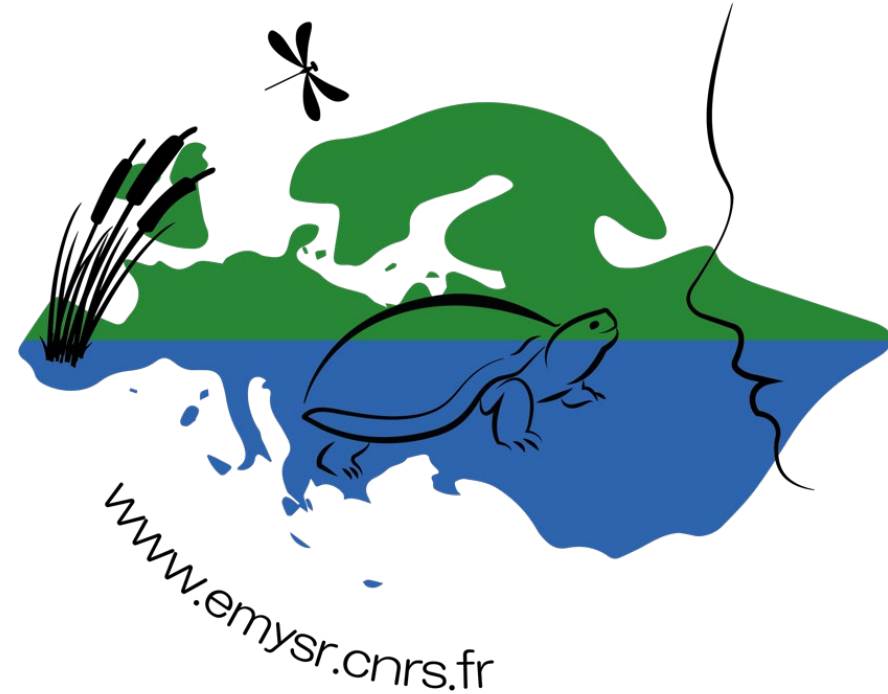


Jean-Yves Georges¹, Kathrin Theissinger² & the Emys-R Consortium³

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Strasbourg, France

² Justus Liebig University Giessen & Fraunhofer Institute
for Molecular Biology and Applied Ecology, Giessen,
Germany

³ <https://emysr.cnrs.fr/>



Life Platform Meeting, Amphibian and Reptile Conservation in Europe
22-24 May 2024, Santander, Spain

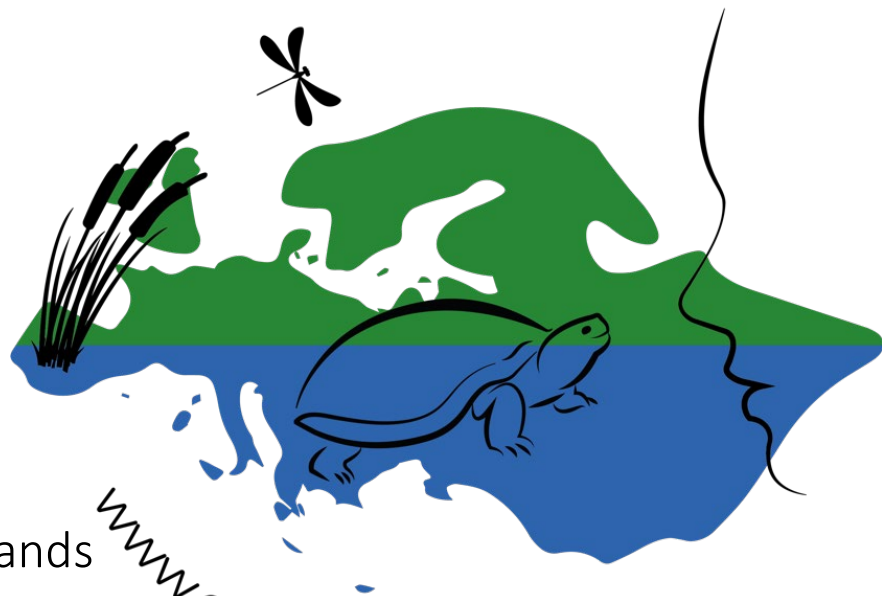


EMYS-R: Who we are

- 3-yr international transdisciplinary action-oriented research project
- Biodiversa+ & Water JPI funded (2022-25)
- 70 people (incl. 4 PhD candidates)



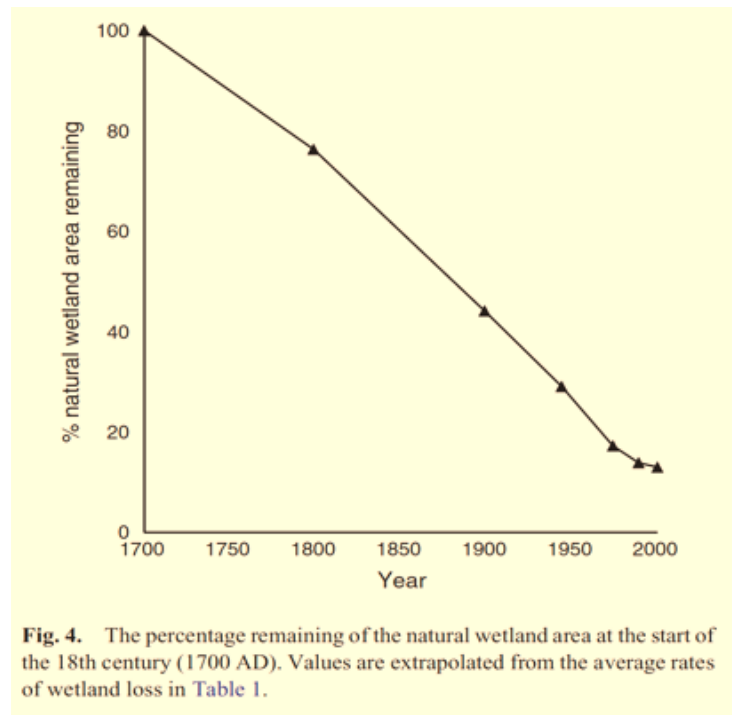
→ A socio-ecological evaluation of wetlands restoration and reintroduction programs in favour of the emblematic European pond turtle and associated biodiversity: a pan-European approach



www.emysr.cnrs.fr

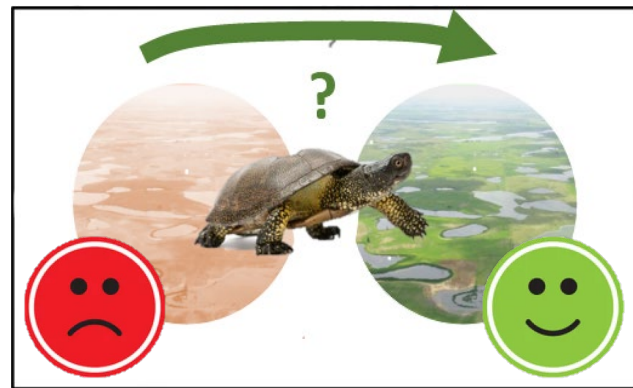
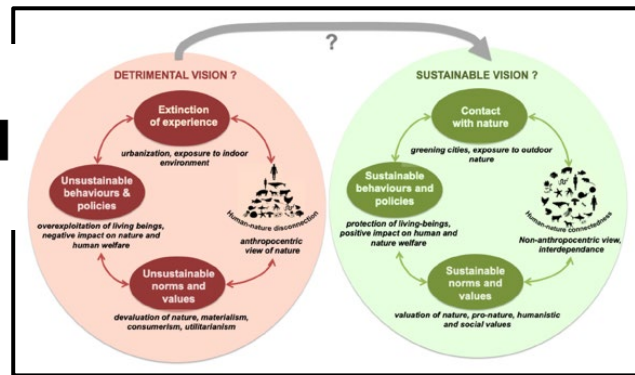
Context: Anthropocene, wetlands, biodiversity

- 6th biodiversity crisis
- Wetlands are hotspots of biodiversity and ecosystem services
- Since 1700s, wetlands have vanished by 90% worldwide due to mismanagement



Context: Anthropocene, wetlands, biodiversity

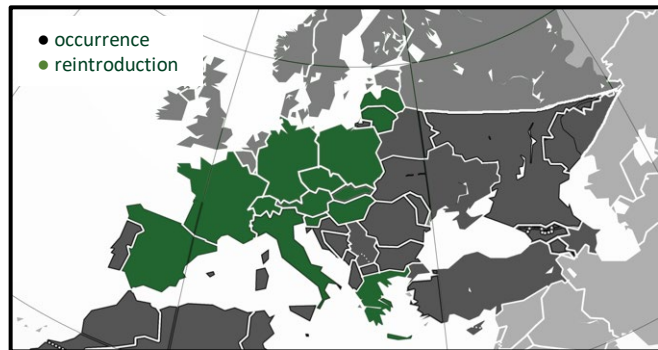
- A potential remedy
 - Habitat restoration & species reintroduction
 - Species reintroduction: deliberate release of individuals of a species at places it used to live (IUCN Guidelines 2013)
 - Human-nature connectedness as a pathway to sustainability (Barragan-Jason et al. 2021 *Cons Lett*)
- The study case of Emys-R
 - Wetlands and turtles: two opposite perceptions of nature



→ *Can the European pond turtle *Emys* be an emissary (Emys-R) of wetlands for reconnecting people and nature?*

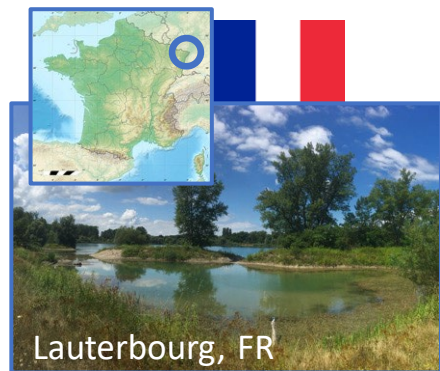
The European pond turtle *Emys orbicularis*

- Small-sized freshwater turtle
 - Max body size: 20 cm long, 1 Kg
 - Habitats: ponds and lentic waterbodies
 - Diet: opportunistic at all trophic levels
 - Distribution: Europe and Northern Africa
 - Conservation status
 - Most dramatic decline for reptiles in Europe
 - Numerous reintroductions throughout Europe
 - Results poorly disseminated
- *which protocols lead to reintroduction success?*



Emys-R study sites

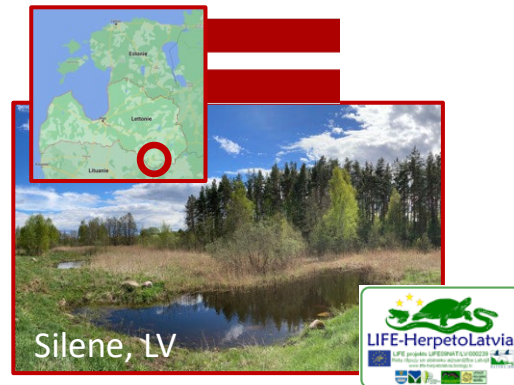
- Three study sites with contrasted socio-ecosystemic contexts



Lauterbourg, FR
Natura 2000 + Biological Reserve
5km from town, poorly frequented
Emys and associated biodiversity



Neuburg am Rhein, DE
Natura 2000
Urban, highly frequented
Emys as a communication tool



Silene, LV
Natura 2000 + Natural Park
No man's land (LV-BY border)
Emys and associated biodiversity

- National Action Plan

YES, coordinated actions

NO

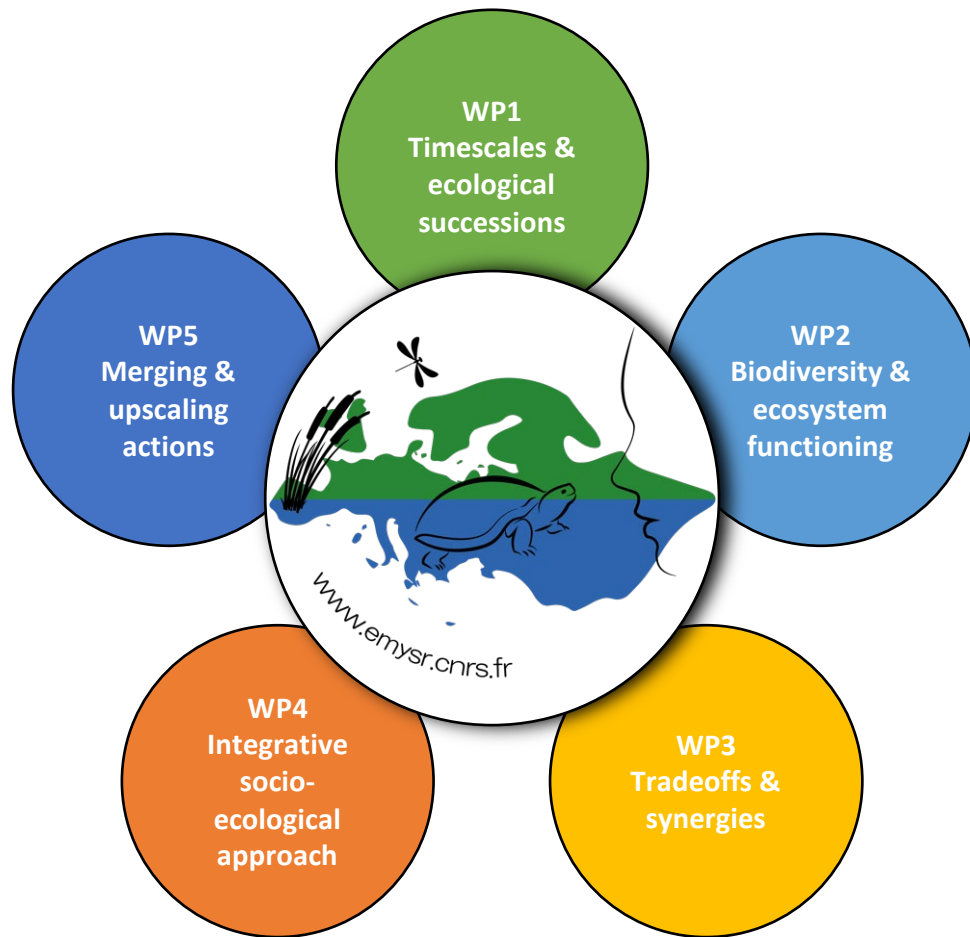
YES, coordinated actions

Emys-R goals

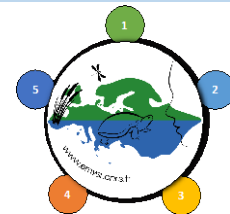
Defining and disseminating

- the most efficient, socially-supported, ecological methods to restore wetlands
- in favour of *Emys* reintroduction and associated biodiversity
- throughout Europe





EMYS-R: WP1 – temporal approach

WP1
Timescales &
ecological
successionsT1.1. Chronosystemic
frames (1900 – today)

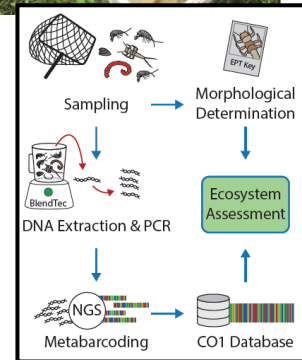
T1.2. Degree of recovery

→ **Historical use and land cover assessment**

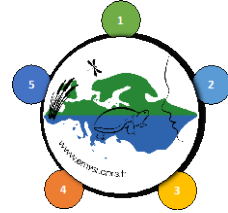
Archives and orthophotos

→ **Biocenotic indices of water bodies**

Biodiversity surveys + eDNA metabarcoding

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

EMYS-R: WP2 – functional approach



WP2
Biodiversity &
ecosystem
functioning

T2.1. Emys population
monitoring

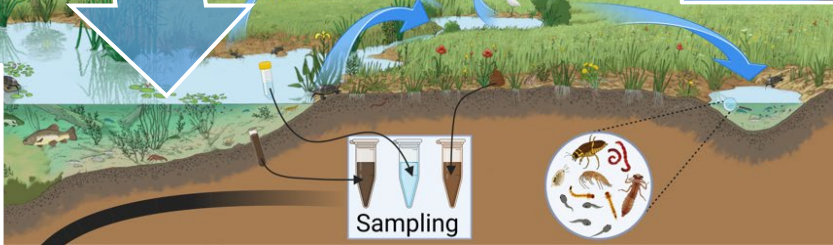
→ **Determinants of Emys released population trends**
Survival, health, dispersion, reproduction

T2.2. Wetland
ecosystem functioning

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

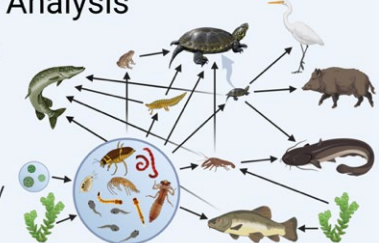


Carolin Eichert (*Emys microbiome*)
Johannes Meka (*Emys trophic ecology*)

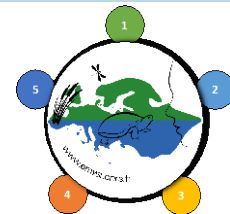
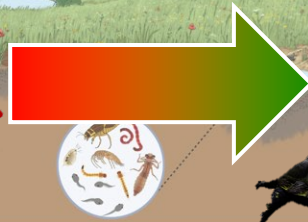


Food Web Analysis

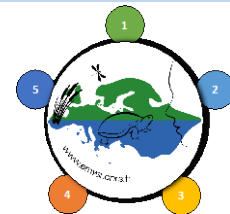
- Consumed Food Items
- Available Food Items
- Turtle Presence / Absence



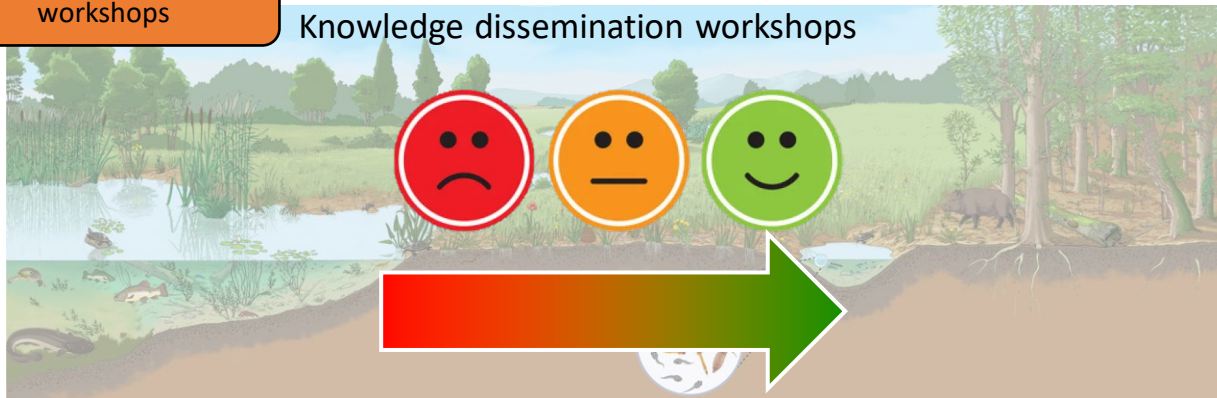
EMYS-R: WP3 – tradeoff approach

WP3
Tradeoffs &
synergiesT3.1. Not-target species
monitoring→ **Protected & invasive species**
Occurrence, distribution and abundanceT3.2. Adaptive
management→ **Emys-friendly invasive-proof habitats**
Experimental pond*Pelobates fuscus**Faxonius immunis**Trachemys sp.*

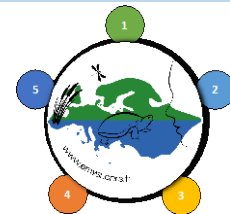
EMYS-R: WP4 – sociological approach

WP4
Integrative
socio-
ecological
approachT4.1. Economic benefit
analysis**→ Restoration economic benefits**
Adapted habitat evaluation procedureT4.2. Public perception
assessment**→ Perception, motivation, behaviour**
Ethnographic survey

T4.3. Public seminars

→ Public awareness and engagement
Participatory deliberative reflectionT4.4. Participatory
workshops**→ Participative policy guidelines**
Knowledge dissemination workshopsPatrycja Romaniuk (*environmental sociology*)

EMYS-R WP5: integrated approach



WP5
Merging &
upscaling
actions

T5.1. Literature review

T5.2. Bioclimatic
modelling

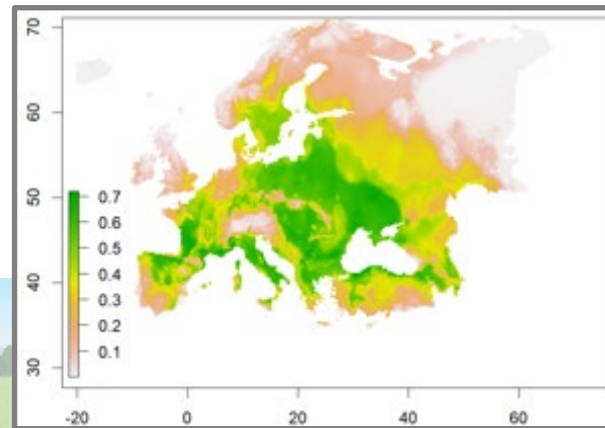
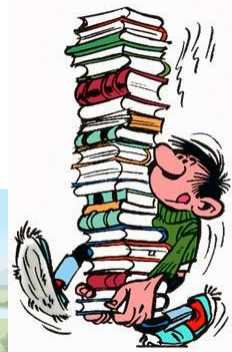
T5.3. Guidelines of best
practices

→ **State of the art**

Wetland restoration, Emys reintroduction, long term monitoring

→ **Forecasting 2100+**

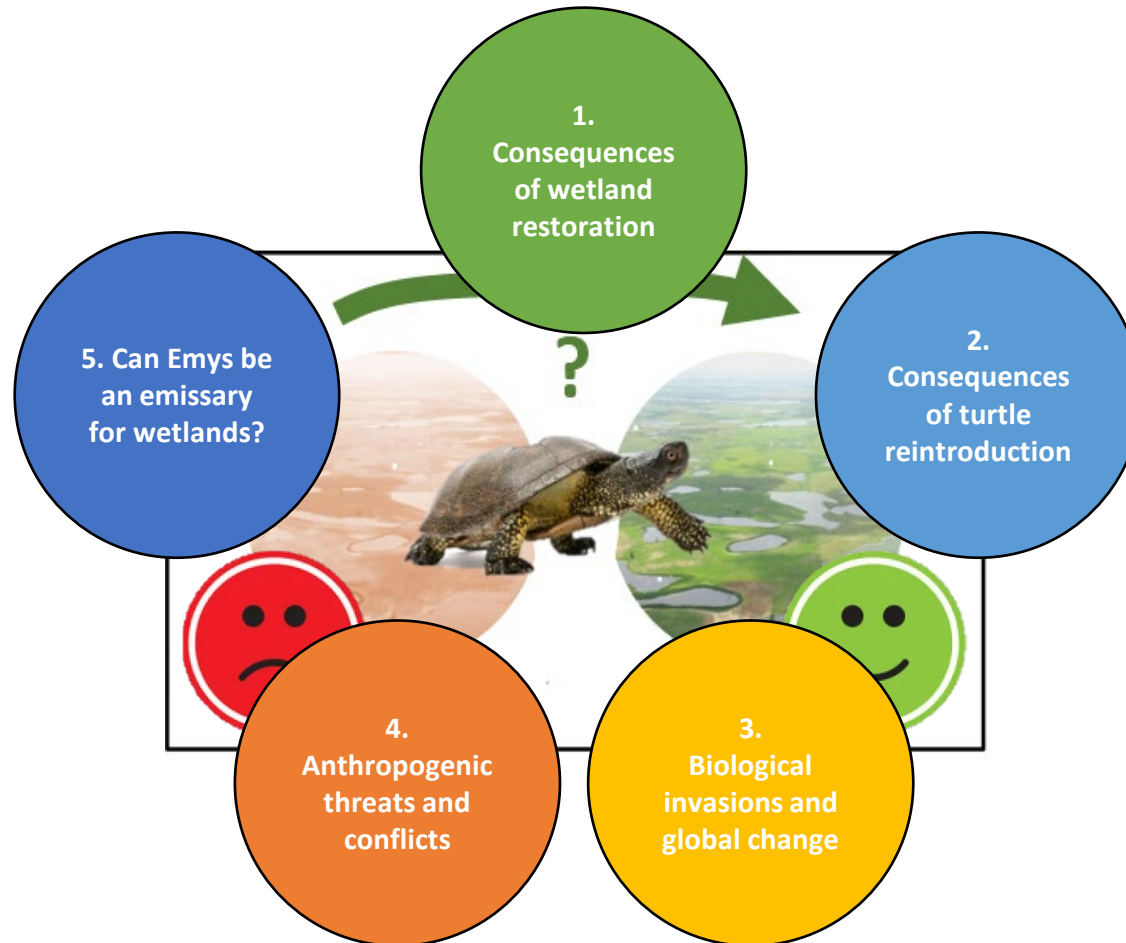
Forthcoming conservation initiatives



Dr Oksana Nekrasova (*modelling*)

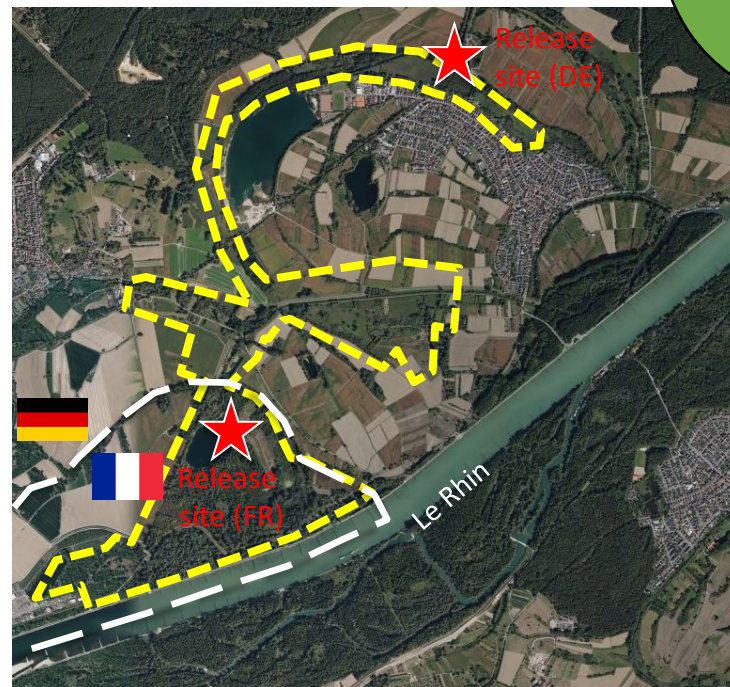
Dr Oleksii Marushchak (*review*)





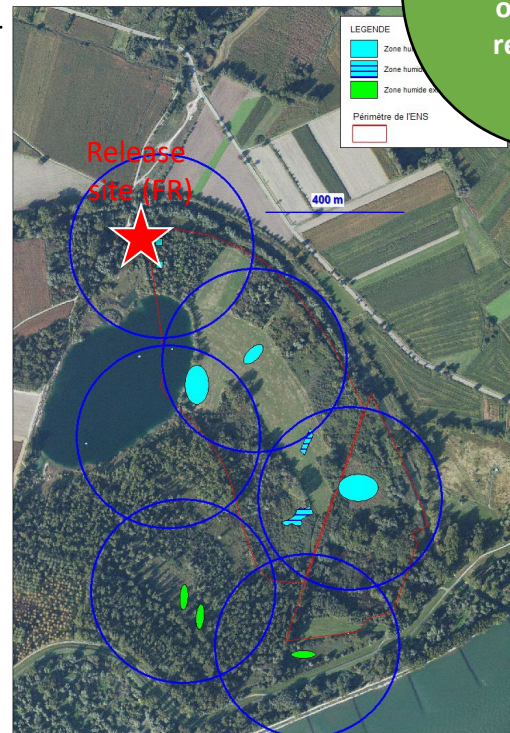
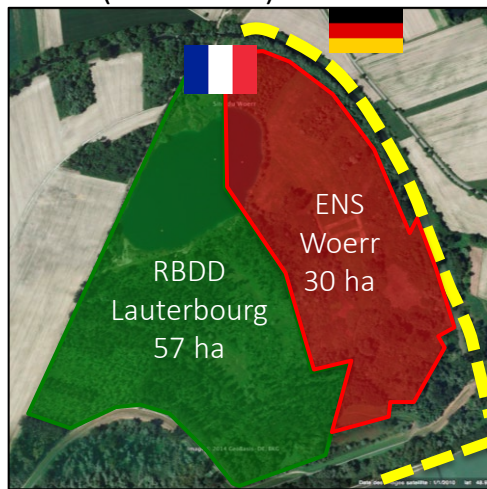
1.
Consequences
of wetland
restoration

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



1.
Consequences
of wetland
restoration

- The Woerr site (FR): restoration in action since 1994
 - Smoothing gravel pond edges (4500m²)
 - Opening 2 reed ponds (3100m²)
 - Creating 8 ponds (2100m²)



1.
Consequences
of wetland
restoration

- The Woerr site (FR): Ecological assessment of restoration
 - Habitat maps before restoration (1994-2003) and afterward



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

1. Consequences of wetland restoration

- The Silene site (LV)
 - Creation of connected & isolated ponds for amphibians
 - Occurrence of the invasive alien predatory fish Chinese sleeper *Percottus glenii*

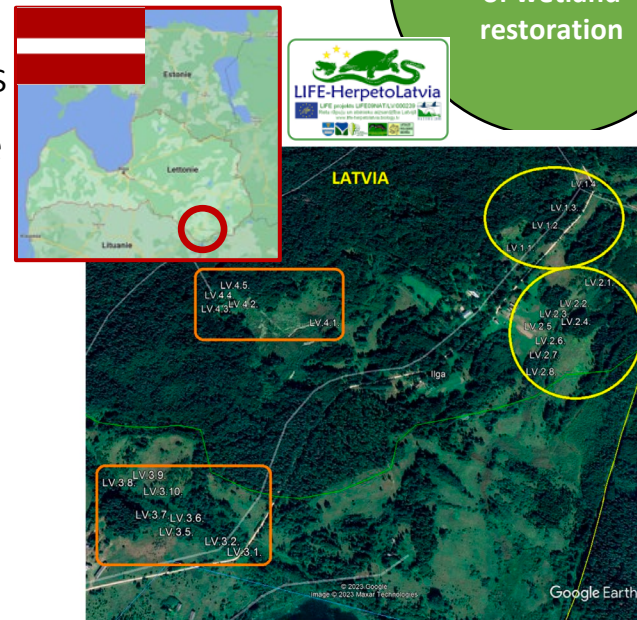


Figure 1. A map of the location of ponds in the Silene Nature Park, South East of Latvia: yellow ovals—geographically isolated wetlands (GIW) (isolated ponds); orange rectangles—non-isolated ponds (nGIW) (the green arrow indicates the location of the study area).

1. Consequences of wetland restoration

- The Silene site (LV): Ecological assessment after restoration
 - Geographically isolated wetlands are beneficial for amphibians due to preventing the Chinese Sleeper to spread (Pupins et al. 2022; 2023)

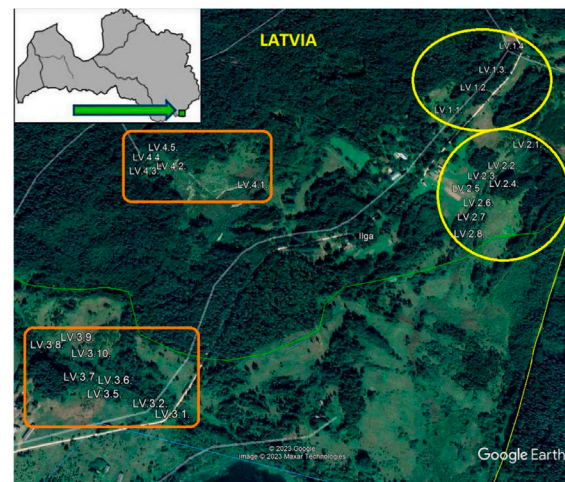
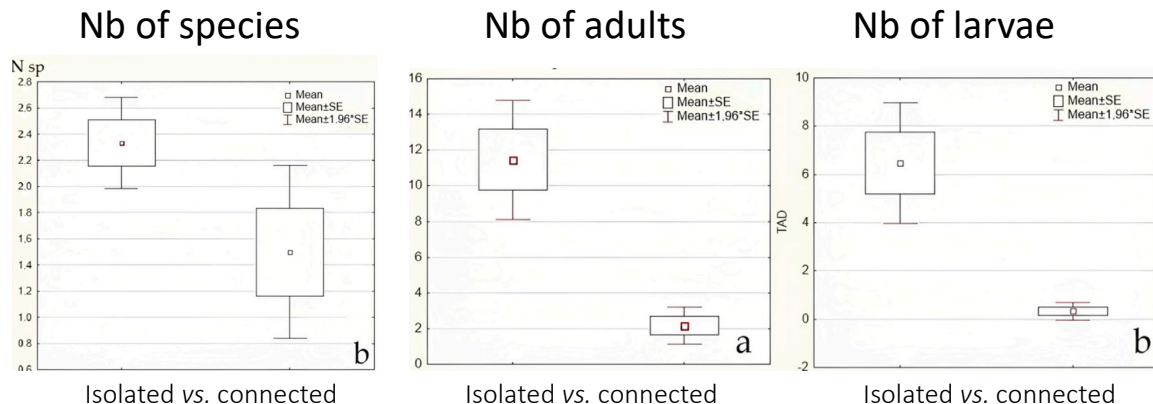


Figure 1. A map of the location of ponds in the Silene Nature Park, South East of Latvia: yellow ovals—geographically isolated wetlands (GIW) (isolated ponds); orange rectangles—non-isolated ponds (nGIW) (the green arrow indicates the location of the study area).

1.
Consequences
of wetland
restoration

Restoring landscape/pondscape connectedness is not always the solution

Key challenges

- Ensure integrated ecological assessment prior habitat restoration
- Support long-term monitoring of slow ecological succession processes
- Forecast and mitigate impacts of alien invasive species and climate change

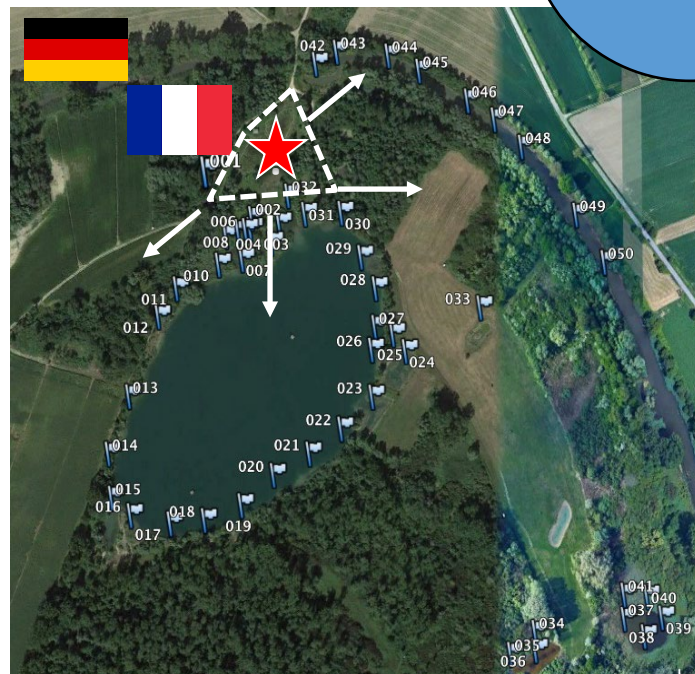
2.
Consequences
of turtle
reintroduction

- The Woerr site (FR) : *Emys* population monitoring
 - 2013-2023: 573 *Emys* soft-released in acclimatization site



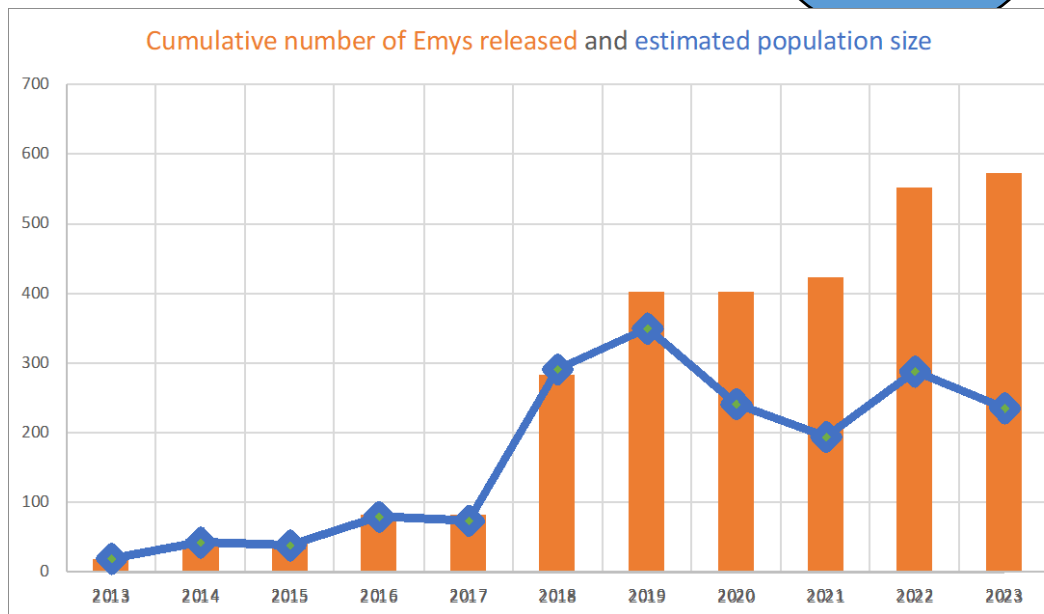
2.
Consequences
of turtle
reintroduction

- The Woerr site (FR) : *Emys* population monitoring
 - 2013-2023: 573 *Emys* soft-released
 - Long-term capture-mark-recapture



2.
Consequences
of turtle
reintroduction

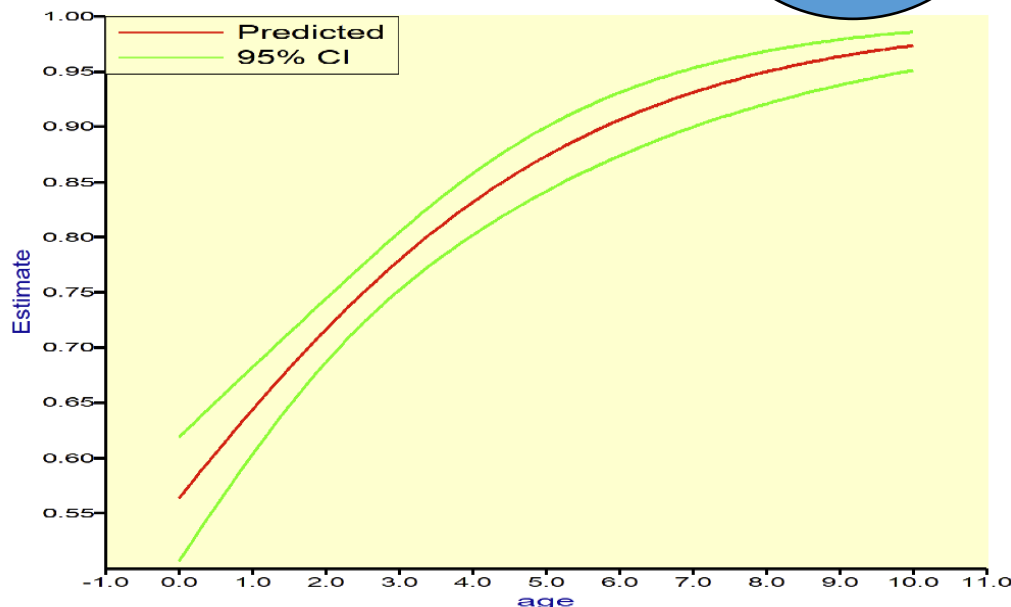
- The Woerr site (FR) : *Emys* population monitoring
 - 2013-2023: 573 *Emys* soft-released
 - Overall apparent survival ~37%
 - Spain: 30-40% (Bertholero unpubl.)
 - Italy: 67-91% (Canessa et al. 2016)



2.
Consequences
of turtle
reintroduction

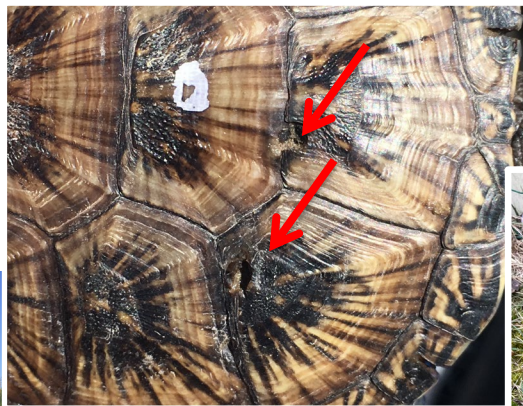
- The Woerr site (FR) : *Emys* population monitoring
 - 2013-2023: 573 *Emys* soft-released
 - Overall apparent survival ~37%
 - Survival determinants
 - Age at release >> body mass at release
 - Site of release
 - Acclim (76%) >> Gravel pond (44%)

➔ Soft release of old individuals!



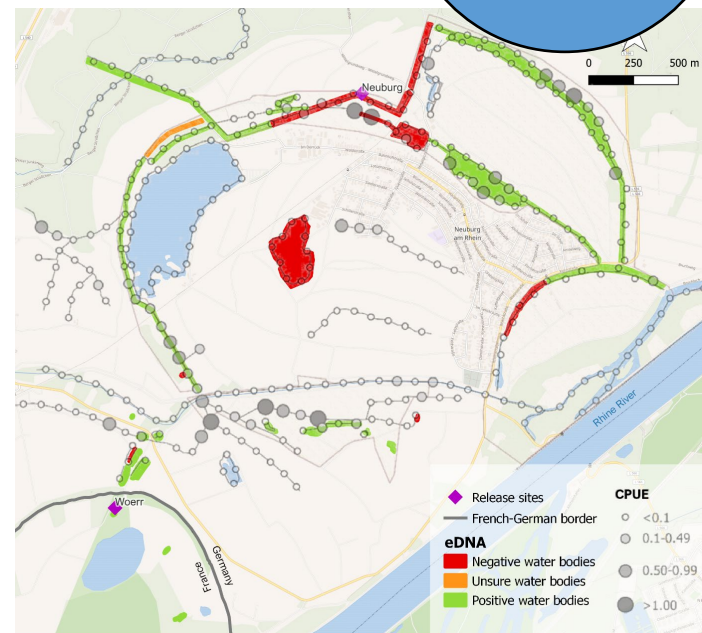
2.
Consequences
of turtle
reintroduction

- The Woerr site (FR) : *Emys* population monitoring
 - 2013-2023: 573 *Emys* soft-released
 - Overall apparent survival ~37%
 - Dispersion ~10%
 - Within site
 - Self-dispersion
 - Predatory-borne dispersion
 - Homing (back to acclim) ~30%



- The Woerr site (FR) : *Emys* population monitoring
 - 2013-2023: 573 *Emys* soft-released
 - Overall apparent survival ~37%
 - Dispersion ~10%
 - Within site
 - Self-dispersion
 - Predatory-borne dispersion
 - Homing (back to acclim) ~30%
 - Transbordering dispersion (FR $\leftrightarrow$ GER)
 - Evidence from sediment eDNA (Graf et al. in prep)

2. Consequences of turtle reintroduction



2.
Consequences
of turtle
reintroduction

- The Woerr site (FR) : *Emys* population monitoring
 - 2013-2023: 573 *Emys* soft-released
 - Overall apparent survival ~37%
 - Dispersion ~20% (+ homing)
 - Reproduction < 2%
 - Spain: < 5%
 - Italy: not published

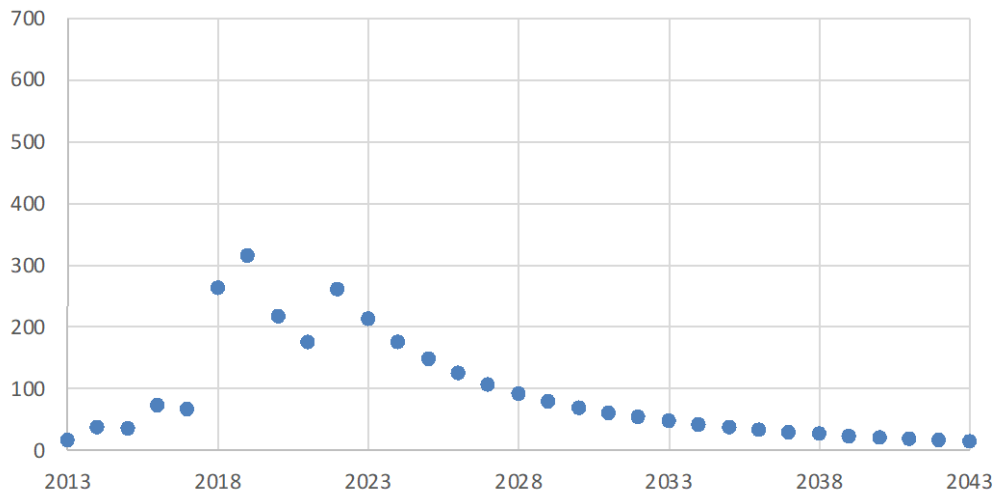


2.
Consequences
of turtle
reintroduction

- The Woerr site (FR) : *Emys* population monitoring
 - 2013-2023: 573 *Emys* soft-released
 - Overall apparent survival $\sim 37\%$
 - Dispersion $\sim 20\%$ (+ homing)
 - Reproduction $< 2\%$

→ The population is not self-sustaining
on the short term

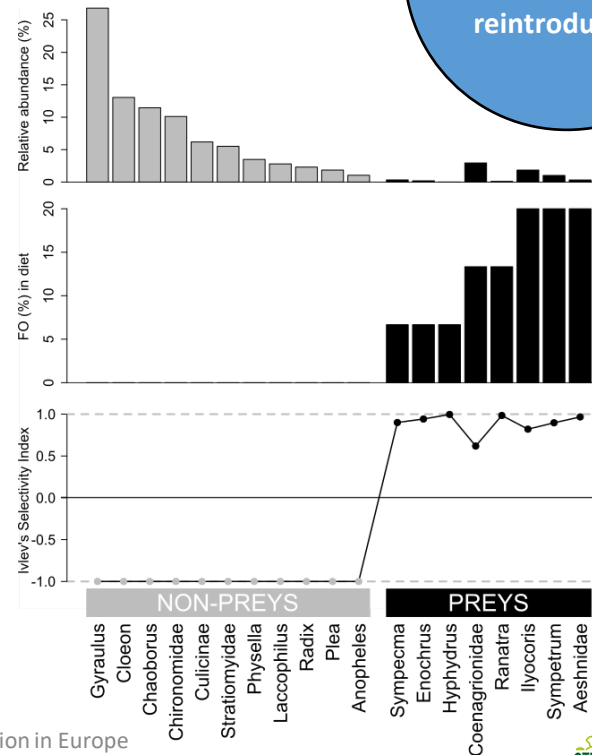
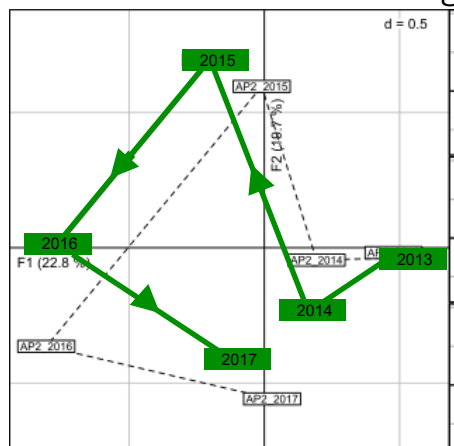
Predicted trends of the *Emys* population on Woerr (FR)



2. Consequences of turtle reintroduction

- The Woerr site (FR) : *Emys* functional ecology
 - Emys* as a predator (Meyer et al. in prep)
 - Main preys = aquatic macroinvertebrates (MI)
 - Prey selection = larger preys are preferred
 - No impact on overall MI communities throughout time

Changes in MI communities in pond **without** and **with** *Emys*



2.
Consequences
of turtle
reintroduction

- The Woerr site (FR) : *Emys* functional ecology
 - *Emys* as a predator (Meyer et al. in prep)
 - *Emys* as a prey (Meka et al. in prep)
 - Local predators (eggs: badger, hatchlings: heron, adults: fox)
 - (New) invasive alien species (e.g. raccoon *Procyon lotor*)



2.
Consequences
of turtle
reintroduction

The reintroduced population of *Emys* is not self-sustaining on the short term
If additional releases may occur, soft releases of oldest individuals with short residence should be preferred

Key challenges

- Ensure suitable aquatic habitats for *Emys* growth and dispersion
- Provide suitable terrestrial habitats for nesting
- Limit risky seasonal (homing) migrations
- Mitigate predation risks

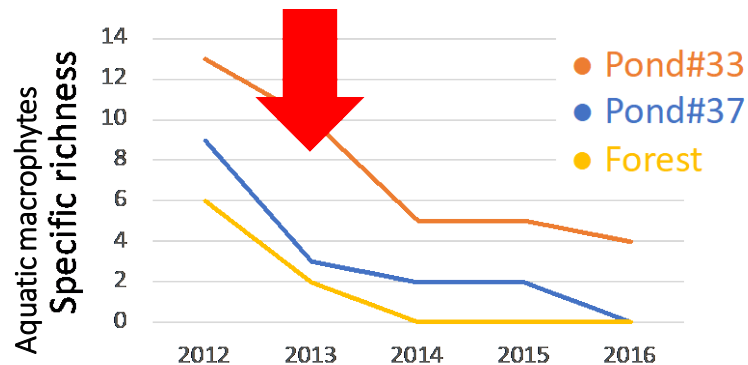
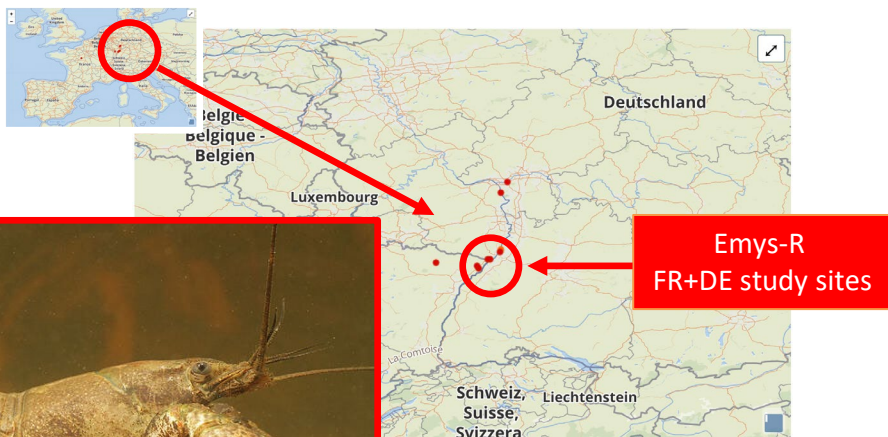
3.
Biological
invasions and
global change

- Bycatch of invasive alien species during *Emys* monitoring



3.
Biological
invasions and
global change

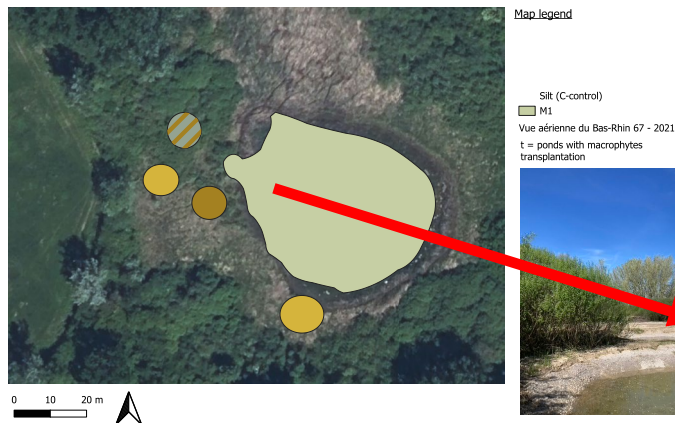
- The calico crayfish *Faxonius immunis*
 - A new invasive alien species



→ Presence of calico leads to unsuitable habitat for *Emys*

3.
Biological
invasions and
global change

- The calico crayfish *Faxonius immunis*
 - A new invasive alien species
 - Co-creation of calico-proof, *Emys*-friendly, adaptive ponds (Combroux et al.)
 - Sept 2022: one adaptive pond in meadow
 - Feb 2024: nine adaptive ponds near reed pond

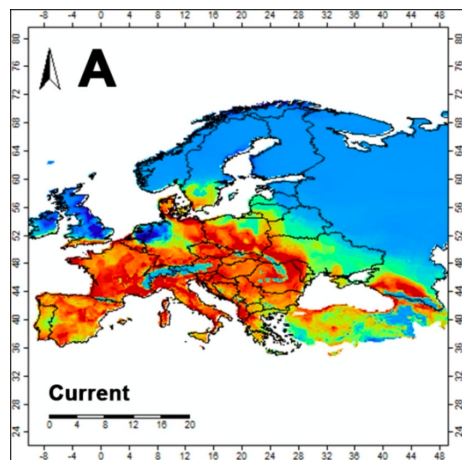


3.
Biological
invasions and
global change

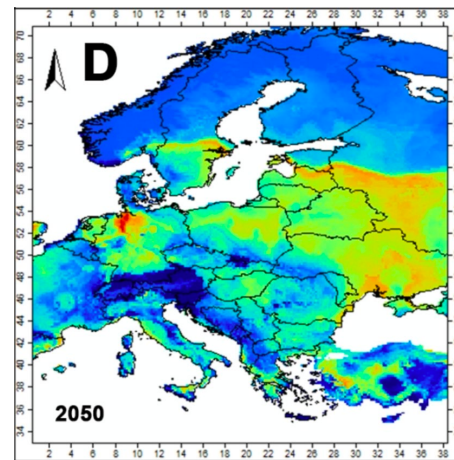
- The exotic freshwater turtles
 - Forecasting suitable areas for *Emys* without exotic conspecifics in Europe (Nekrasova et al. submitted)



Trachemys scripta elegans



A. Current areas of overlap between *Emys* and 7 exotic freshwater turtles



D. Forecasted areas suitable for *Emys* exempt of exotic freshwater turtles (by 2050)

3.
Biological
invasions and
global change

IAS and global change have rapid, increasingly disrupting, long lasting impacts on restored wetland functioning and reintroduction success

Key challenges

- Prevent reintroductions turn into invasions
- Ensure integrated ecological assessment prior & after habitat restoration
- Prospect future suitable areas for threatened native biodiversity

4.
Anthropogenic
threats and
conflicts

- The Neuburg am Rhein site (GER)
 - A Natura 2000 site entangled between unsuitable agricultural and urban areas
 - Potential nesting sites for *Emys* in private properties and unsuitable crop fields



Figure 4. Map of study site with observed catch per unit effort (CPUE). Points indicate trap locations. B 1-4 indicate locations turtles were observed basking.



4.
Anthropogenic
threats and
conflicts

- The Neuburg am Rhein site (GER)
 - 12-15 July 2021: massive European floods
 - Release of 10-d stagnant (anoxic) waters from crop fields to pond network
 - 1-5 August 2021: 40.000 – 80.000 dead fish (estimation, Georges & Theissinger, unpubl.)



Flooding in Rhineland-Palatinate (July 2021)



Georges & Theissinger (unpubl.)



© Clint Gebhard

4.
Anthropogenic
threats and
conflicts

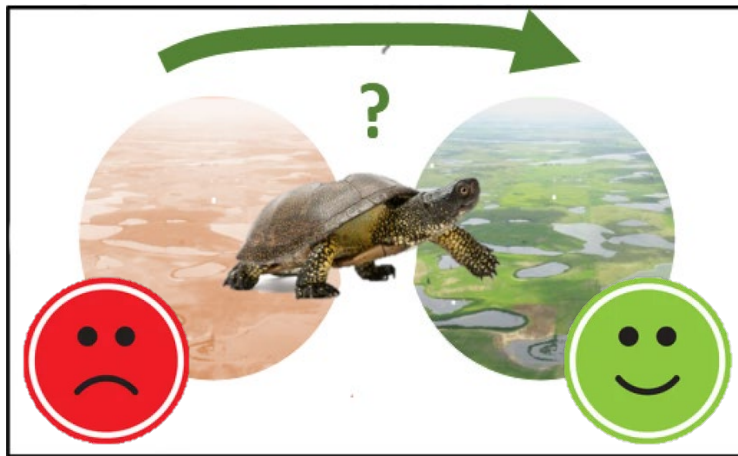
Protection status of reintroduction sites do not prevent mismanagement and deleterious anthropogenic hazards

Key challenges

- Address aquatic and terrestrial habitat suitability
- Make links with stakeholders, farmers and inhabitants before reintroduction

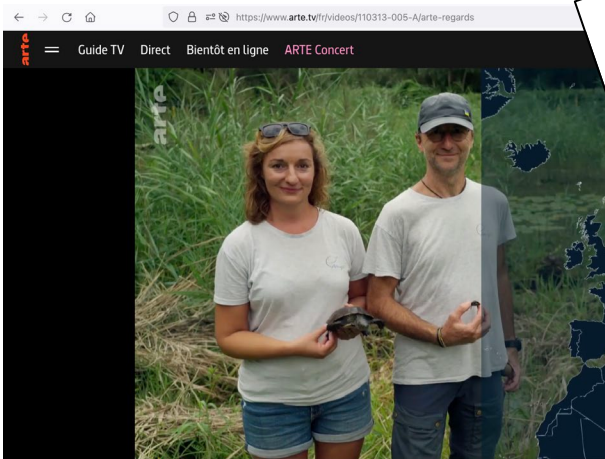
5. Can Emys be
an emissary
for wetlands?

- Mobilizing values of wetlands, its biodiversity and their conservation
 - Interviews: stakeholders, inhabitants
 - Public seminars: wetlands, biodiversity, functioning, conservation
 - Participatory workshops: sharing knowledge for sustainable governance



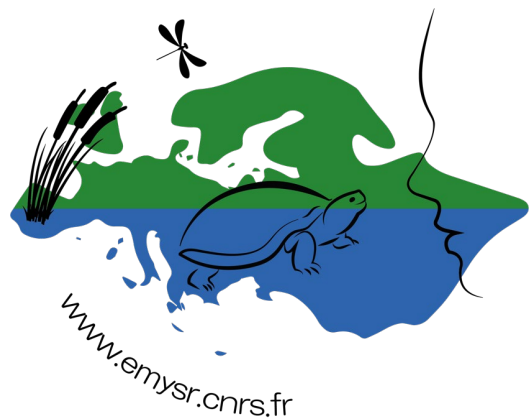
5. Can Emys be
an emissary
for wetlands?

- Mobilizing values of wetlands, its biodiversity and their conservation
- Public outreach actions
 - During release events
 - In medias (watch <https://www.arte.tv/fr/videos/110313-005-A/arte-regards>)



Do species reintroductions globally make sense?

Ex-situ conservation measures such as habitat restoration and species reintroduction must follow IUCN guidelines yet can only be sustainable if accepted and supported by stakeholders and the broad public.



Emys-R (<https://emysr.cnrs.fr/>) and was funded through the 2020-2021 Biodiversa+ and Water JPI joint call for research projects, under the BiodivRestore ERA-NET Cofund (GA N°101003777), with the EU and the funding organisations Agence Nationale de la Recherche (ANR, France, grant ANR-21-BIRE-0005), Bundesministerium für Bildung und Forschung (BMBF, Germany, grant BMBF project number 16LW015), State Education Development Agency (VIAA, Latvia, grant ES RTD/2022/2), and National Science Center (NSC, Poland, grant 2021/03/Y/NZ8/00101).

