



HAL
open science

A combined method for assessing ecological intensification in aquaculture systems

Aurélie Wilfart, Jéhane Prudhomme, Jean-Paul Blancheton, Joël Aubin

► **To cite this version:**

Aurélie Wilfart, Jéhane Prudhomme, Jean-Paul Blancheton, Joël Aubin. A combined method for assessing ecological intensification in aquaculture systems. LCAFOOD2012, 8th International Conference on LCA in the Agri-Food Sector, Rennes, France, 2-4 October 2012, Oct 2012, Saint-Malo (France), France. 2012. hal-04146685

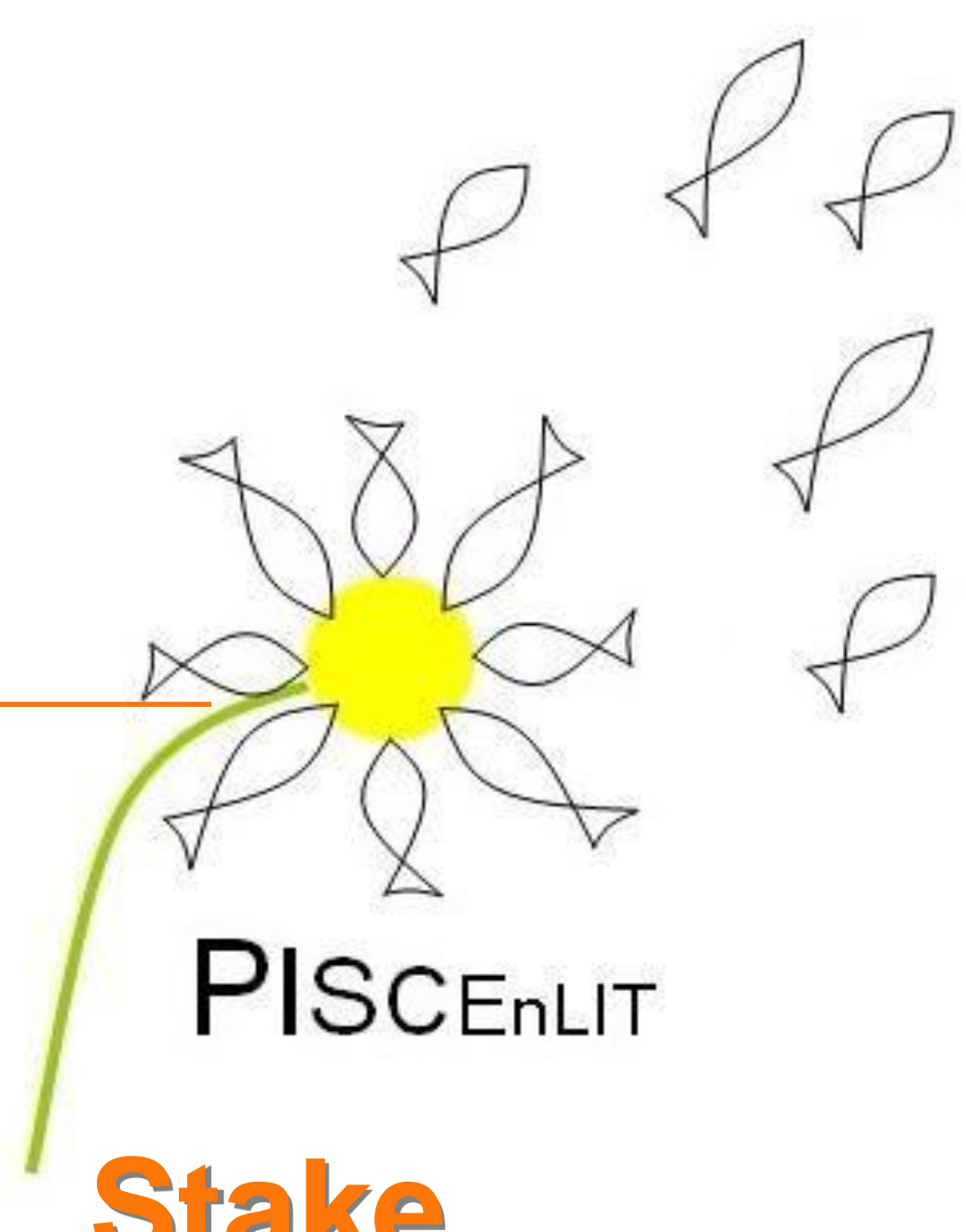
HAL Id: hal-04146685

<https://hal.inrae.fr/hal-04146685v1>

Submitted on 30 Jun 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



A combined method for assessing ecological intensification in aquaculture systems

Aurélie Wilfart^{1,2,*}, Jéhane Prudhomme^{1,2,3}, Jean-Paul Blancheton³, Joël Aubin^{1,2}

¹INRA, UMR 1069, Soil, Agro and hydroSystem, F-35000 Rennes, France

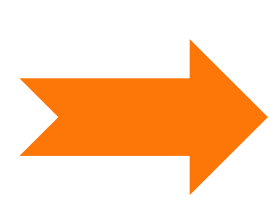
²Agrocampus Ouest, UMR 1069, Soil, Agro and hydroSystem, F-35000 Rennes, France

³IFREMER, Laboratoire de Recherche Piscicole de Méditerranée, Chemin de Maguelone, 34250 Palavas-les-Flots, France

Stake

2050: 9 billiards of people on earth

- Increasing demand for food but decrease in wild fish stocks
- Increasing pressure on natural resources but demand for more sustainable production systems and a respected environment



These refers to a **new paradigm**: High level of output/ha, production in harmony with the environment by enhancing natural resources and ecosystemic services → **Ecological Intensification** of fish farming system



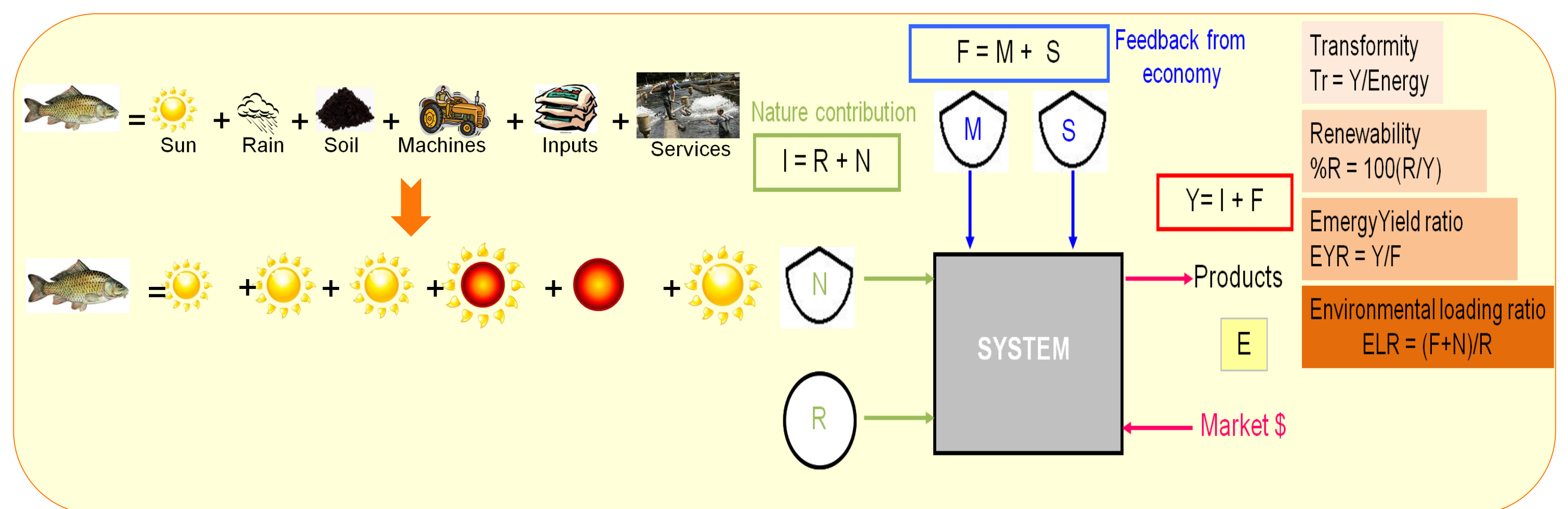
A multiscale assessment method is needed for assessing ecological intensification of fish farming system : Combination of LCA and Emery accounting is proposed.

Methods

LCA

- CML 2001 (v2.04) for Climate change (CC), eutrophication (EU), acidification (AC), land occupation (LO),
- Total cumulative energy demand (v1.05) (TCED)
- Net primary production use (Papatryphon et al, 2004) (NPPU)
- Water dependence (Aubin et al, 2009)(WD)

Emery Accounting



Fish farming systems

Recirculating System Farm (RSF)

- 55 tons of Atlantic salmon
- Water area : 1.7 ha
- Fish density : 32.35 t/ha
- Feed: Commercial (50% fish)
- Fingerlings: 100 % from Scotland
- Chemical inputs: Disinfectants

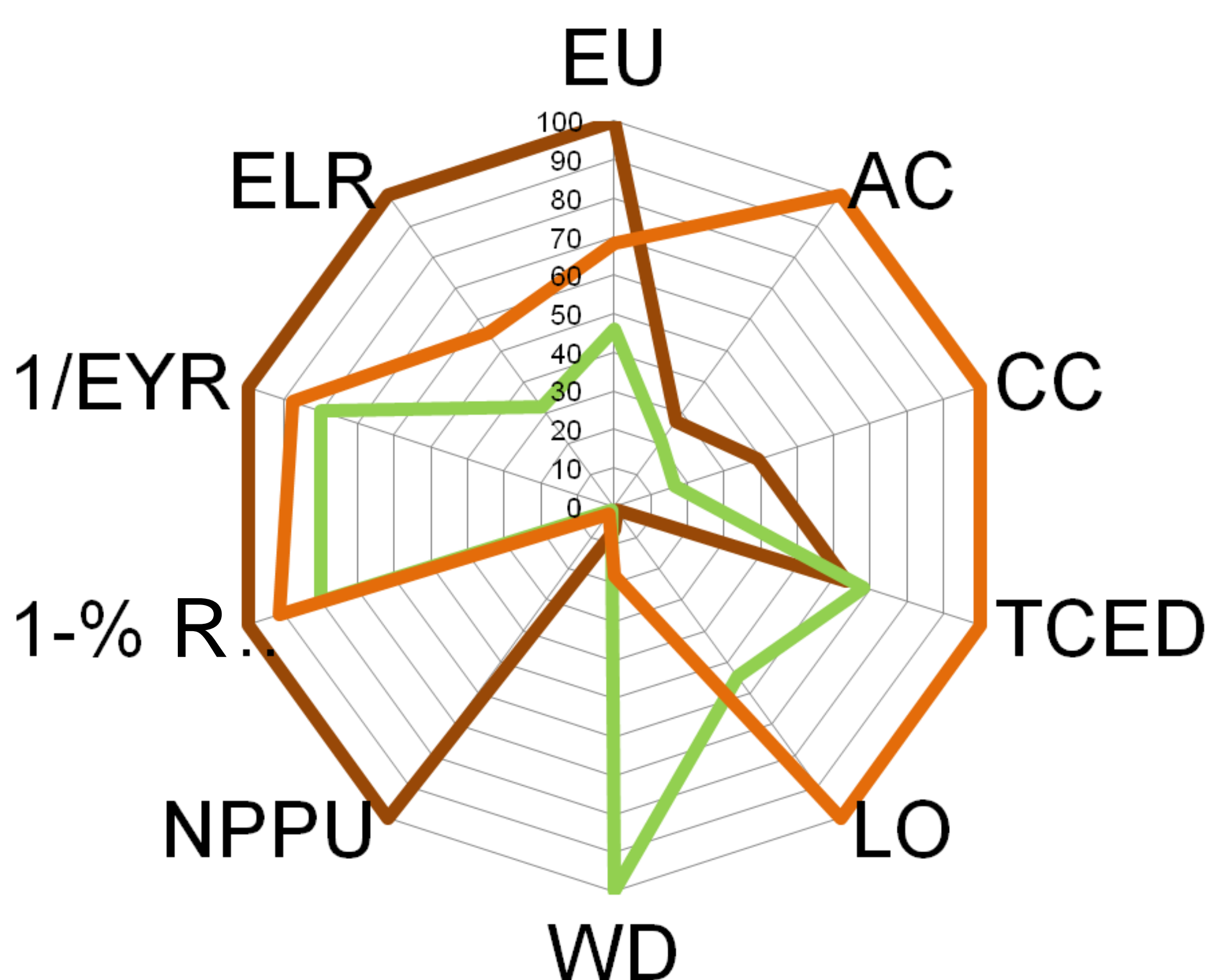
Extensive pond farm (PF1)

- 35 tons of carp, tench, roach...
- Water area : 96.0 ha
- Fish density : 0.36 t/ha
- Feed: 100 % unprocessed (wheat)
- Fingerlings: 99 % Natural
- Chemical inputs: 100 kg/ha Lime

Semi-extensive pond farm (PF2)

- 3.3 tons of carp, tench, roach...
- Water area : 12.0 ha
- Fish density : 0.28 t/ha
- Feed: Commercial (wheat, rape meal, extruded soybean)
- Fingerlings: 50 % natural
- Chemical inputs: 1000 kg/ha Lime

Results



Relative environmental profile of RSF, PF1 and PF2 according to LCA and Emery indicators

- Environmental profile allows comparing systems
- RSF has better potential impacts but is
 - more dependant to economical inputs
 - use less renewable resources
 - rely less on local resources
 - is more sensitive to economical stress

EU: Eutrophication
 AC: Acidification
 CC: Climate Change
 TCED: Total Cumulative Energy Demand
 LO: Land Occupation
 WD: Water Dependence
 NPPU: Net Prim. Production Use
 1-%R: 1- % Renewability
 1/EYR: 1/Emery Yield Ratio
 ELR: Environmental Loading Ratio

Conclusions

- Extensive system is not necessarily more sustainable than an intensive system
- For 1 tonne of fish produced, RSF has a more favourable environmental balance than the ponds
- Recirculated systems are clearly disconnected from the surrounding environment and are highly dependent on external resources
- Ponds better value renewable natural resources but have high environmental impacts due to a low valorisation of external inputs

What should be ecological intensification for aqua system ?

- a decrease of potential impacts per kilograms of final products
- a decrease of economical and external resource dependency
- an increase of renewable natural resources
- an increase of input efficiency.

This project has been funded by French National Research Agency

