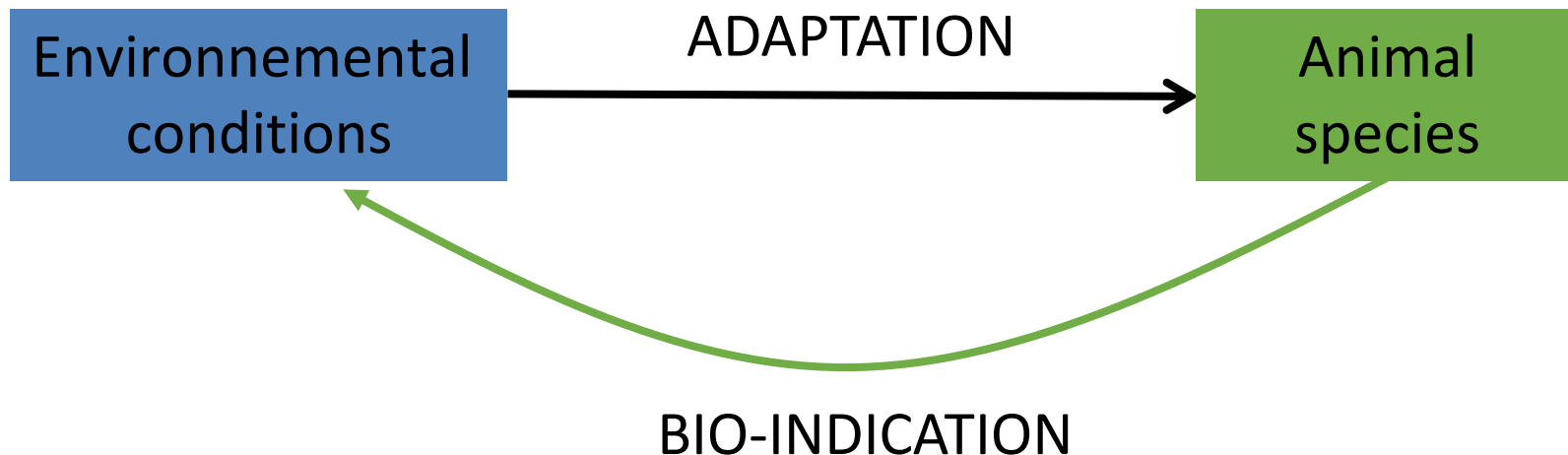
Research topics

- How do animals adapt to a changing world?
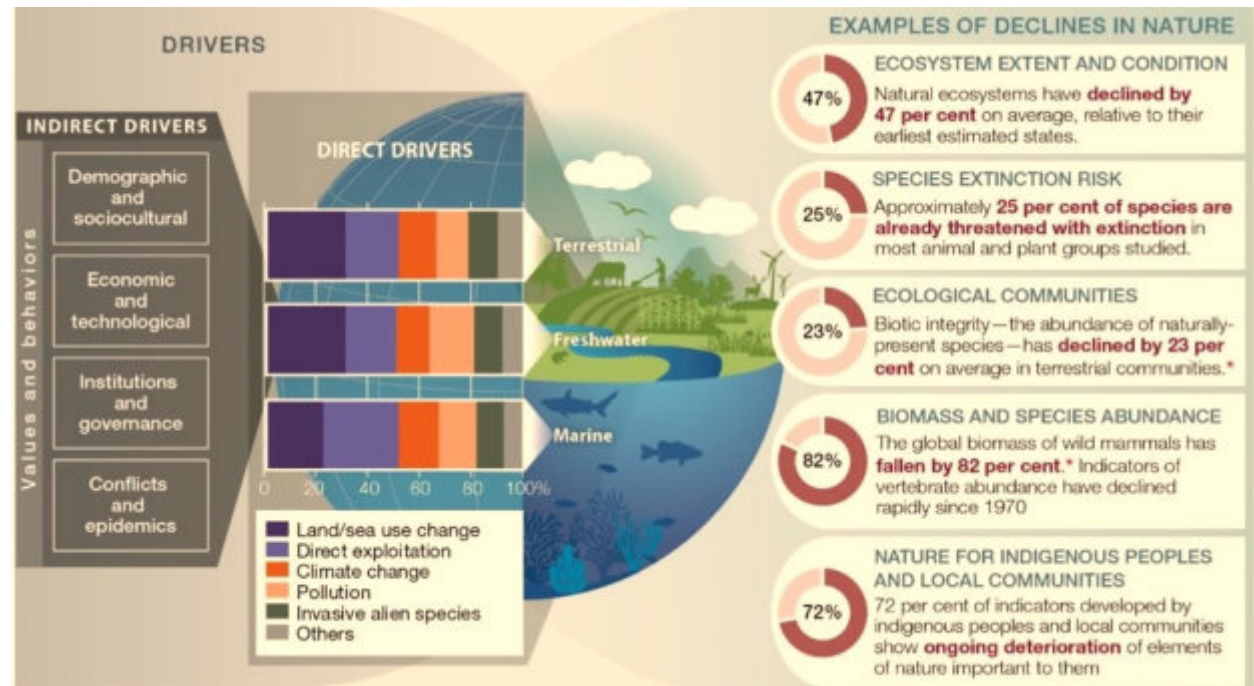- From behavioural ecology… to global ecology

CONTEXT: anthropocene

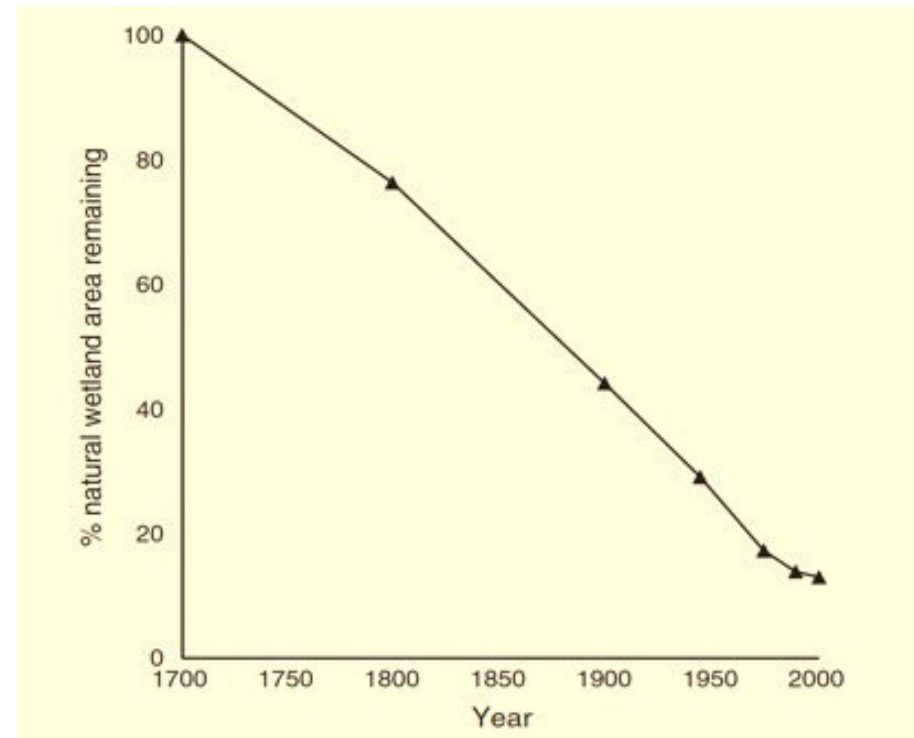# CONTEXT: anthropocene, biodiversity

- 6th crisis of biodiversity loss

CONTEXT: anthropocene, biodiversity and wetlands

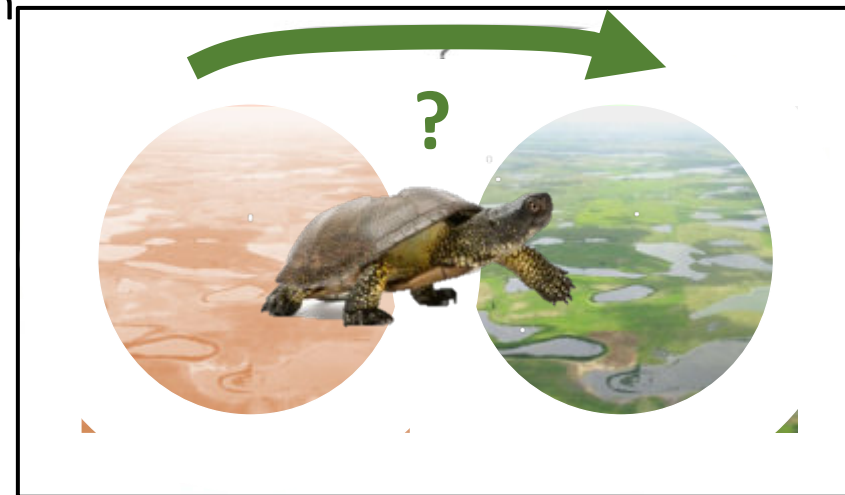- 6th crisis of biodiversity loss
- Wetland collapse since 1700s

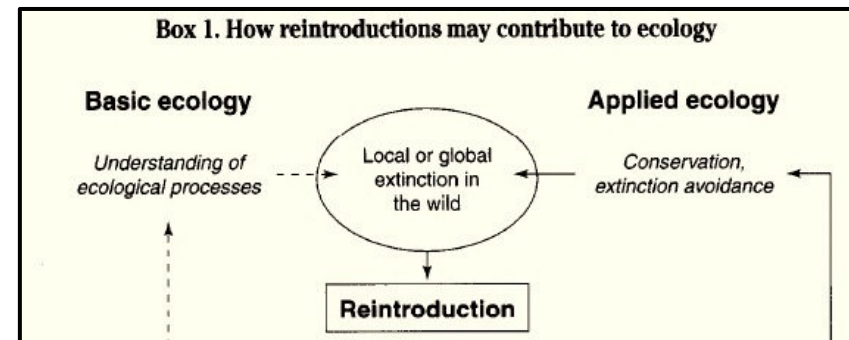Fig. 4. The percentage remaining of the natural wetland area at the start of the 18th century (1700 AD). Values are extrapolated from the average rates of wetland loss in Table 1.

Davidson (2014) *Mar Freshwater Res*

CONTEXT: anthropocene, biodiversity and wetlands

A potential remedy

- Habitat restoration & species reintroduction
  - Open-air experiments both basic and applied (Sarrazin & Barbault 1996 *TREE*)
  - Human-nature connectedness as a pathway to sustainability (Barragan-Jason et al. 2021 *Cons Lett*)

- The study case
  - Wetlands and turtles: two opposite perceptions of nature
  - Can Emys be an emissary (**Emys-R**) for reconnecting/reconciliating people and nature?


Box 1. How reintroductions may contribute to ecology

Basic ecology — Understanding of ecological processes ⟶ Local or global extinction in the wild ⟵ Conservation, extinction avoidance — Applied ecology

Reintroduction

EMYS: the European pond turtle

Emys orbicularis

- Small-sized freshwater turtle
  - 20 cm, 1 kg
  - Ponds and lentic waterbodies
  - Europe and North Africa
  - Opportunistic feeder

- Conservation status
  - Most dramatic decline for reptiles in Europe
  - Numerous reintroduction initiatives throughout Europe (umbrella species)

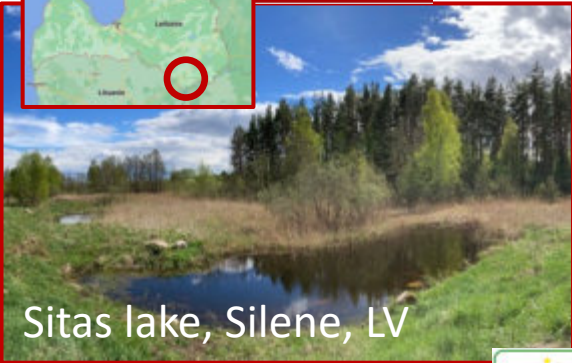→ **Results dissemination to be promoted**

- occurrence
- reintroduction
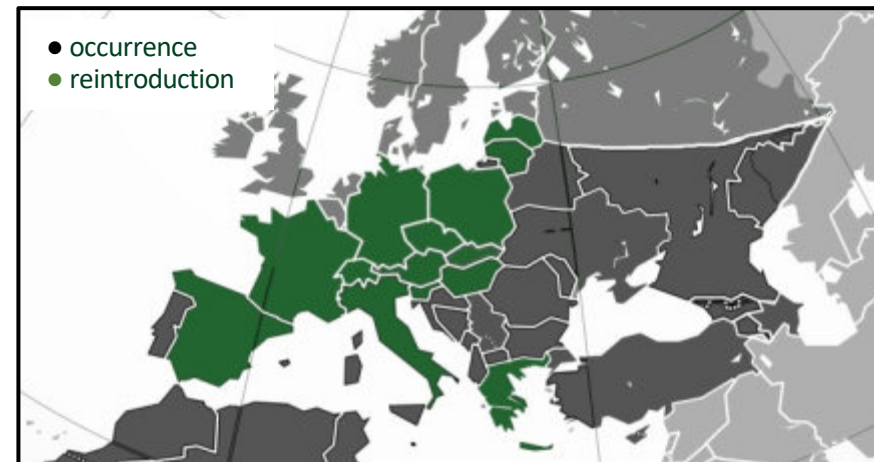
EMYS-R: the DE+FR+LV+PL Consortium

What are the most appropriate ways to restore wetlands for *Emys*?

- Three major study sites with contrasted socio-ecosystemic contexts

Woerr, Lauterbourg, FR   Neuburg am Rhein, DE   Sitas lake, Silene, LV

- ○ 6 ponds   ○ 14 ponds   ○ 27 ponds
- ○   ------ 43 sp. macrophytes -----   ○ 90 sp.
- ○ 5 km from town   ○ in town   ○ no man's land

- Common monitoring protocols (since 2021)

EMYS-R: the DE+FR+LV+PL Consortium and beyond

Supportive partners

Pending partners

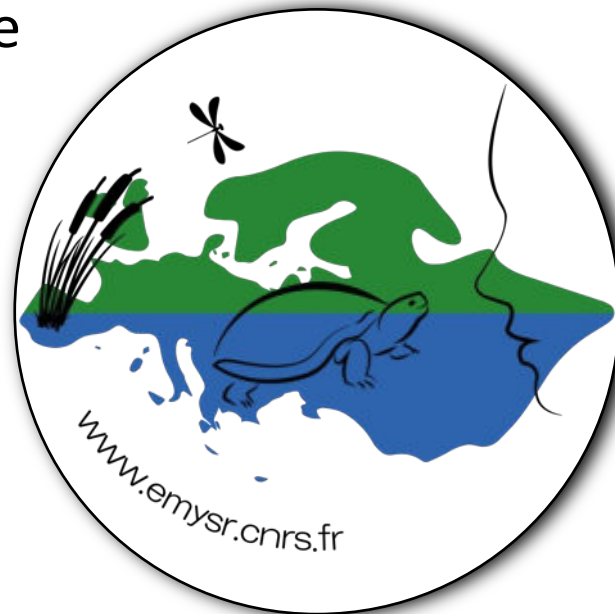# EMYS-R: a transdisciplinary action-oriented research

For defining and disseminating

- the most efficient, socially-supported, ecological methods to restore wetlands

- in favour of *Emys* reintroduction and associated biodiversity

- throughout Europe
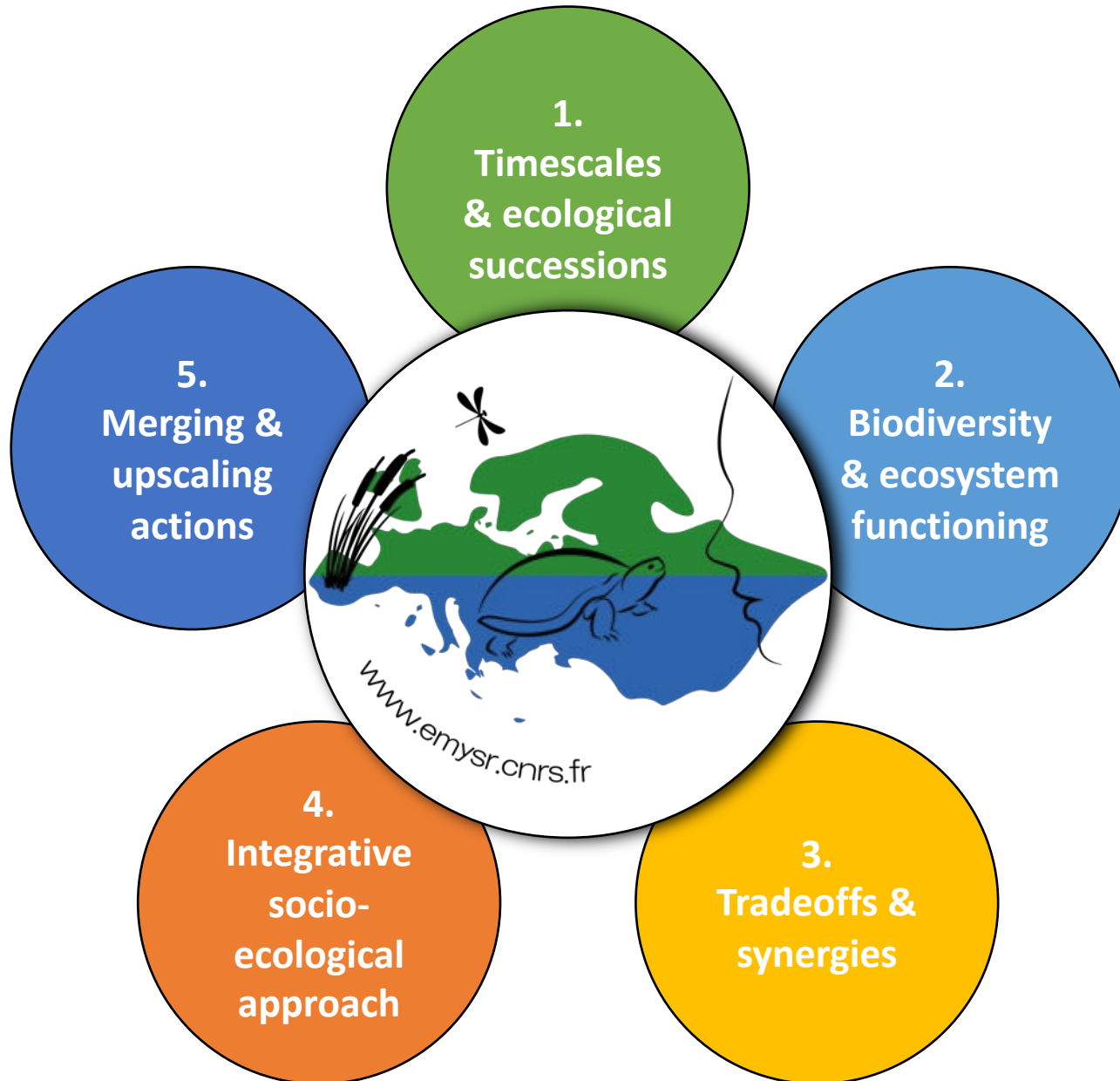
www.emysr.cnrs.fr

1.
Timescales
& ecological
successions

2.
Biodiversity
& ecosystem
functioning

3.
Tradeoffs &
synergies

4.
Integrative
socio-
ecological
approach

5.
Merging &
upscaling
actions

www.emysr.cnrs.fr

T5.1. Literature review

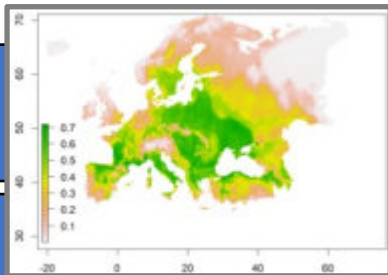T5.2. Bioclimatic modelling

T5.3. Guidelines of best practices

5. Merging & upscaling actions

1. Timescales & ecological successions

T1.1. Chronosystemic frames (1900 – today)

T1.2. Degree of recovery

2. Biodiversity & ecosystem functioning

T2.1. Emys population monitoring

T2.2. Wetland ecosystem functioning

www.emysr.cnrs.fr

T4.1. Economic benefit analysis

T4.2. Public perception assessment

T4.3. Public seminars

T4.4. Participatory workshops

4. Integrative socio-ecological approach

3. Tradeoffs & synergies

T3.1. Not-target species monitoring

T3.2. Adaptive management

1. Timescales & ecological successions

T1.1. Chronosystemic frames (1900 – today)

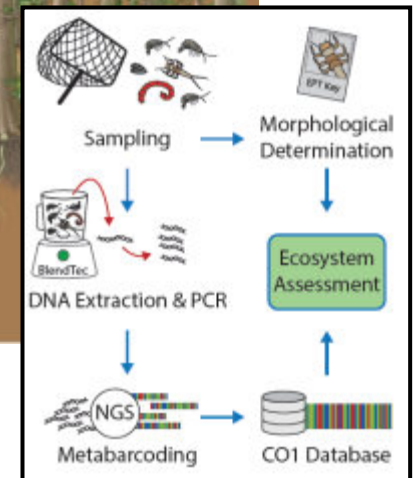→ **Historical use and land cover assessment**
Archives and orthophotos

T1.2. Degree of recovery

→ **Biocenotic indices of water bodies**
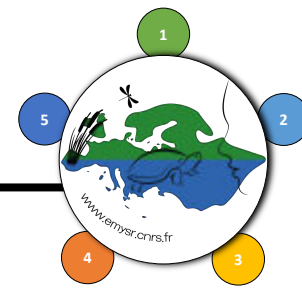Biodiversity surveys + eDNA metabarcoding

Kari-Anne van der Zon (*ecological successions*)

EMYS-R WP2: functional approach

T2.1. Emys population monitoring

→ **Determinants of population trends**
Survival, health, dispersion, reproduction

2. Biodiversity & ecosystem functioning

T2.2. Wetland ecosystem functioning

→ **Food web analysis**
eDNA in prey-predator feaces

Food Web Analysis

- Consumed Food Items
- Available Food Items
- Turtle Presense / Absense

Sampling
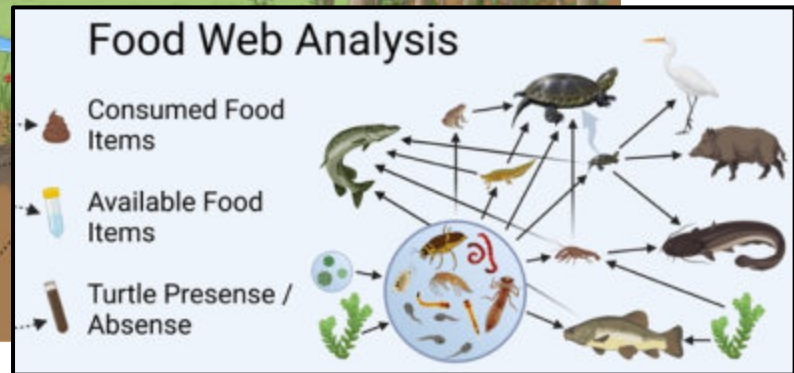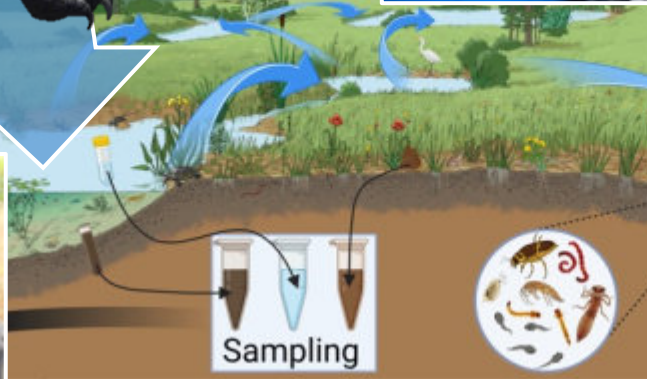
Carolin Eichert (*Emys microbiome*)
Johannes Meka (*Emys trophic ecology*)

EMYS-R WP3: tradeoff approach

3. Tradeoffs & synergies
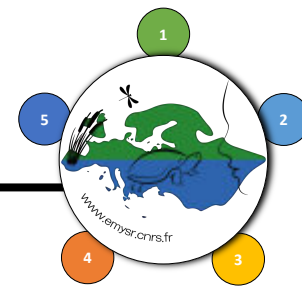
T3.1. Not-target species monitoring

→ **Protected & invasive species**
Occurrence, distribution and abundance

T3.2. Adaptive management

→ **Emys-friendly invasive-proof habitats**
Experimental pond

Pelobates fuscus

Faxonius immunis

Trachemys sp.

FR, Sept 2022

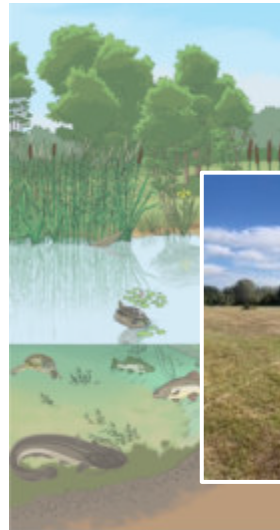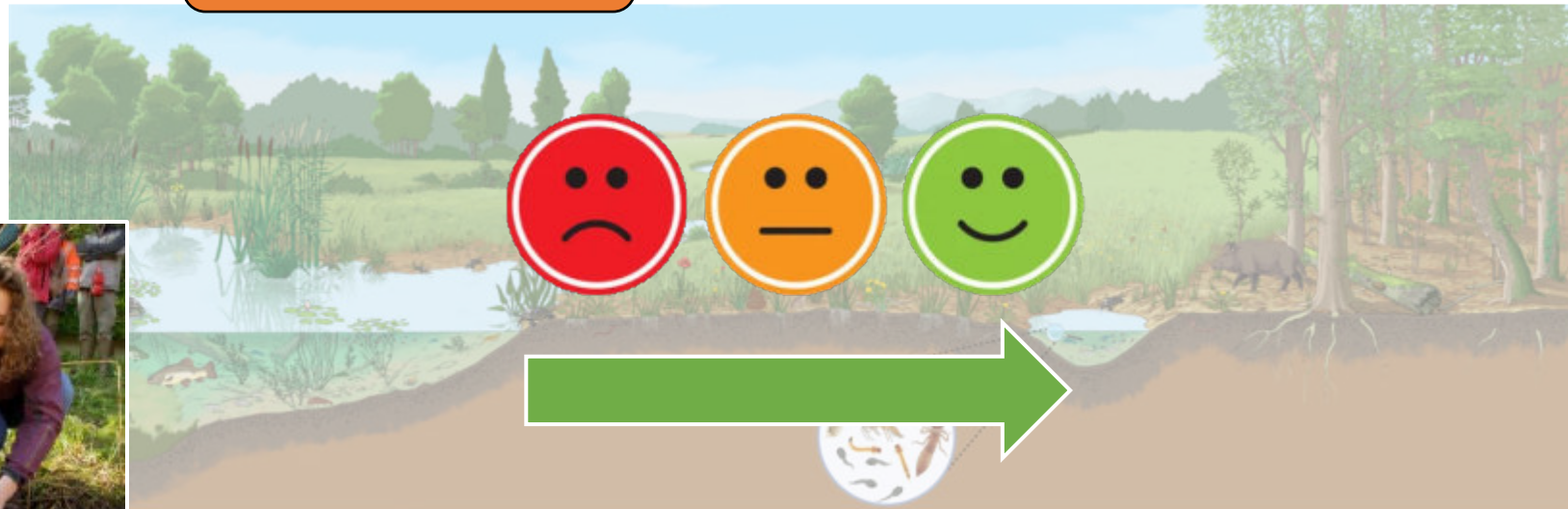# EMYS-R WP4: sociological approach

4. Integrative socio-ecological approach

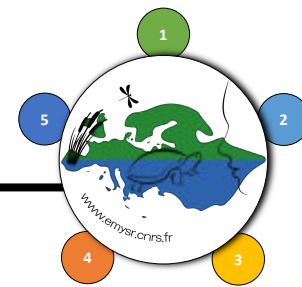| T4.1. Economic benefit analysis | → **Restoration economic benefits**
Adapted habitat evaluation procedure |
T4.2. Public perception assessment	→ **Perception, motivation, behaviour** Ethnographic survey
T4.3. Public seminars	→ **Public awareness and engagement** Participatory deliberative reflection
T4.4. Participatory workshops	→ **Participative policy guidelines** Knowledge dissemination workshops

Patrycja Romaniuk (*environmental sociology*)

EMYS-R WP5: integrated approach

5. Merging & upscaling actions

T5.1. Literature review
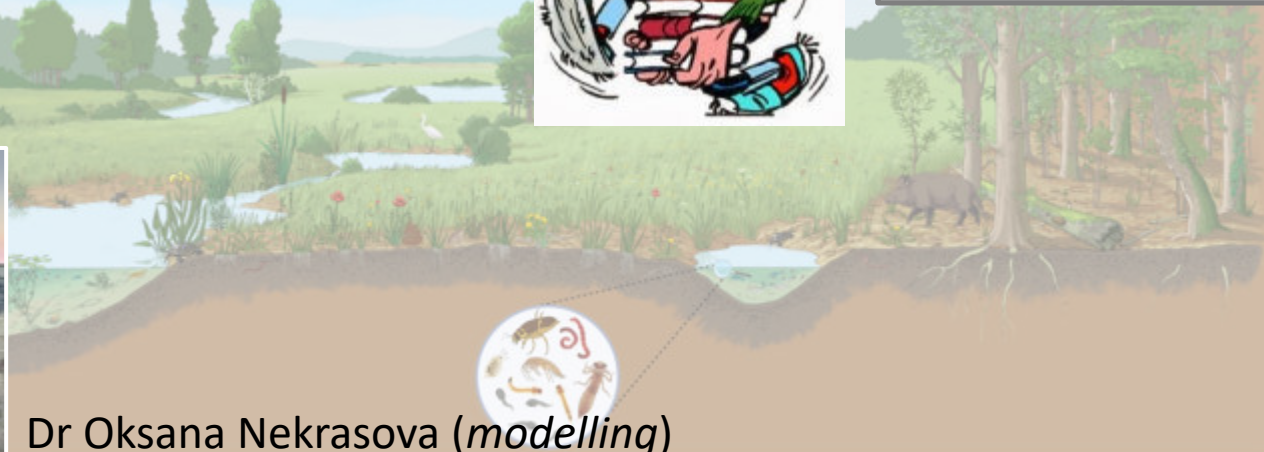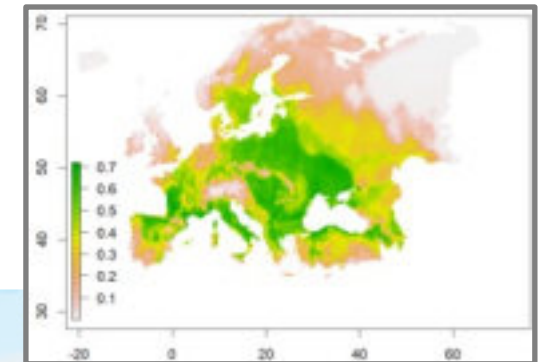
T5.2. Bioclimatic modelling

T5.3. Guidelines of best practices

→ **State of the art**
Wetland restoration, Emys reintroduction, long term monitoring

→ **Forecasting 2100+**
Forthcoming conservation initiatives

Dr Oksana Nekrasova (*modelling*)
Dr Oleksii Marushchak (*review*)

Some results

WP1: Assessing wetland restoration

- The Woerr site (FR) at the FR-DE border
  - NE of France (Alsace)
  - INTERREG C12 (2009-2012)
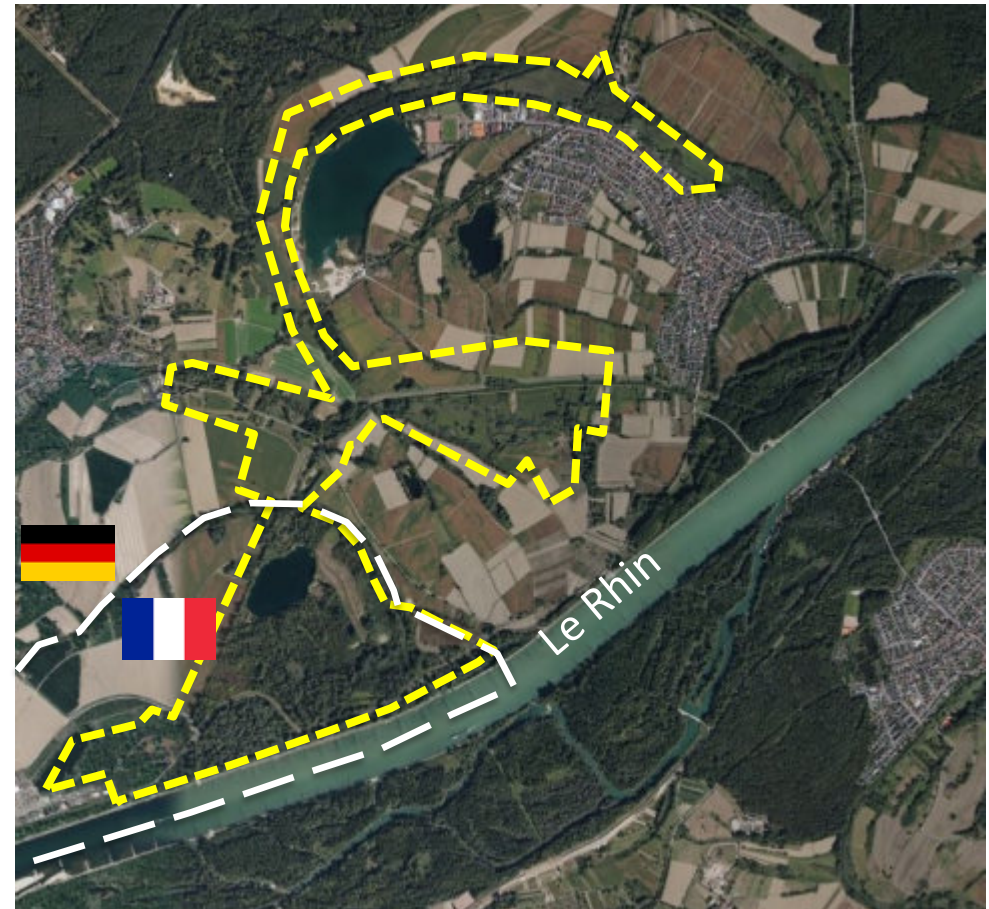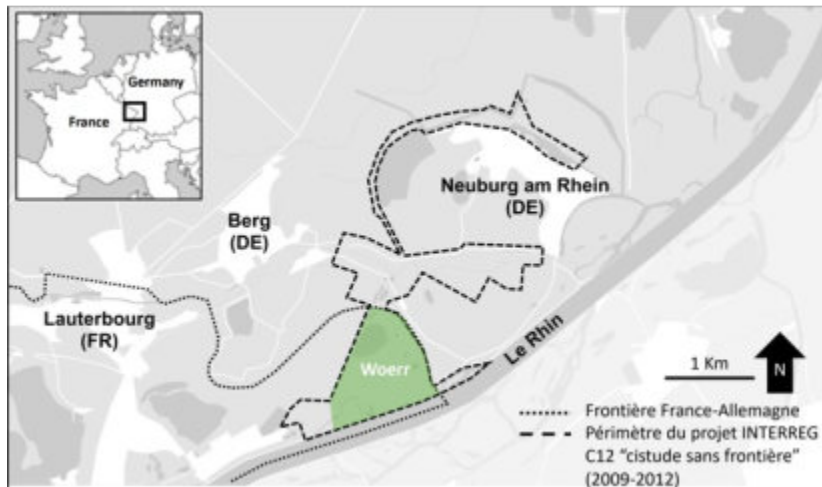
Germany
France

Neuburg am Rhein (DE)

Berg (DE)

Lauterbourg (FR)

Woerr

Le Rhin

1 Km

N

········· Frontière France-Allemagne

– – – Périmètre du projet INTERREG C12 "cistude sans frontière" (2009-2012)

Le Rhin

WP1: Assessing wetland restoration

- Wetland restoration in action (since 1994)

  - Creating 8 ponds (2100m2)

  - Opening 2 reed ponds (3100m2)

  - Smoothing gravel pond edges (4500m2)
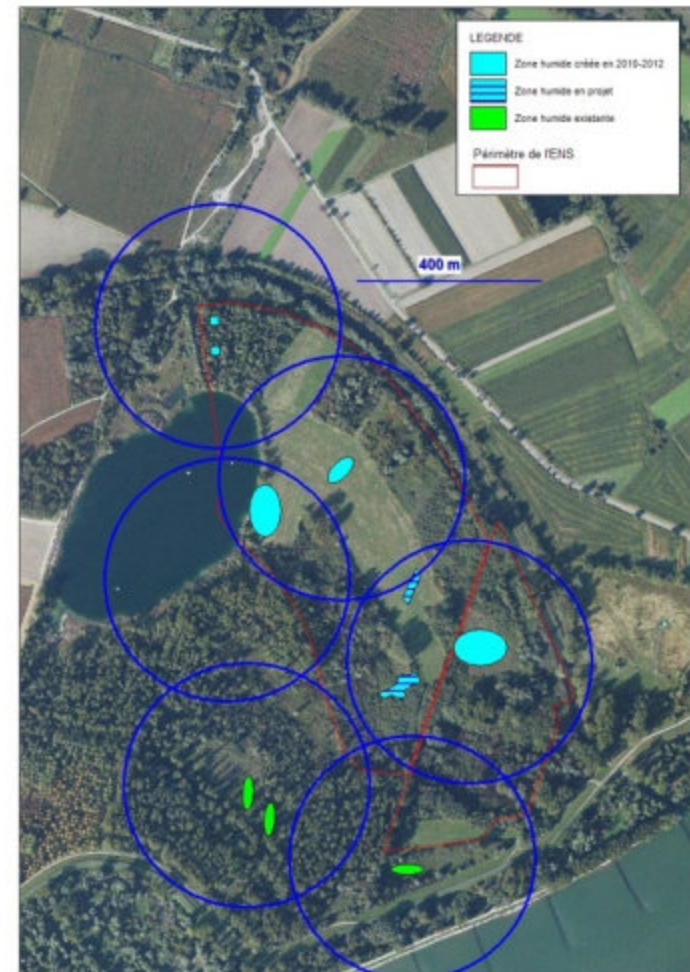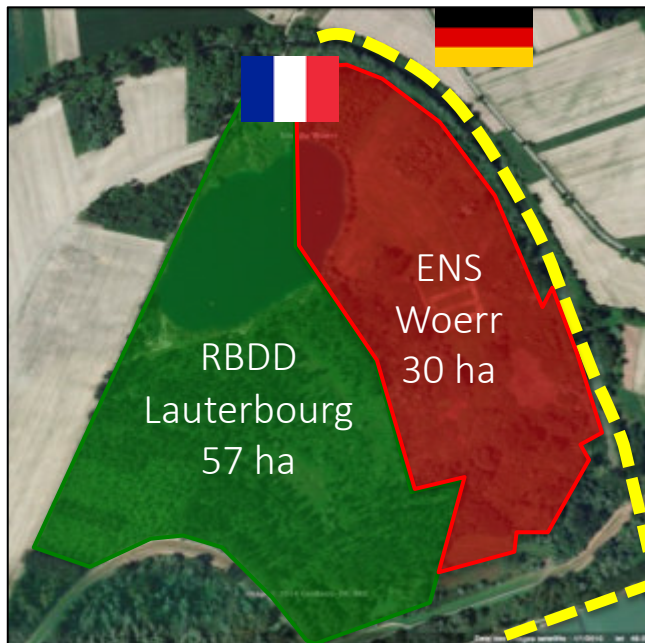
WP1: Assessing wetland restoration

- Ecological and economical assessments
  - Adapted habitat Habitat Evaluation Procedure (Vulliez 2023)

1994-2003   **2012-2014**   **2021-2023**

Habitats:
- Forêt alluviale mixte
- Forêt de salicacées
- Prairie
- Champs de culture
- Roselière
- Gravière
- Vieille Lauter
- Mare
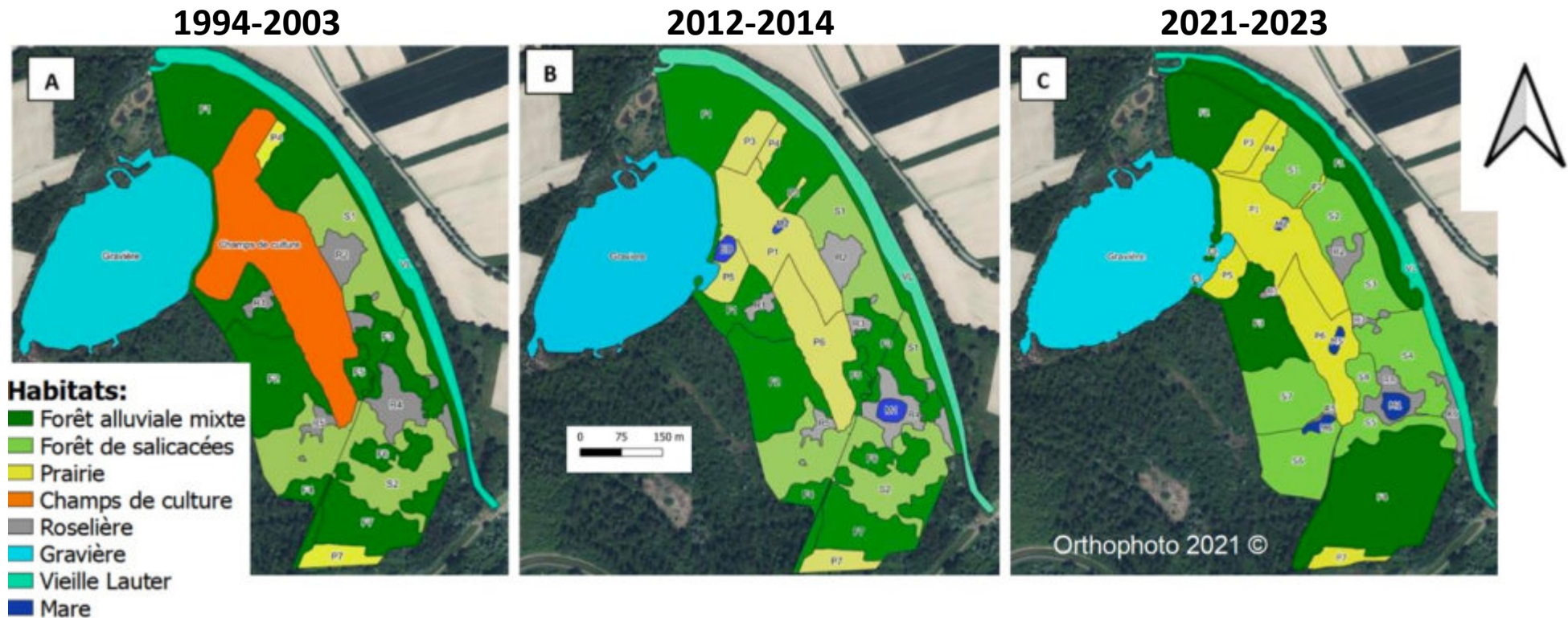
Woerr site: Habitat map before restoration (1994-2003) and afterward

WP1: Assessing wetland restoration

- Ecological and economical assessments
  - Adapted habitat Habitat Evaluation Procedure (Vulliez 2023)

1994-2003   **2012-2014**   **2021-2023**

Classe de HSI
- 0,75 - 0,82
- 0,82 - 0,88
- 0,88 - 0,94
- 0,94 - 1

Woerr site: Habitat Suitability Index before restoration (1994-2003) and afterward

WP1: Assessing wetland restoration

- Ecological and economical assessments
  - Adapted habitat Habitat Evaluation Procedure (Vulliez 2023)

1994-2003   **2012-2014**   **2021-2023**
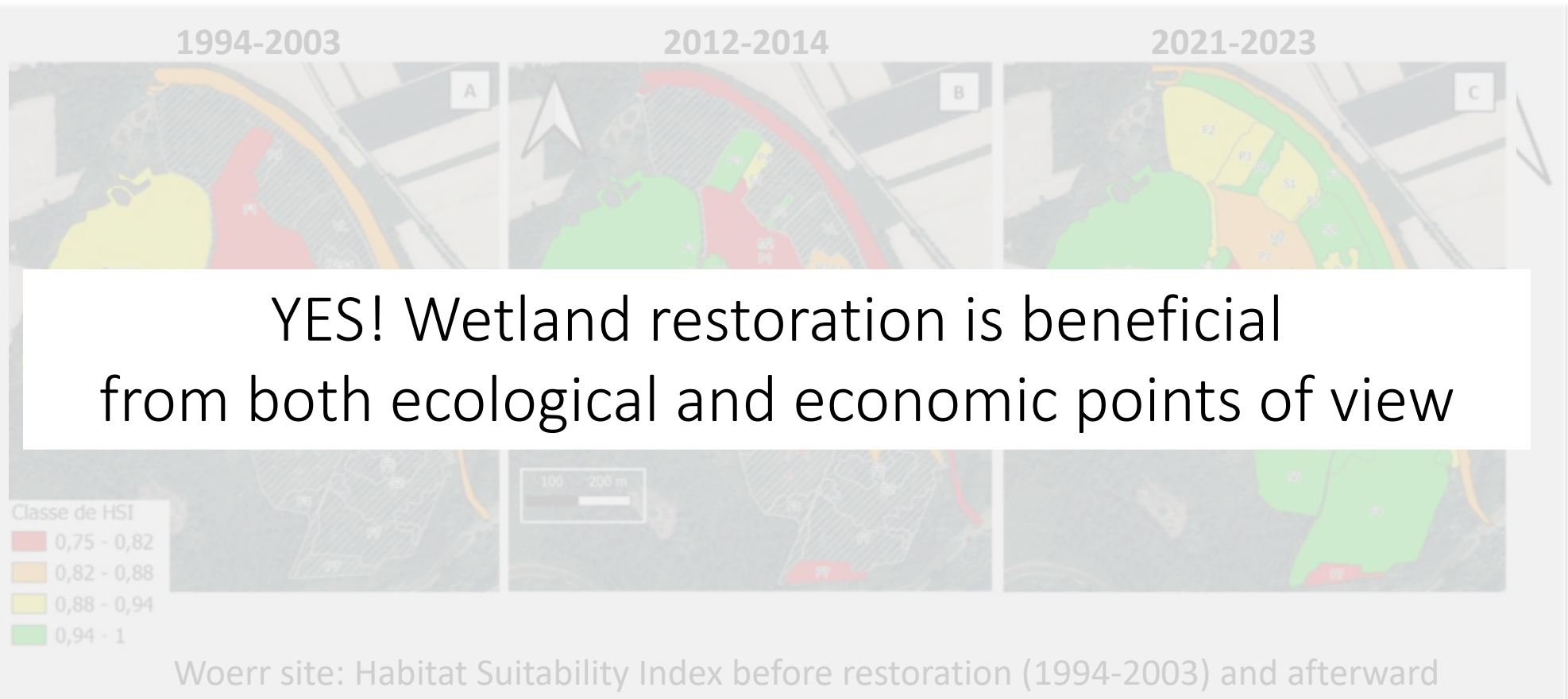
YES! Wetland restoration is beneficial
from both ecological and economic points of view

Classe de HSI
- 0,75 - 0,82
- 0,82 - 0,88
- 0,88 - 0,94
- 0,94 - 1

Woerr site: Habitat Suitability Index before restoration (1994-2003) and afterward

WP2: Emys reintroduction assessment

- ## The Woerr population
  - 2013-2023: 8 release events → 573 Emys released in acclimatation site

Acclimatation site
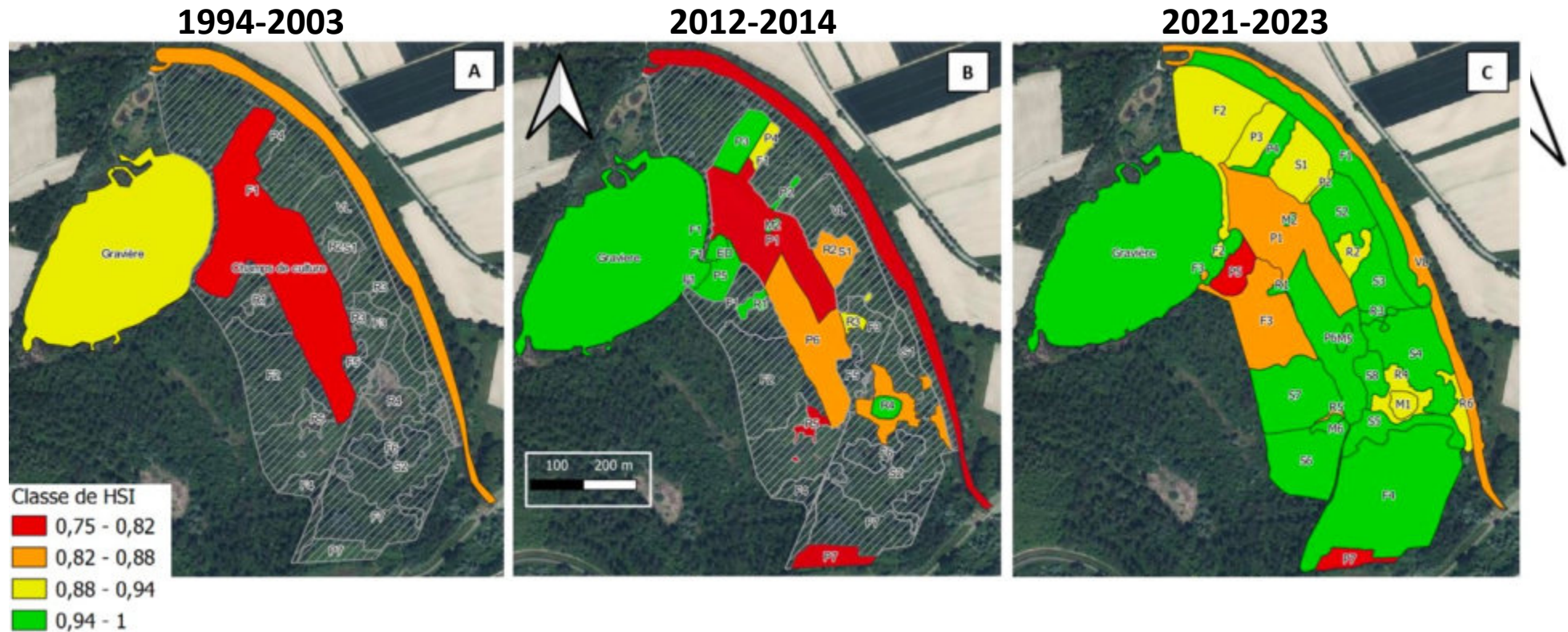
WP2: Emys reintroduction assessment

2. Biodiversity & ecosystem functioning

- ## The Woerr population
  - 2013-2023: 8 release events → 573 Emys released
  - Capture-Marking-Recapture

WP2: Emys reintroduction assessment

- ## The Woerr population
  - 2013-2023: 8 release events → 573 Emys released
  - CMR and Population modelling (Georges et al. in prep)

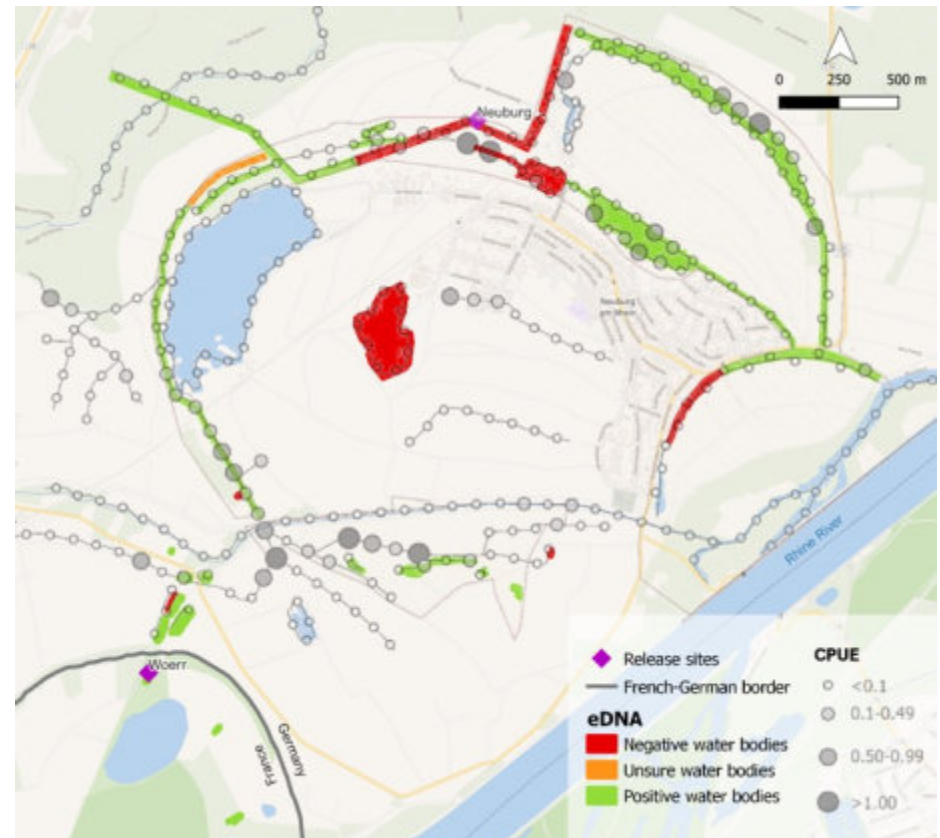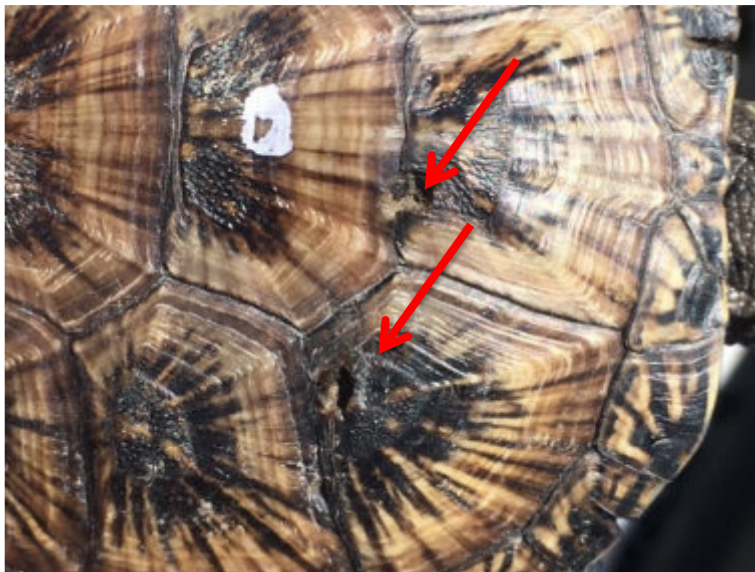| Group	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Acclim N Acclim S Gravel pond	18	23		41		202	119		20	102 26	22
Age (yr) @release	6-7	4-6		4		1-5	1		2-3	1-3	Adults
Mass (g) @release	164	66		37		37	69		93	93	671
Recapture (p)		0.94 (0.69-0.99)	0.94 (0.78-0.98)	0.92 (0.77-0.97)	0.94 (0.66-0.98)	0.97 (0.89-0.99)	0.87 (0.80-0.92)	0.92 (0.86-0.95)	0.60 (0.51-0.63)	0.74 (0.63-0.83)	0.80 (0.65-0.89)
Survival (S)	0.88 (0.69-0.99)	0.93 (0.87-0.96)		0.92 (0.87-0.95)		0.70 (0.66-0.74)	0.57 (0.50-0.63)		0.93 (0.66-0.99)	0.85 (0.47-0.97)	

WP2: Emys reintroduction assessment

- The Woerr population
  - Survival ✅
    - Similar to results in Spain and Italy
    - Age @release >> body size/mass @release
    - Release site: acclim >> gravel pond

WP2: Emys reintroduction assessment

- The Woerr population
  - Survival ✅
  - Dispersion ✅
    - Incl. transbordering dispersion
    - Incl. predatory-borne dispersion

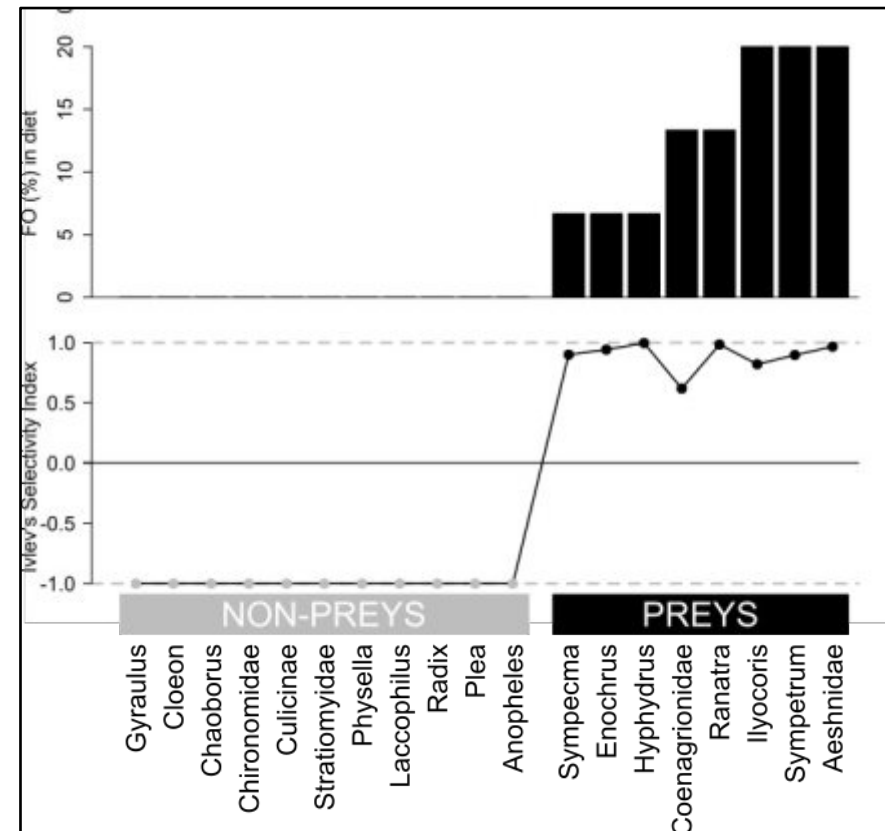Graf, Schmidt et al. in prep

WP2: Emys reintroduction assessment

- The Woerr population
  - Survival ✅
  - Dispersion ✅
  - Reproduction ✅
    - Even if low

WP2: Emys reintroduction assessment

- The Woerr population
  - Survival ✅
  - Dispersion ✅
  - Reproduction ✅
  - Functional ecology ✅
    - Emys as a new top predator
    - Emys as a prey for new alien species

- The Woerr population
  - Survival ✅
  - Dispersion ✅
  - Reproduction ✅
  - Functional ecology ✅

YES! Emys reintroduction is effective in NE France and most likely up to the northern edge of its range
yet not easy

WP3: Non-target species assessment

- Bycatch monitoring

Esox lucius

Myocastor coypus

Trachemys scripta elegans

Lepomis gibbosus

Faxonius immunis

WP3: Non-target species assessment

- The calico crayfish: a new invasive alien species
  - Origin: Northern America
  - 1997: first detection in Europe (DE)
  - 1998: first reproduction in Europe (DE)
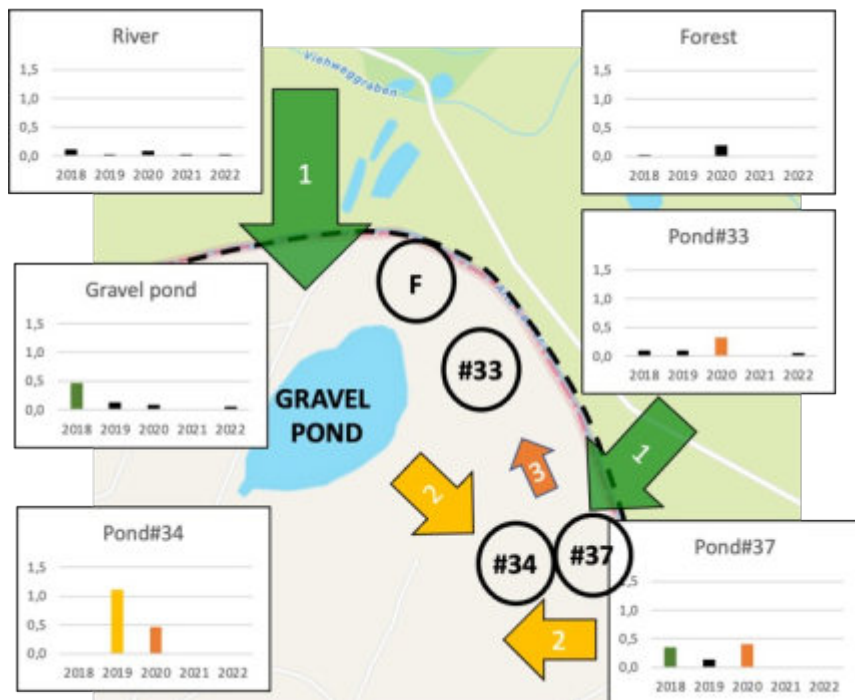 - 2013: established in NE of France

Emys-R
FR+DE study sites

WP3: Non-target species assessment

- The calico crayfish: a new invasive alien species
 - Bycatch-based putative invasion scenario (Georges et al. in prep)

WP3: Non-target species assessment

3.
Tradeoffs & synergies

- The calico crayfish: a new invasive alien species
  - Bycatch-based putative invasion scenario (Georges et al. in prep)
  - Co-creation of calico-proof, turtle-friendly, adaptive ponds (Combroux, Grac et al.)

Diagramm of the localisation of experimental crayfish ponds on the Woerr site
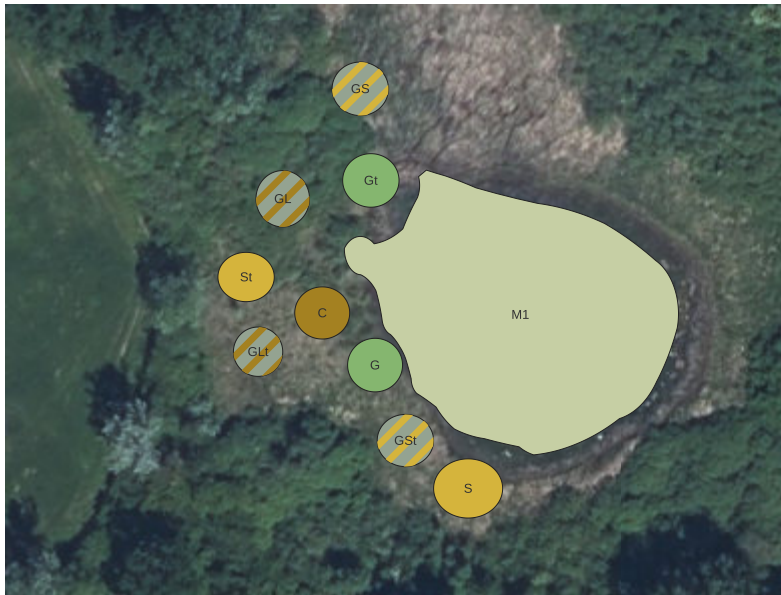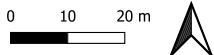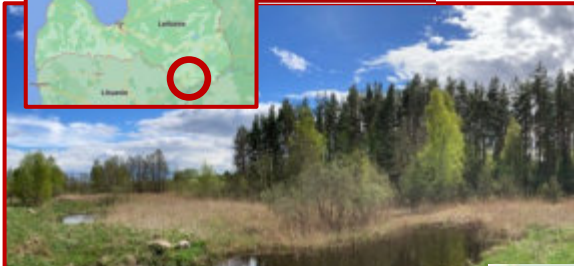

Map legend

- Gravel (G)
- Gravel- sand (GS)
- Gravel-silt (GL)
- Sand (S)
- Silt (C-control)
- M1

Vue aérienne du Bas-Rhin 67 - 2021
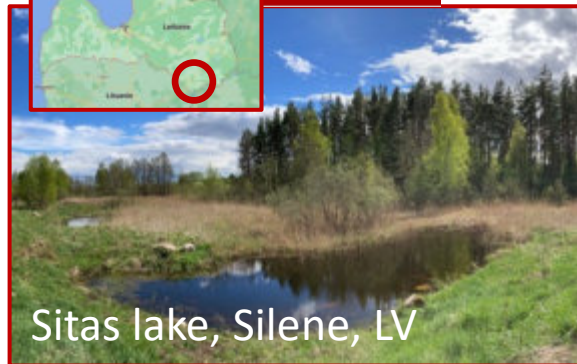
t = ponds with macrophytes transplantation

GS
Gt
GL
St
C
GLt
M1
G
GSt
S

0   10   20 m

Let's go East!

Sitas lake, Silene, LV

LIFE-HerpetoLatvia

WP3: Non-target species assessment

3.
Tradeoffs & synergies

- The native amphibians (frogs and newts)
  - New methods for amphibian monitoring (Pupins, Čeirāns et al. 2022)

Sitas lake, Silene, LV

METHOD OF COLLECTING GREEN FROGS
FOR SCIENTIFIC AND ENVIRONMENTAL STUDIES
BY HAND NET CATCHING

Mihails Pupins, Andris Čeirāns, Oksana Nekrasova,
Kathrin Theissinger, Jean-Yves Georges

2022

WP3: Non-target species assessment

- The native amphibians (frogs and newts)
  - New methods for amphibian monitoring (Pupins et al. 2022)
  - Assessing benefits of wetland restoration for amphibians (Pupins et al. 2023)
    - On specific diversity ✅
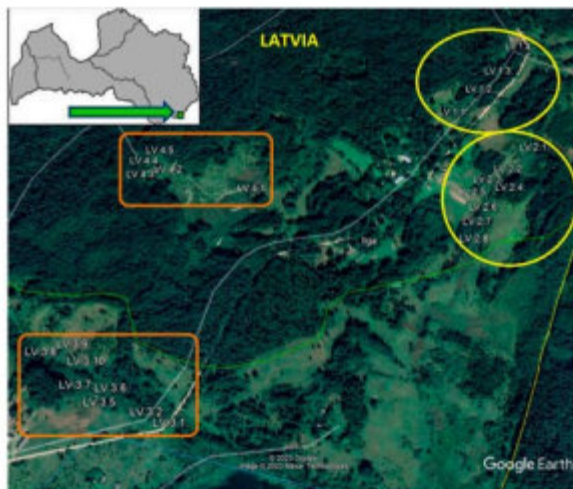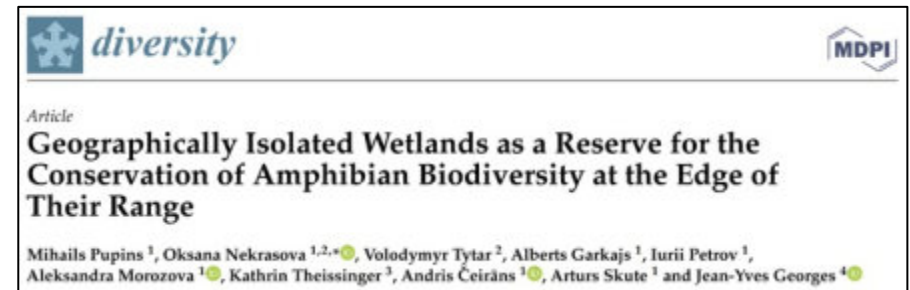   - On adult populations ✅
    - On larvae populations ✅

diversity — MDPI

Article

Geographically Isolated Wetlands as a Reserve for the Conservation of Amphibian Biodiversity at the Edge of Their Range

Mihails Pupins [1], Oksana Nekrasova [1,2,*], Volodymyr Tytar [2], Alberts Garkajs [1], Iurii Petrov [1], Aleksandra Morozova [1], Kathrin Theissinger [3], Andris Čeirāns [1], Arturs Skute [1] and Jean-Yves Georges [4]
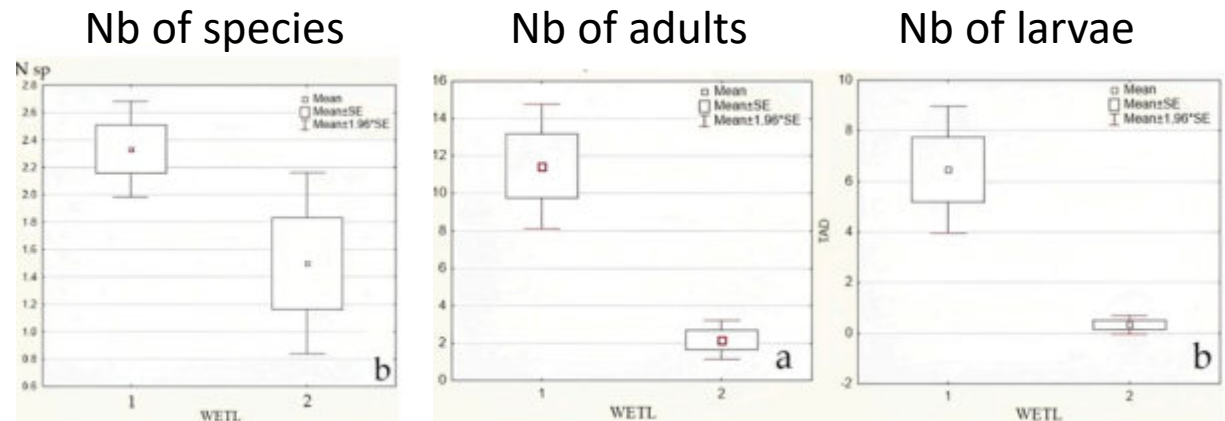

Figure 1. A map of the location of ponds in the Silene Nature Park, South East of Latvia: yellow ovals—geographically isolated wetlands (GIW) (isolated ponds); orange rectangles—non-isolated ponds (nGIW) (the green arrow indicates the location of the study area).

Nb of species   Nb of adults   Nb of larvae

WP3: Non-target species assessment

- The native amphibians (frogs and newts)
  - New methods for amphibian monitoring (Pupins et al. 2022)
  - Assessing benefits of wetland restoration for amphibians (Pupins et al. 2023)
    - On specific diversity ✅
    - On adult populations ✅

diversity

Article

MDPI

YES! Non-target species benefit from wetland restoration in favour of Emys reintroduction
yet not easy (again!)

Figure 1. A map of the location of ponds in the Silene Nature Park, South East of Latvia: yellow ovals—geographically isolated wetlands (GIW) (isolated ponds); orange rectangles—non-isolated ponds (nGIW) (the green arrow indicates the location of the study area).

WP4: Sociological assessment

4. Integrative socio-ecological approach

- *Can Emys be an emissary for poorly perceived wetlands?*
- Mobilising values for wetland conservation in Europe
  - Interviews
  - Public seminars
  - Participatory workshops

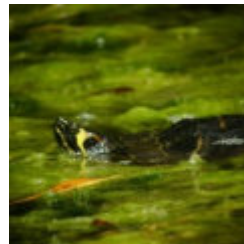Public events soon in Latvia!

Do join!!!

WP5: Forecasting modelling

- Emys, exotic turtles and climate change
  - Some exotic freshwater turtles species in Europe (Georges et al. 2019)
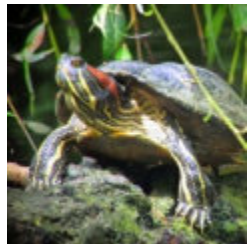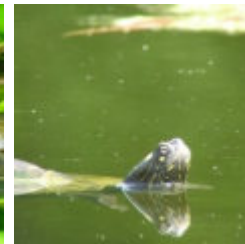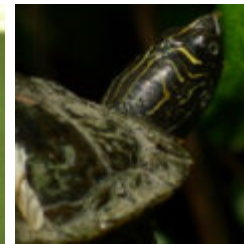
Trachemys scripta elegans   *Trachemys scripta scripta*   *Trachemys scripta troostii*   *Graptemys pseudogeo.*   *Graptemys ouachitensis*   *Graptemys pseudo. kohnii*
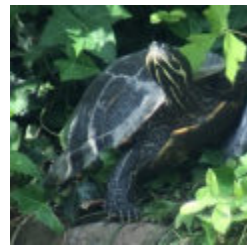
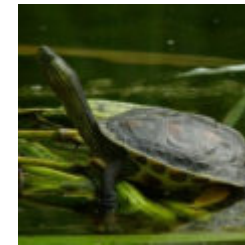*Pseudemys concinna*   *Pseudemys nelsonii*   *Pseudemys rubiventris*   *Pelodiscus sinensis*   *Ocadia sinensis*   *Mauremys mutica*
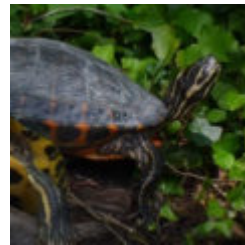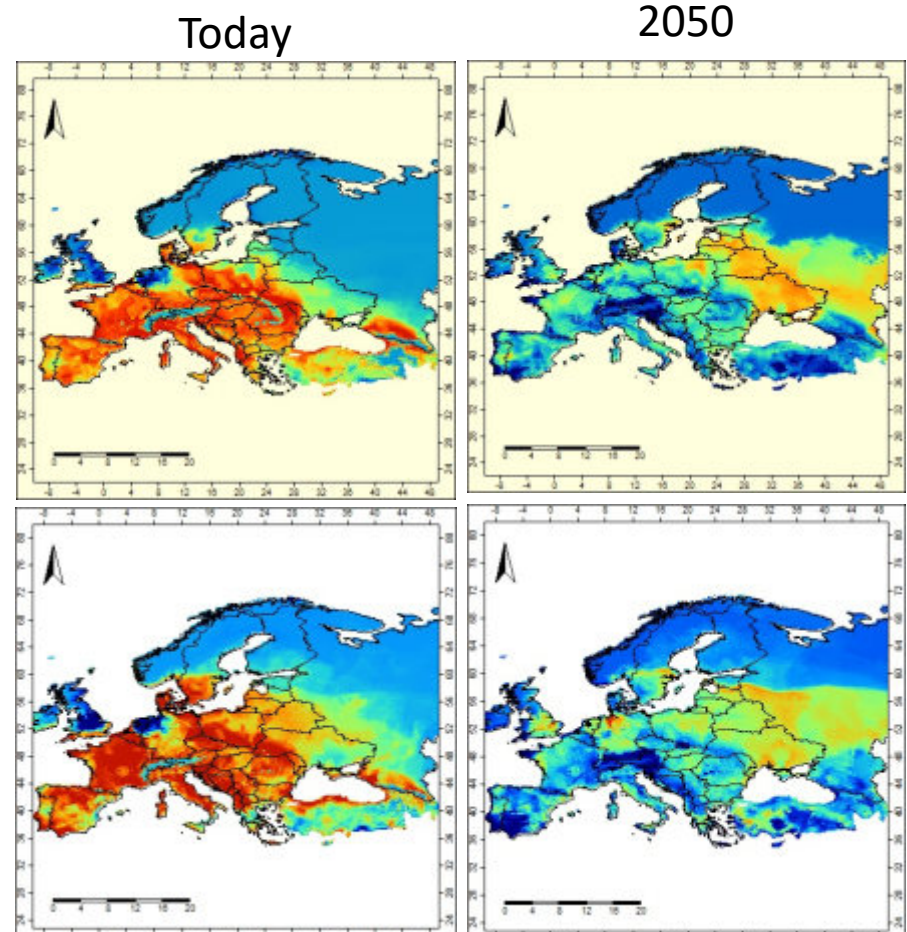
WP5: Forecasting modelling

- Emys, exotic turtles and climate change
  - Forecasting suitable areas for Emys (Nekrasova, Marushchak et al. submitted)

Today   2050

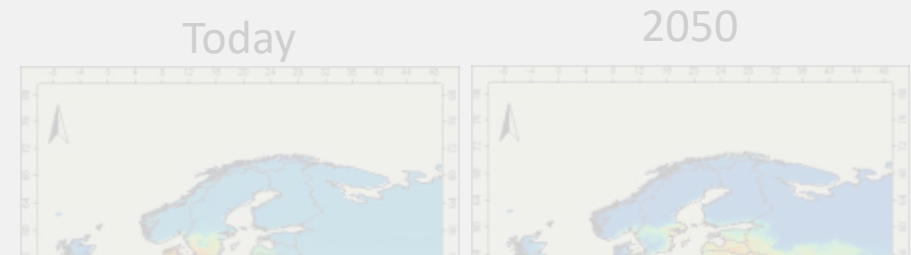Area of intersection of current suitable habitat for Emys and 7 species of exotic freshwater turtle

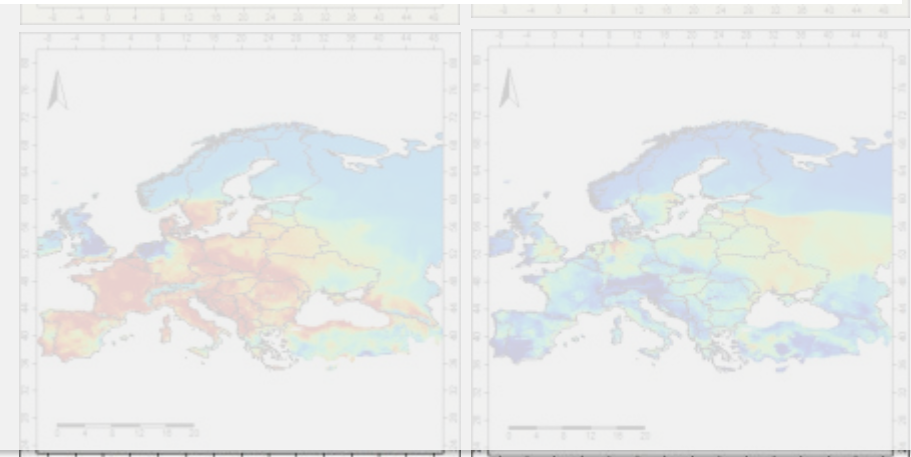Area of promising habitat for Emys **without** the 7 exotic species

5. Merging & upscaling actions

- Emys, exotic turtles and climate change
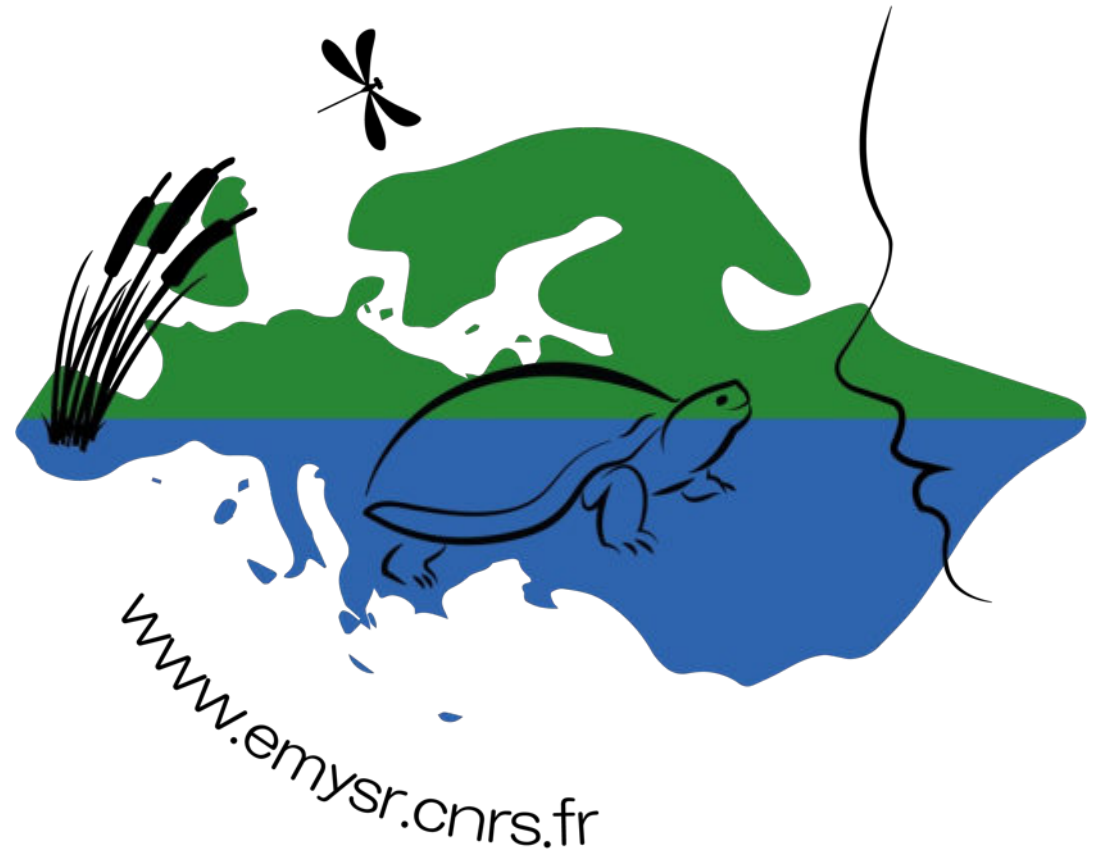 - Forecasting suitable areas for Emys (Nekrasova, Marushchak et al. submitted)

Today

2050

Eastern Europe (Latvia, Ukraine) are the most promising areas for Emys in the medium and long term

Area of promising habitat for Emys **without** the 7 exotic species

Thanks for your attention!
Visit our website and join us!

www.emysr.cnrs.fr