

Online tool for analyzing tradeoffs in farm management strategies

Selecting management practices that optimize agricultural yields and minimize environmental tradeoffs in agro-ecosystems

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EUFRAS Webinar, April 16th 2024

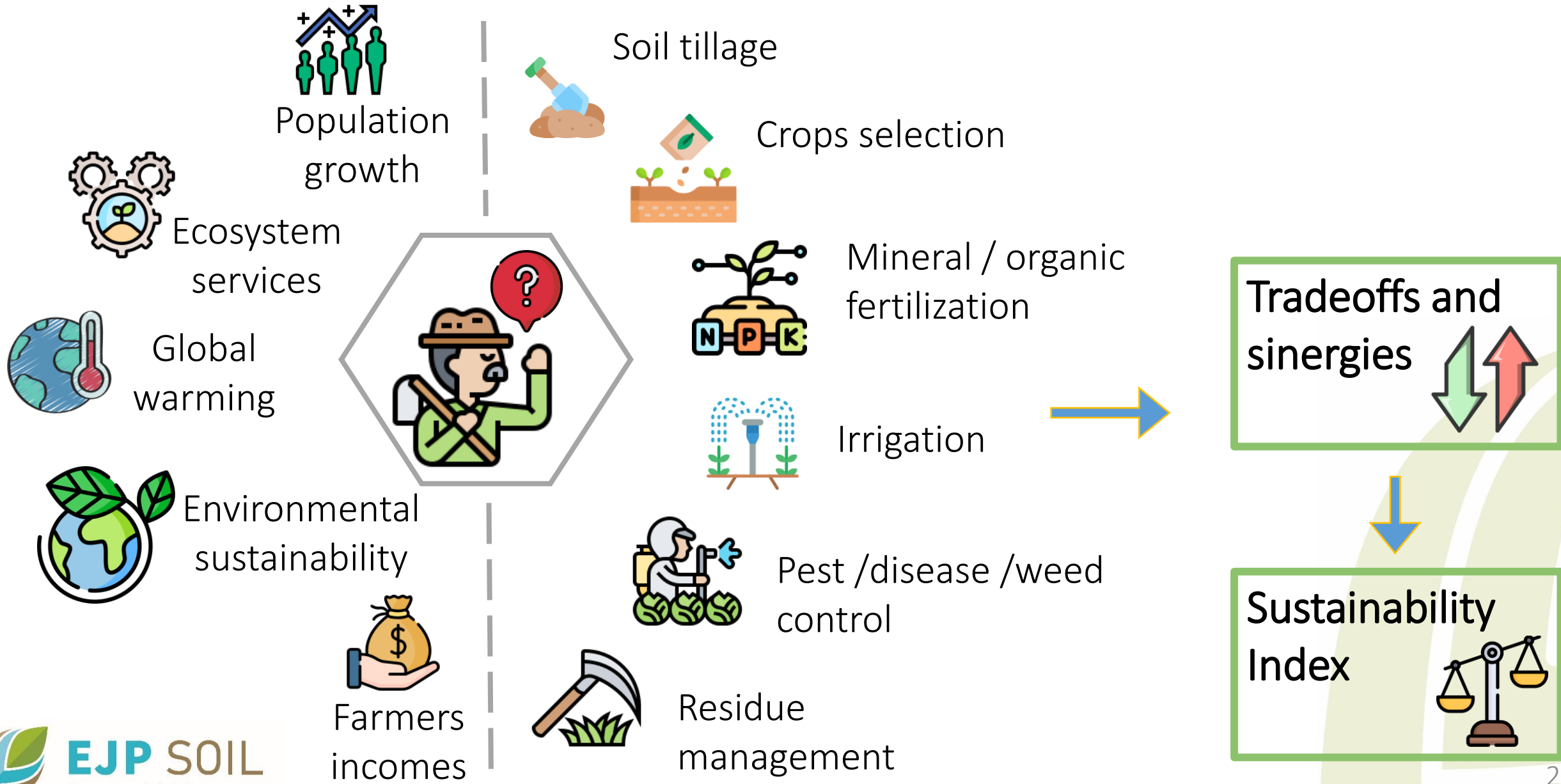


EJP SOIL
European Joint Programme

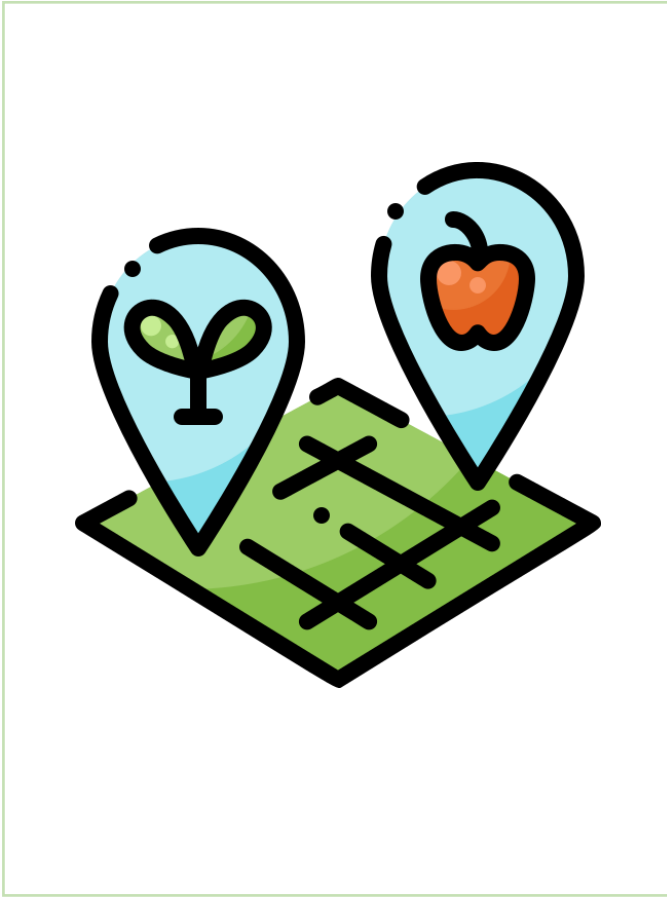
EJP SOIL has received funding from the European Union's Horizon 2020 research and innovation programme: Grant agreement No 862695



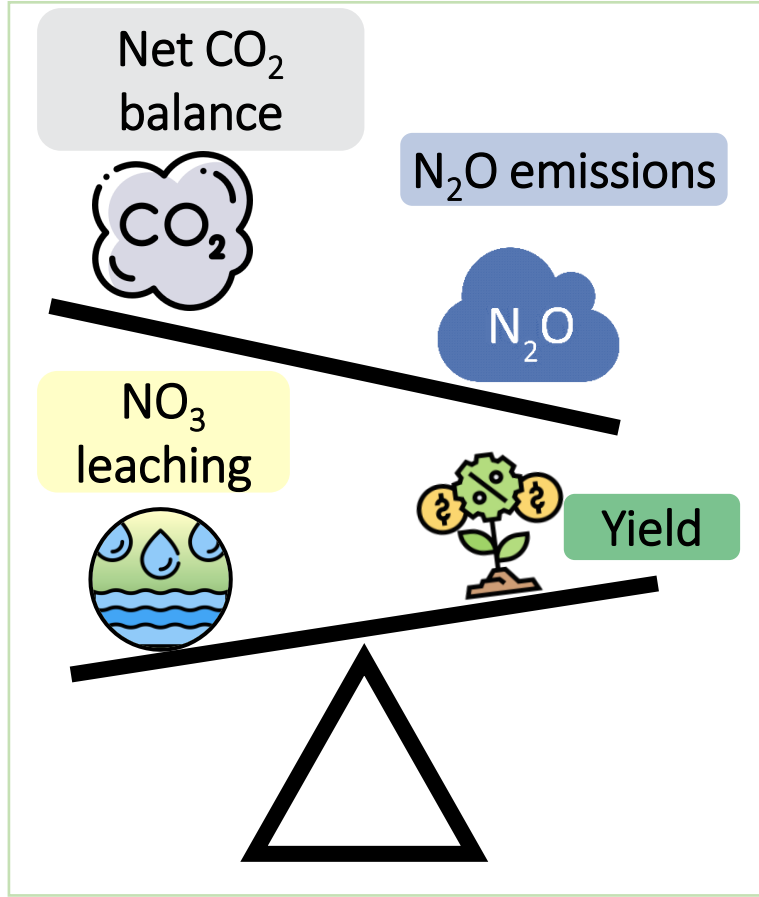
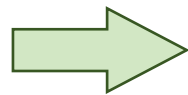
Today agriculture challenges



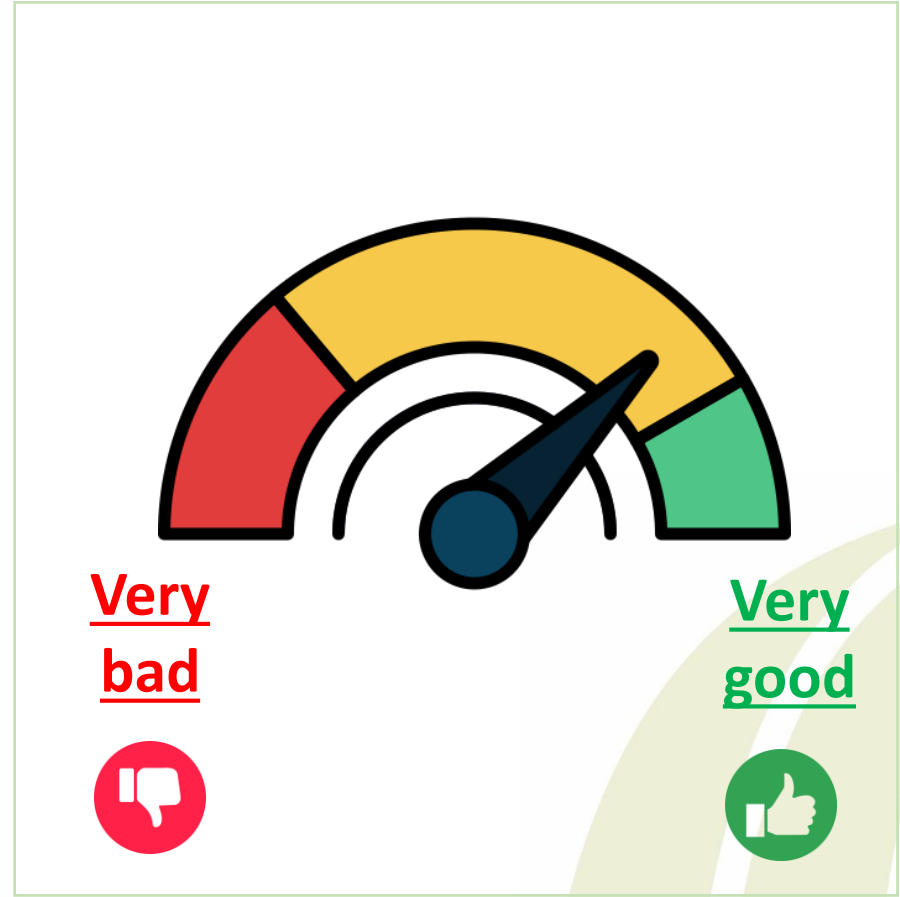
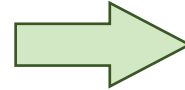
Trade-off assessment system



2 millions agronomic case-scenarios

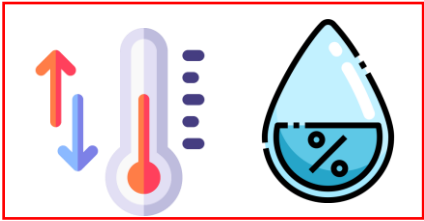


4 trade-off components

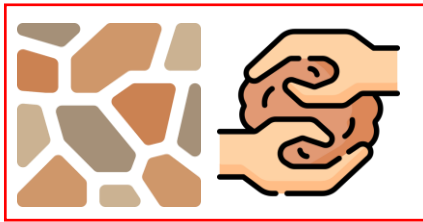


Σommit index

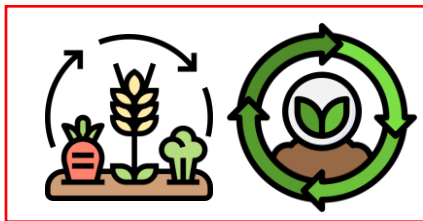
2 Millions agronomic case scenarios



TEMPERATURE REGIME (COOL, WARM)
MOISTURE REGIME (DRY, MOIST)



SOIL CLASS (HIGH ACTIVITY CLAY, VULCANIC, WETLANDS)
SOIL TEXTURE (SAND, SILT, LOAM, CLAY)



CROPS (BARLEY, WINTER - DURUM WHEAT, RYE, OAT, LENTIL, CHICKPEA, BEAN AND GREEN BEAN, SOYBEAN, FIELD - GRAIN PEA, POTATO, SORGHUM, MAISE, BARE FALLOW, PROTEIN PEA, SPRING-WINTER GRAIN MIXES)
RESIDUES (REMOVED - RETAINED)



IRRIGATION (NO IRRIGATION, DRIP IRRIGATION, NON-DRIP IRRIGATION)
SOIL TILLAGE (NO TILLAGE, REDUCED TILLAGE, FULL TILLAGE)



MINERAL FERTILIZATION (NITRATE BASED, AMMONIUM BASED, MIX)
ORGANIC FERTILIZATION (GREEN MANUR, ANIMAL MANURE)

Trade-off components estimation

crop yield

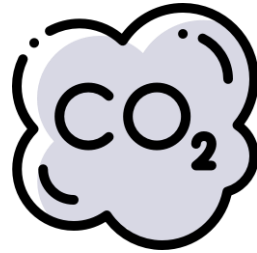


METANALYSIS

Crop response to N fertilization
(Hijbeek et al, 2017)

Crop response to irrigation
(Daryanto et al, 2017)

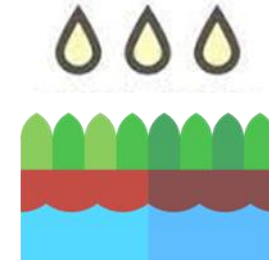
emissions



TIER 1 GUIDELINES

Intergovernmental Panel on Climate Change
(IPCC 2019)

NO₃ leaching



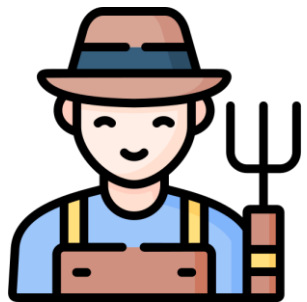
TIER 1 GUIDELINES

Intergovernmental Panel on Climate Change
(IPCC 2019)

Gray water footprint accounting manual
(Franke et al., 2017)

Expert opinions

The index meaning and usefulness can be enhanced incorporating opinions from domain-experts to account for the priorities and perspectives of different users



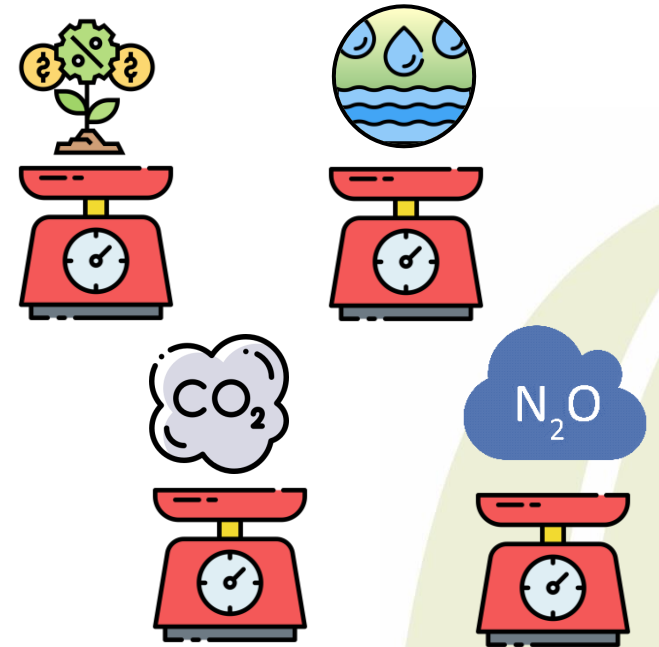
Farmers



Agrochemical
multination
company



Agency for
CAP funds
allocation



Weight of the trade-off
components

Interactive dashboard

Narrative

Balanced ✕ ▾

Environment

Moisture Regime

Dry ▾

Temperature Regime

Cool ▾

Management

Nitrogen Input

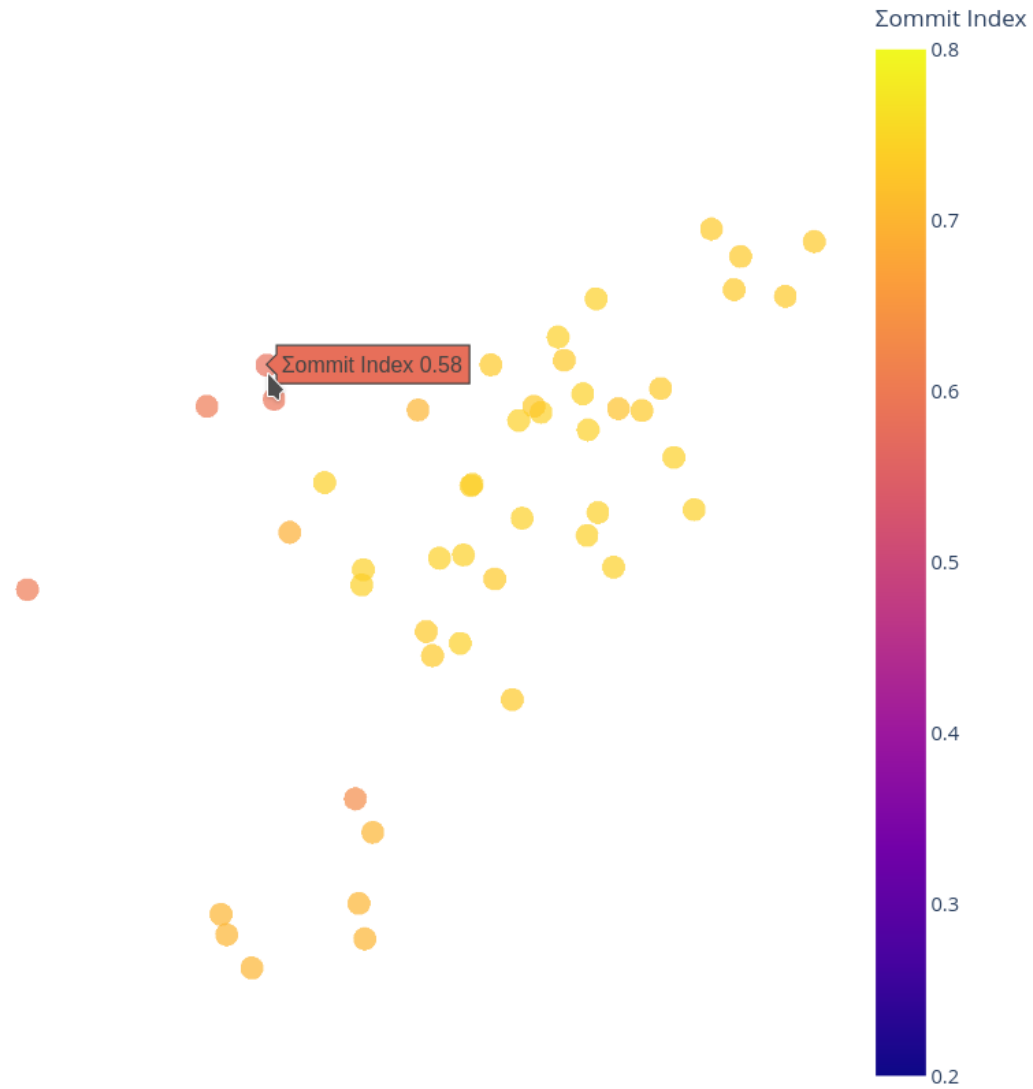
50 ▾

Organic Matter Input

Medium ▾

Crop

✕ Barley ✕ Oat
✕ Wheat ✕ ▾
✕ Durum wheat



Barley

Soil texture Clay

Soil tillage Full tillage

Irrigation Type No irr

Organic Nitrogen

Animal manure

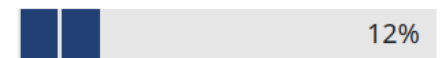
Mineral Nitrogen Nitrate based

Crop residues Removed

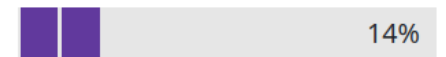
ΔSOC (COeq)



N₂O emissions



N-NO₃ leaching



Crop yield



Σommit Index



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Cool ▾

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Nitrogen Input

50 ▾

Organic Matter Input

Medium ▾

Crop

✕ Barley ✕ Oat

✕ Wheat ✕ ▾

✕ Durum wheat



Different narratives lead to varying index scores depending on subjective socio-economic priorities of different stakeholders

1. Balanced
2. Young Farmers
3. Agrochem Corporation
4. CAP Paying Agency

Σommit Index 0.58



Σommit Index

0.8

0.7

0.6

0.5

0.4

0.3

0.2

Barley

Soil texture Clay

Soil tillage Full tillage

Irrigation Type No irr

Organic Nitrogen

Animal manure

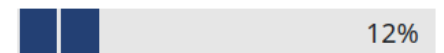
Mineral Nitrogen Nitrate based

Crop residues Removed

ΔSOC (COeq)



N2O emissions



N-NO3 leaching



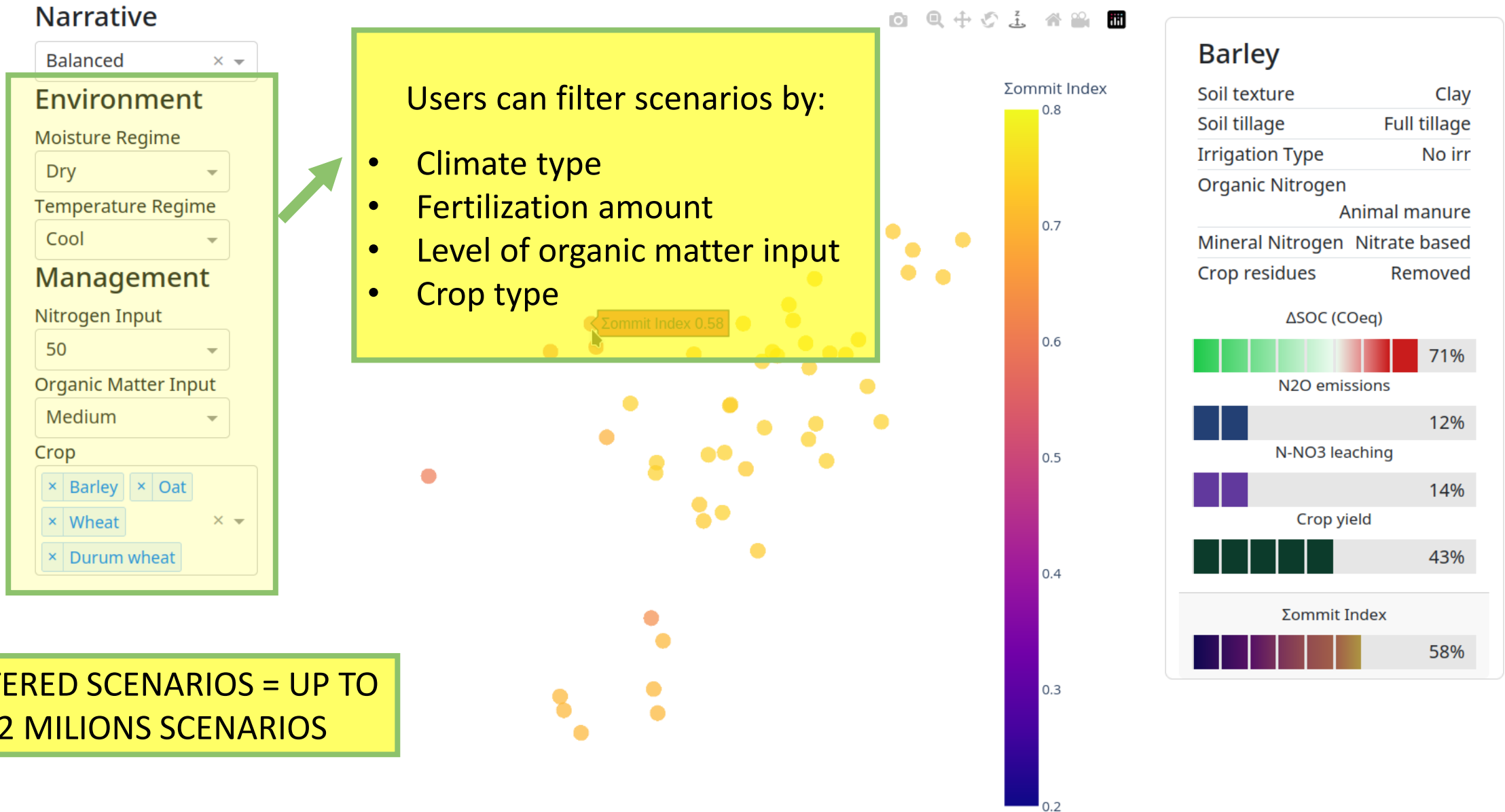
Crop yield



Σommit Index



Interactive dashboard



FILTERED SCENARIOS = UP TO 2 MILLIONS SCENARIOS

Interactive dashboard

Narrative

Balanced

Environment

Moisture Regime

Dry

Temperature Regime

Cool

Management

Nitrogen Input

50

Organic Matter Input

Medium

Crop

Barley Oat

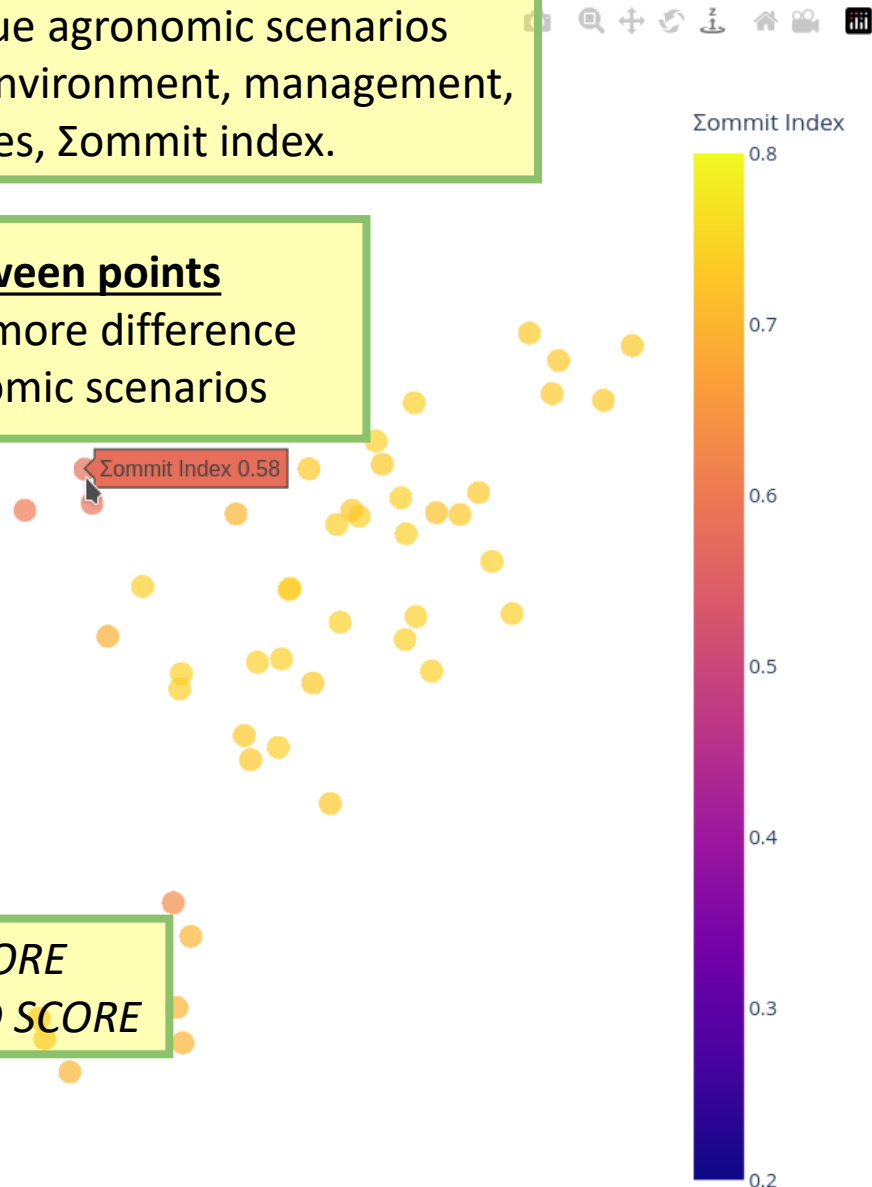
Wheat

Durum wheat

Points → unique agronomic scenarios defined by crop, environment, management, GHG fluxes, Σ ommit index.

Distance between points
more distance = more difference
Between agronomic scenarios

Dark colors → low index value → *BAD SCORE*
Light colors → high index values → *GOOD SCORE*



Barley

Soil texture Clay

Soil tillage Full tillage

Irrigation Type No irr

Organic Nitrogen
Animal manure

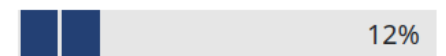
Mineral Nitrogen Nitrate based

Crop residues Removed

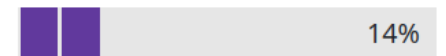
Δ SOC (COeq)



N₂O emissions



N-NO₃ leaching



Crop yield



Σ ommit Index



Interactive dashboard

Narrative

Balanced ✕ ▾

Environment

Moisture Regime

Dry ▾

Temperature Regime

Cool ▾

Management

Nitrogen Input

50 ▾

Organic Matter Input

Medium ▾

Crop

✕ Barley ✕ Oat
✕ Wheat ✕ ▾
✕ Durum wheat

Detailed breakdown of the scenario with specifics on:

- Soil type – tillage
- Irrigation
- N fertilization type
- Crop residues



Σommit Index



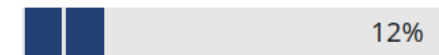
Barley

Soil texture	Clay
Soil tillage	Full tillage
Irrigation Type	No irr
Organic Nitrogen	Animal manure
Mineral Nitrogen	Nitrate based
Crop residues	Removed

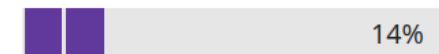
ΔSOC (COeq)



N2O emissions



N-NO3 leaching



Crop yield



Σommit Index



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Narrative

Balanced ✕ ▾

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Moisture Regime

Dry ▾

Temperature Regime

Cool ▾

Management

Nitrogen Input

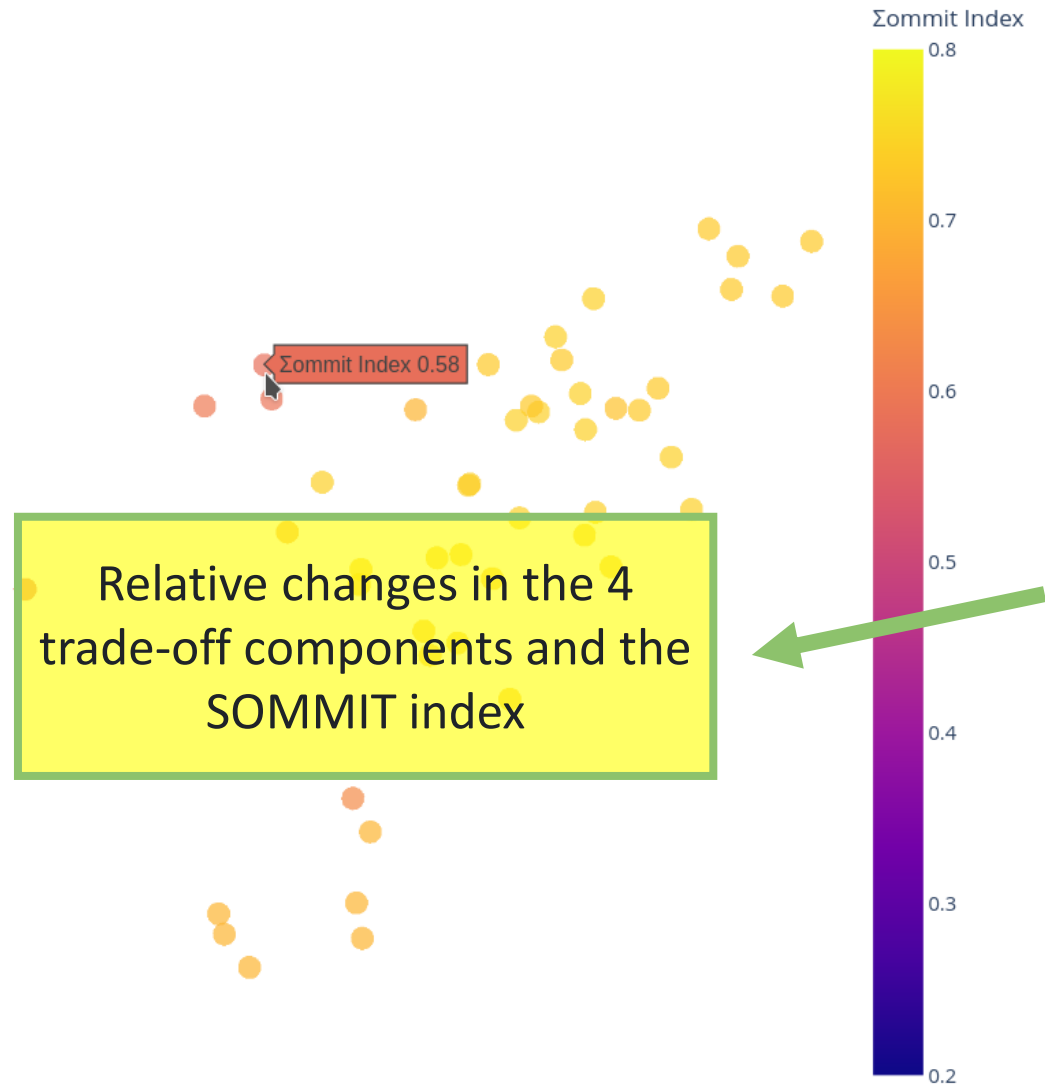
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Organic Matter Input

Medium ▾

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✕ Wheat ✕ ▾
✕ Durum wheat



Barley

Soil texture Clay

Soil tillage Full tillage

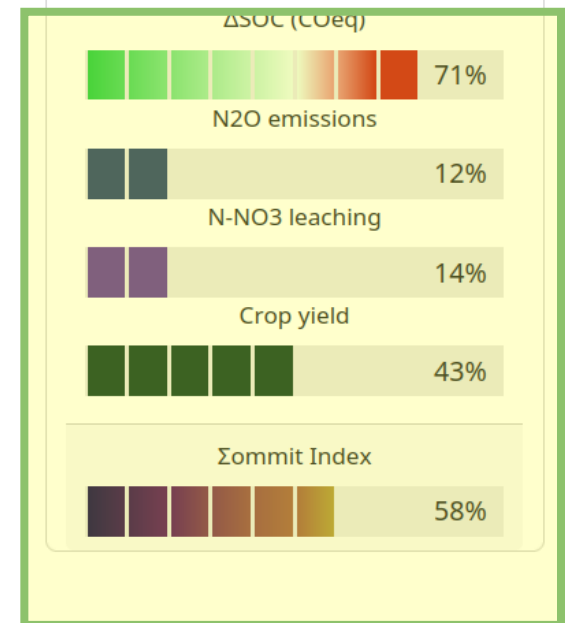
Irrigation Type No irr

Organic Nitrogen

Animal manure

Mineral Nitrogen Nitrate based

Crop residues Removed



• References

- Daryanto, S., Wang, L., Jacinthe, P.-A., 2017. Global synthesis of drought effects on cereal, legume, tuber and root crops production: a review. *Agric. Water Manag.* 179, 18–33. <https://doi.org/10.1016/j.agwat.2016.04.022>.
- Franke, N., Boyacioglu, H., Hoekstra, A., 2013. Grey Water Footprint Accounting Tier 1 Supporting Guidelines Value of Water Research Report Series, p. 65.
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- IPCC, 2019. In: Calvo Buendia, E., Tanabe, K., Kranjc, A., Baasansuren, J., Fukuda, M., Ngarize, S., Osako, A., Pyrozhenko, Y., Shermanau, P., Federici, S. (Eds.), *Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Published: IPCC, Switzerland.