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# Drying-out as a key management practice for fish ponds, to promote primary producers and macrophytes species richness?

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*Maintaining and increasing pond biodiversity*

*International Pond Conference 2024, Wednesday 13<sup>th</sup> November 2024*



# Introduction

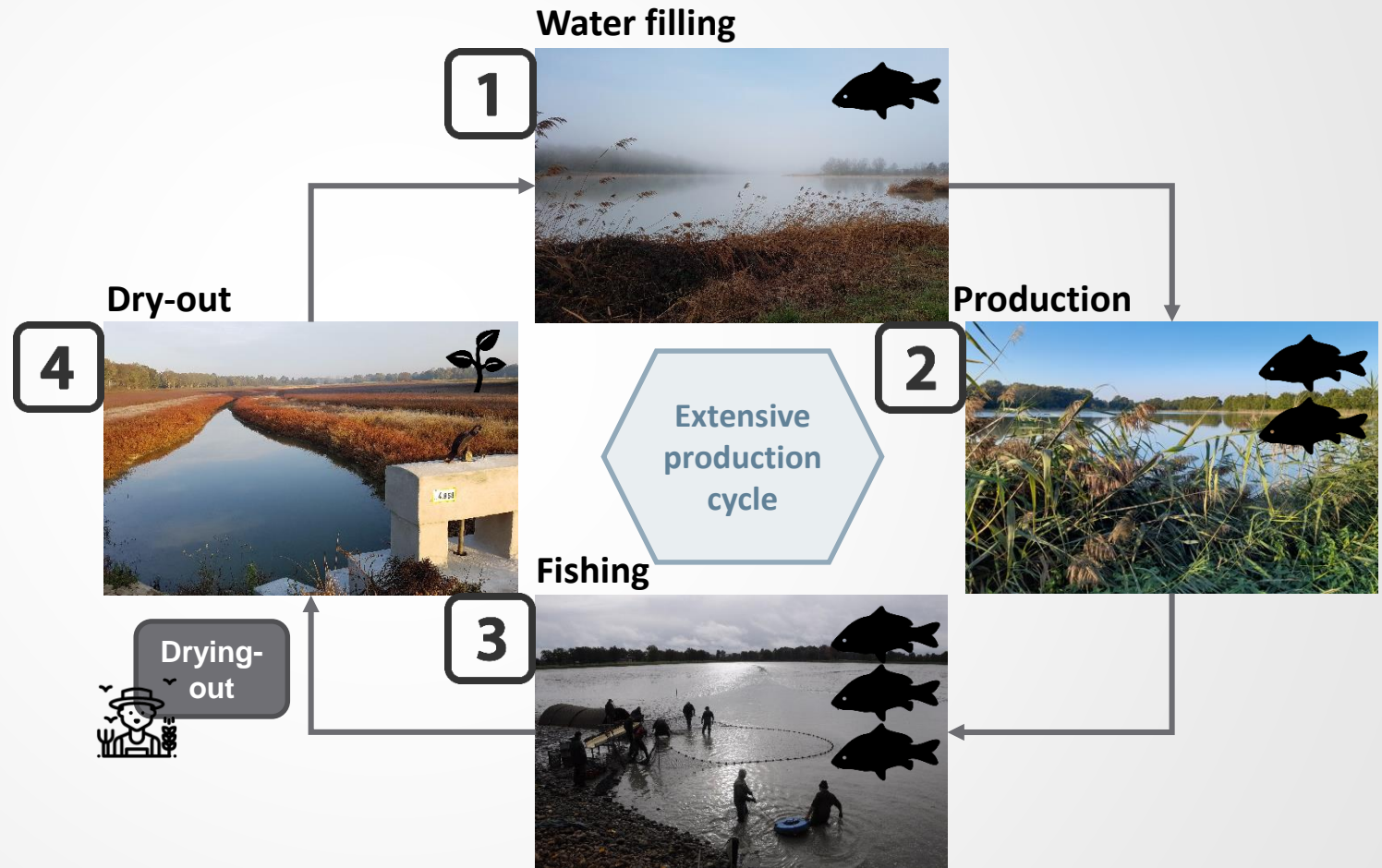
## Ponds for fish production, the case of the Dombes region (France)

Originally a wetland, transformed during the Middle Ages by monastic communities to create ponds  
(*Avocat, 1975; Guichenon, 1650 cited in Sceau, 1980*)

### A “productive pondscape”:

Around 1,100 ponds for 10,000 ha of water (average of 10 ha and 80 cm deep)  
Between 600 and 1,000 tonnes of fish produced per year

- Artificial and managed environments (*Hansson et al., 2005*)
- But also with significant biodiversity (*Wezel et al., 2014; Robin et al., 2014*)



➔ Drying-out, a **historical practice** but also a major **disturbance** for the ecosystem

# Materials and Methods

## How drying-out affect primary producers abundance and diversity?

(Wezel et al., 2013)



➔ Historical database of 85 fish ponds (134 statistical individuals) from the Dombes region (sampled several times between 2007-2014)

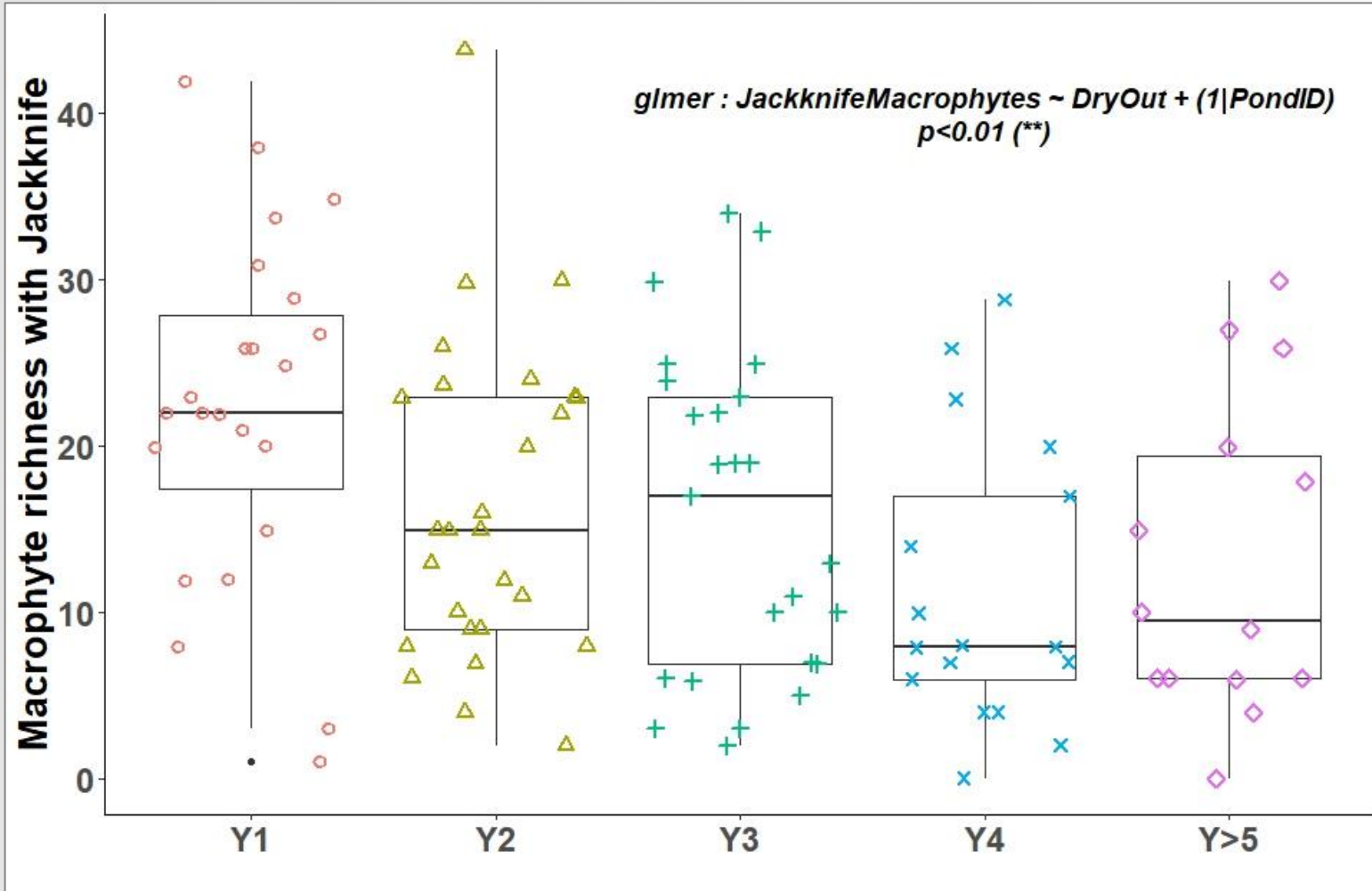
➔ Macrophyte species richness and cover  
Chlorophyll a concentration

Management data (time since the last dry-out and fish yields)

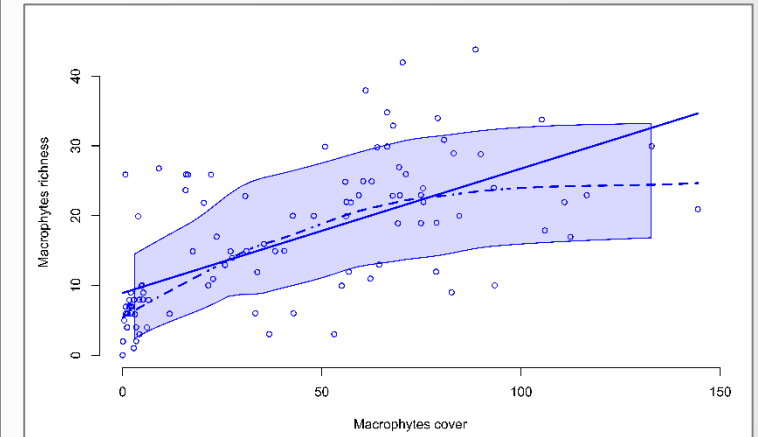


# Results

## Effects of drying-out on macrophyte richness and cover



(Girard et al., 2023)



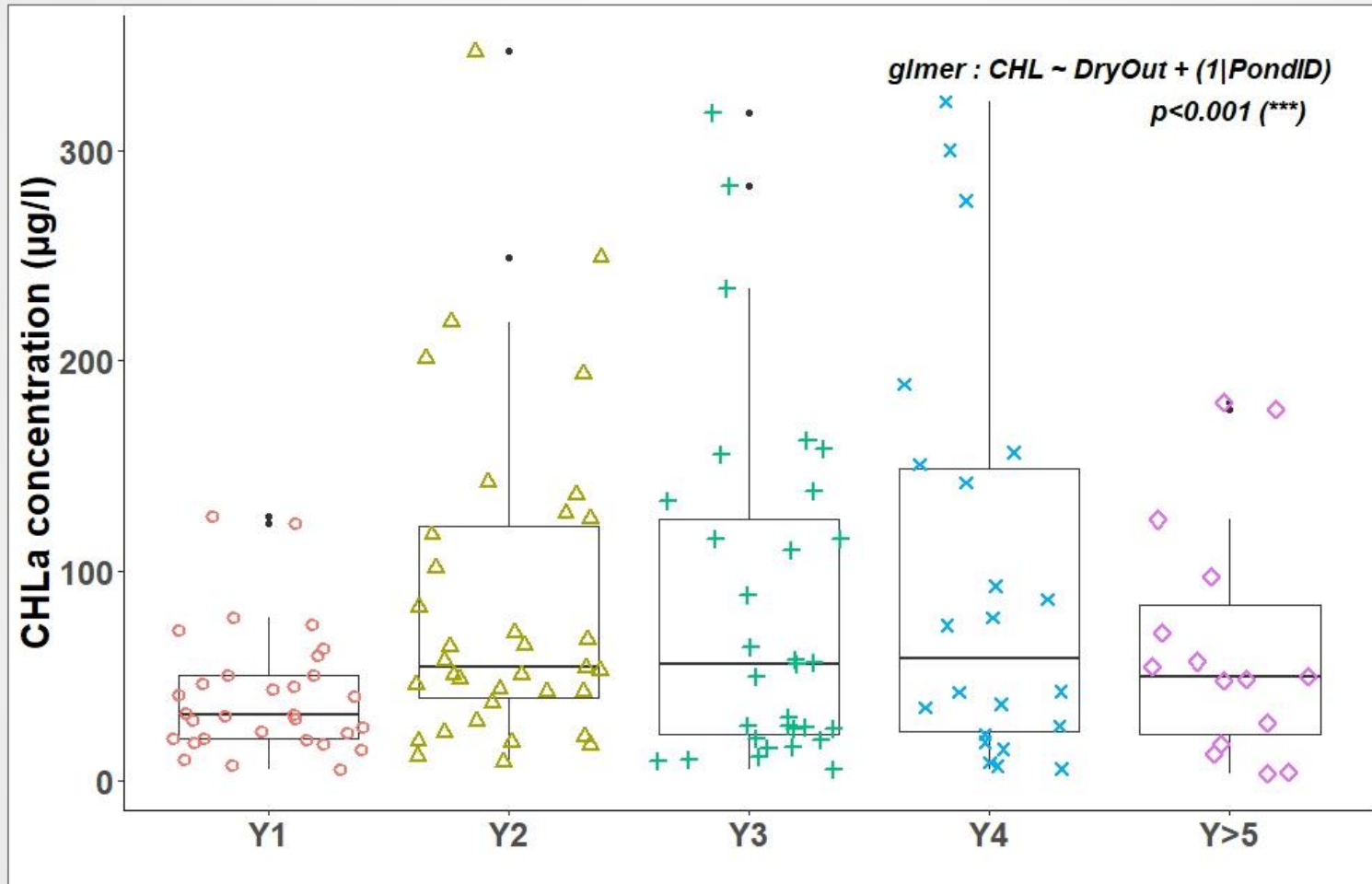
$(R^2 = 0.732, p < 0.0001)$

Same trends for species richness and cover

➔ Drying out is followed by **macrophyte recolonization**, with **higher diversity and cover in the first year of production**

# Results

## Effects of drying-out on chlorophyll a concentration

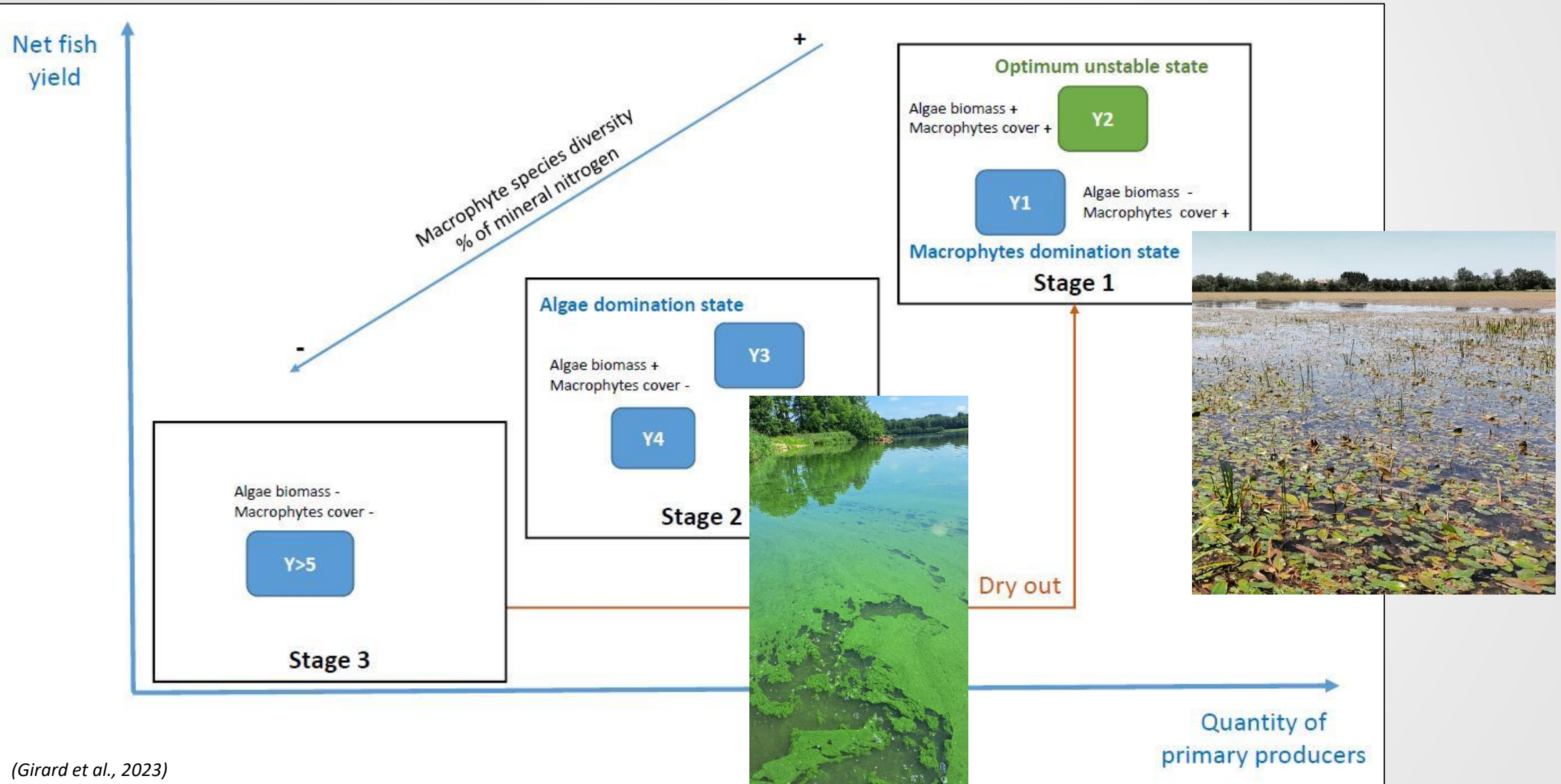


(Girard et al., 2023)



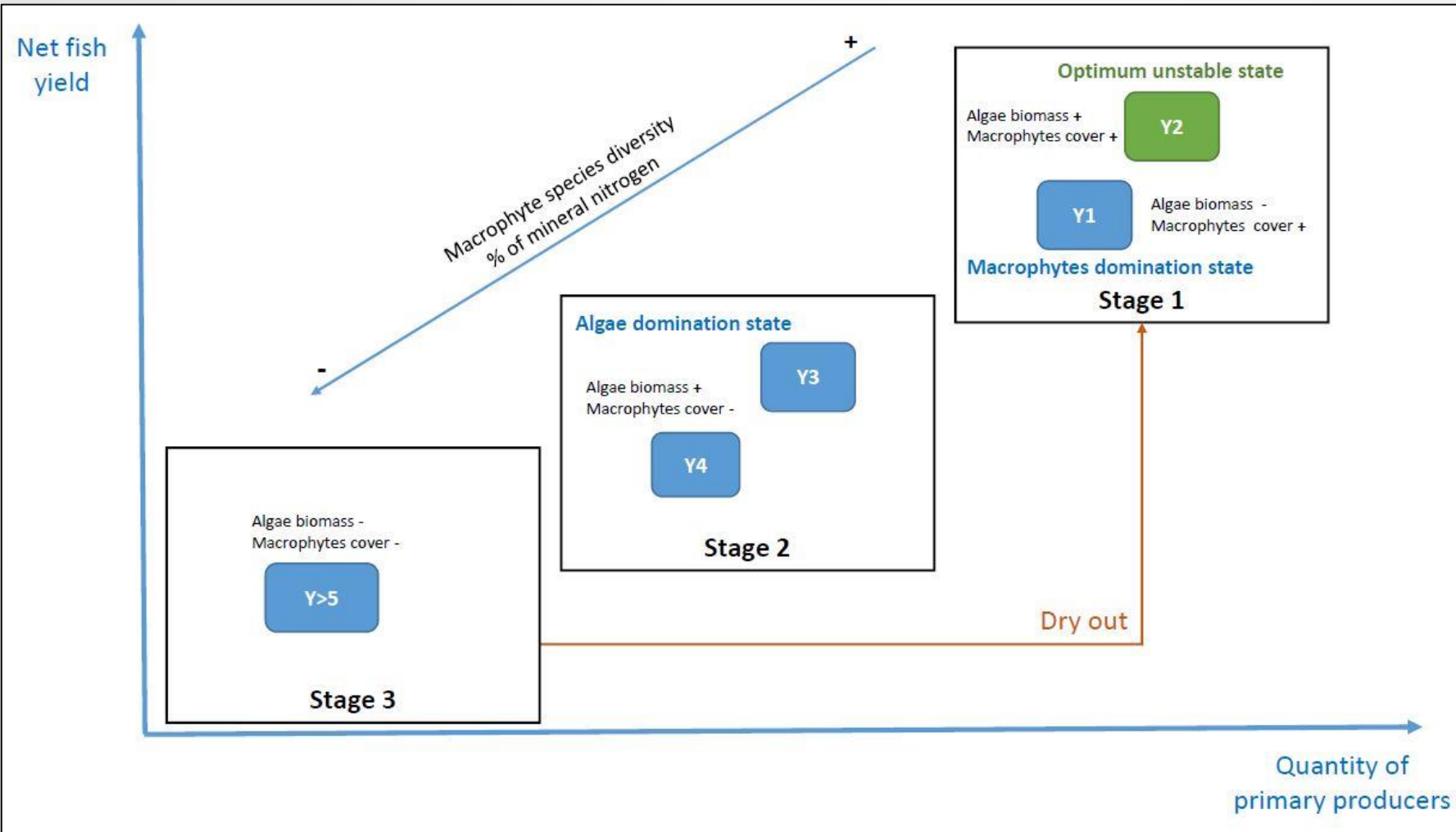
Phytoplankton gradually dominate in Y2 to Y4 and both phytoplankton and macrophytes decline in years 5 and more

# Results and Discussion



(Girard et al., 2023)

# Results and Discussion



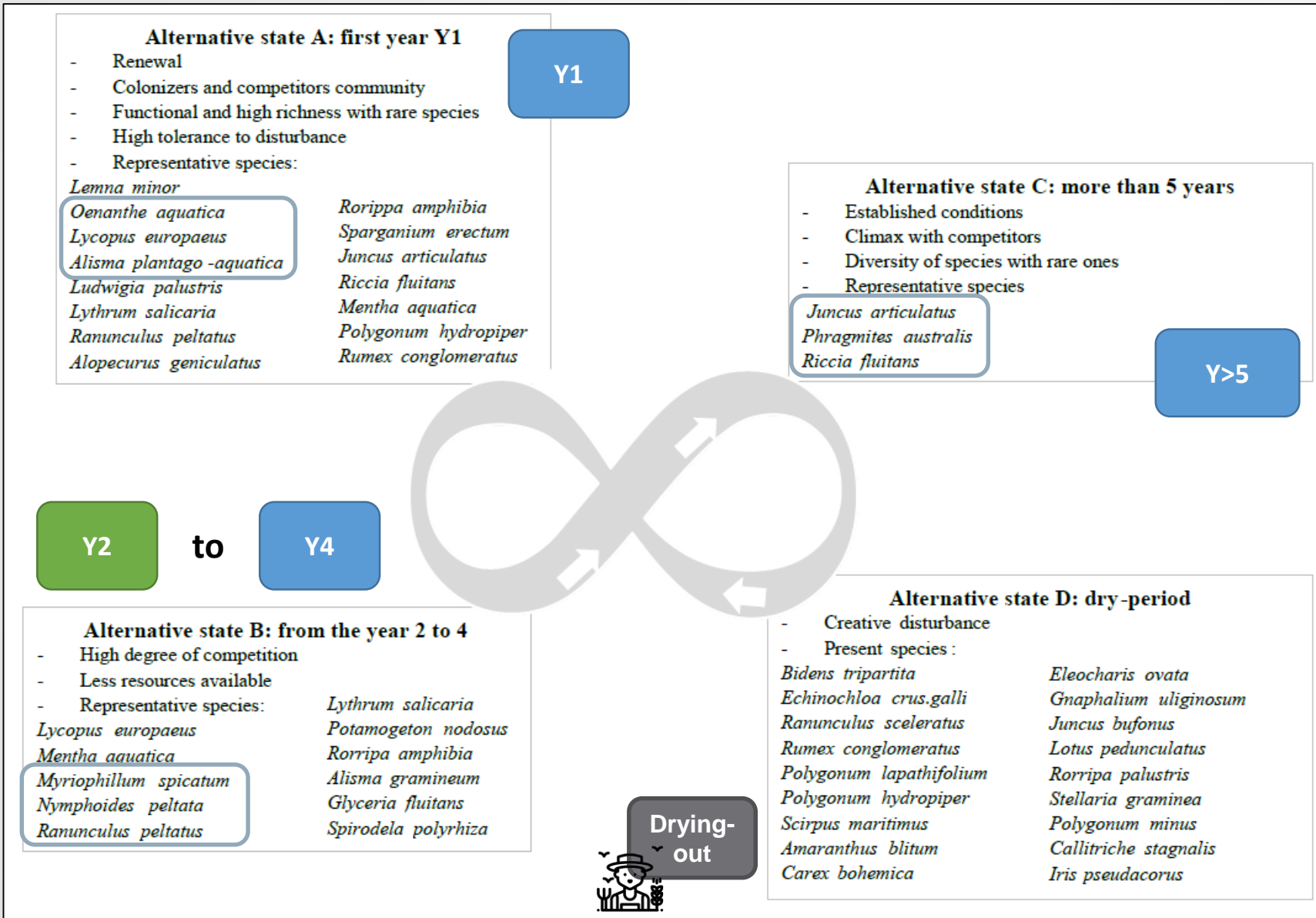
➔ An **unstable state, optimal for fish production and the diversity of primary producers**, favored by the practice of drying-out

↓  
A **major agroecological practice** for extensive pond fish farming

(Girard et al., 2023)



# Results



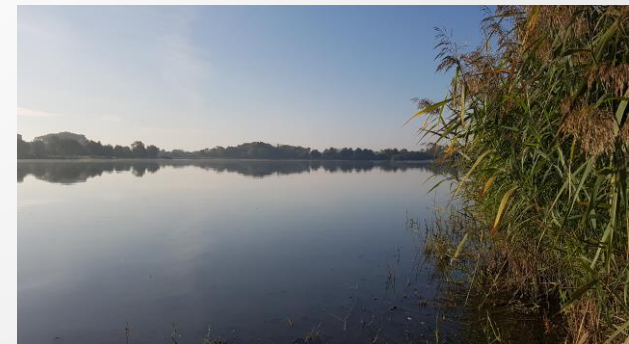
➔ An evolution of communities linked to the phenomenon of nestedness, based on a loss of several species but not on a complete turnover

(Fontanilles et al., 2023)

# Discussion and Conclusion

- Drying-out allow the **recolonization of macrophytes** and provide an **“optimal unstable state”** during the second year of the cycle
- Drying-out is a **major agroecological practice** for extensive pond fish farming
- Drying-out is **essential to maintaining these environments** and the **ecosystem services** they can provide:
  - Biodiversity conservation (support services)
  - Extensive, agroecological fish production (provisioning services)
  - Carbon storage (regulating services)
- But also a **major disturbance**, associated with **significant emissions of greenhouse gas** (to be studied more in details on the entire dry year)

➔ A need for future research to rethink about the hierarchy of desired ecosystem services



# Thanks for your attention!



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## Questions?

*Thanks to all colleagues and partners from Isara and PONDERFUL.  
Thanks to all fish farmers and pondscape stakeholders.*