REGIONE DEL VENETO

PROGRAMMA 2007 2013 PSR VENETO SVILUPPO RURALE

UNIVERSITÀ DEGLI STUDI DI PADOVA

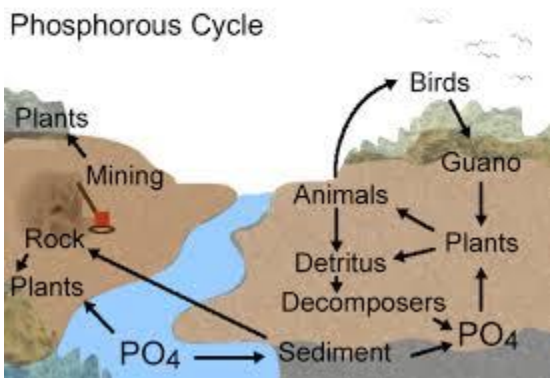
DAFNAE
Department of Agronomy Food Natural resources Animals Environment

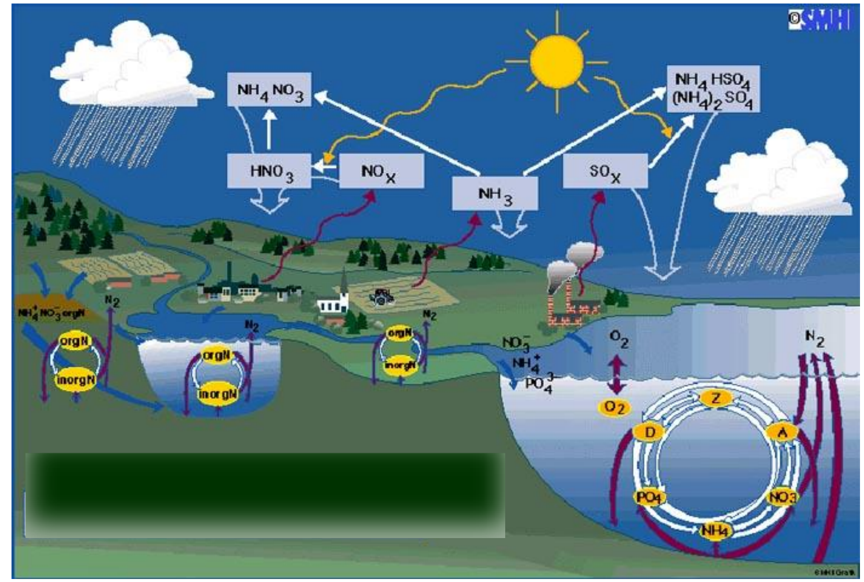
Assessing the role of agri-environmental measures to enhance the environment in the Veneto Region with a model based-approach

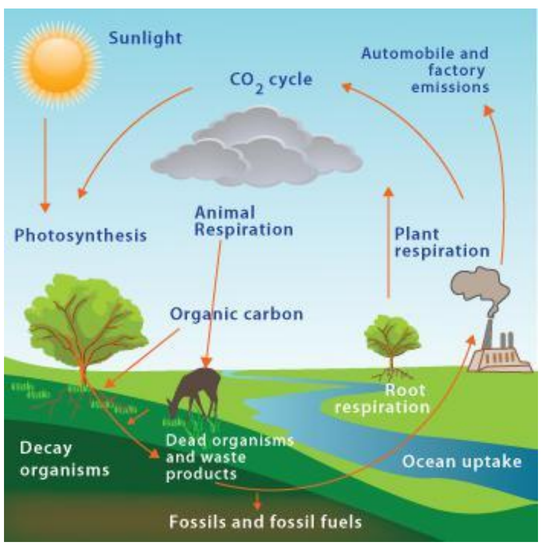
Francesco Morari

Department of Agronomy Food Natural resources Animals Environment - University of Padova, Italy

Introduction

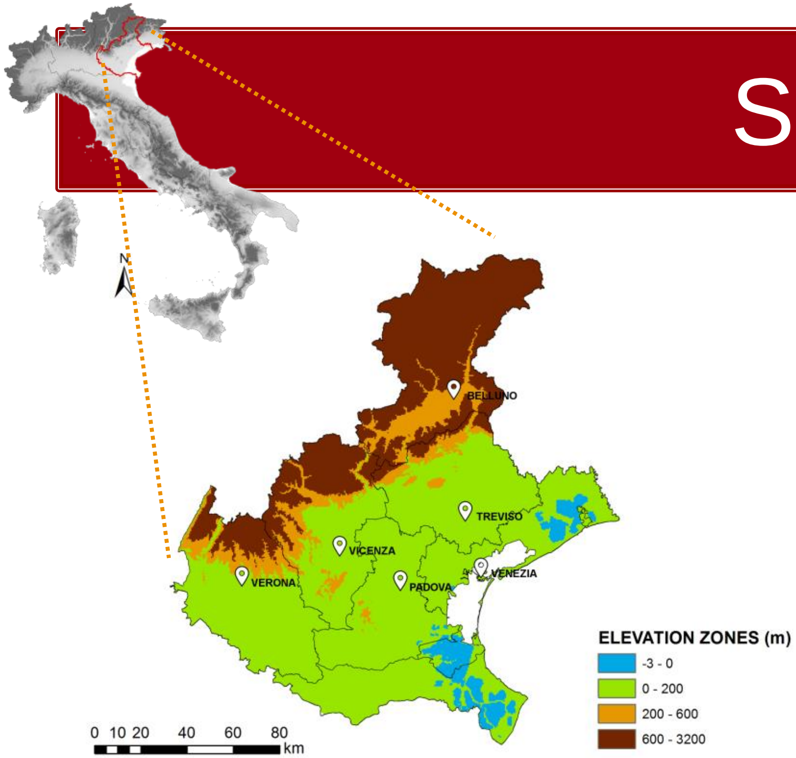






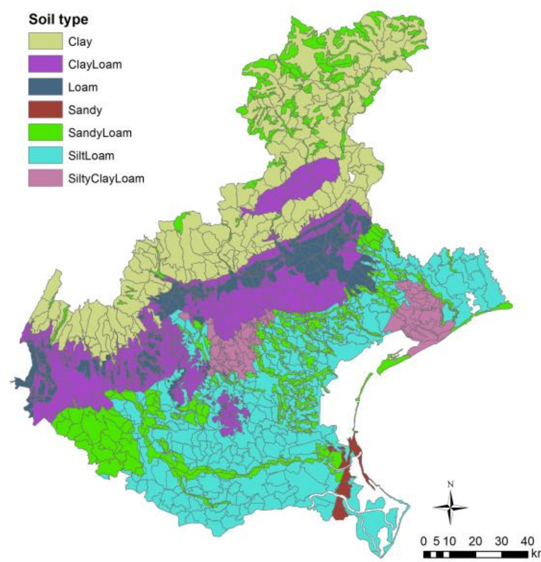
Evaluating the global impact of AEMs on biogeochemical cycles is particularly tricky

Study Site



- Veneto region: 18400 km^2 (55% alluvial plain)
- **Climate:** continental sub-humid
- **T$_{mean}$** 7-15 °C; **P** 700-1400 mm y^{-1}
  ET$_0$ 750-1100 mm y^{-1}
- Farming covers ≈ 57% of regional land, mainly in the plain area (92%)

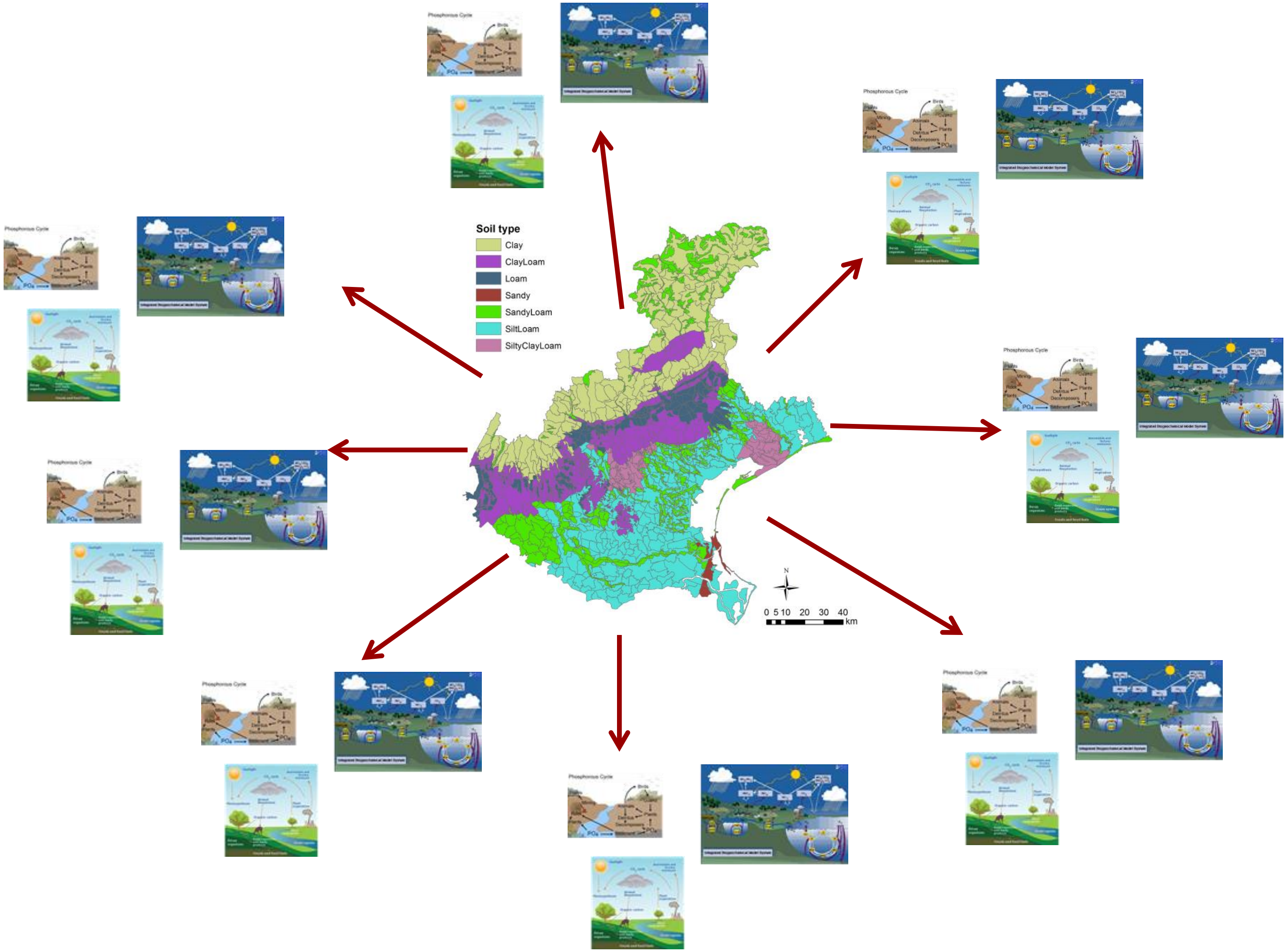
- Soils range from silty and sandy-loam in the plain to clay and clay-loam in the mountains and piedmont areas
- SOM: 1-2% in the plain, up to 4-6% in the mountain



Università degli Studi di Padova

DAFNAE
Department of Agronomy Food Natural resources Animals Environment

Study Site


Soil type
Clay
ClayLoam
Loam
Sandy
SandyLoam
SiltLoam
SiltyClayLoam
N
0 5 10 20 30 40
km

Open Questions

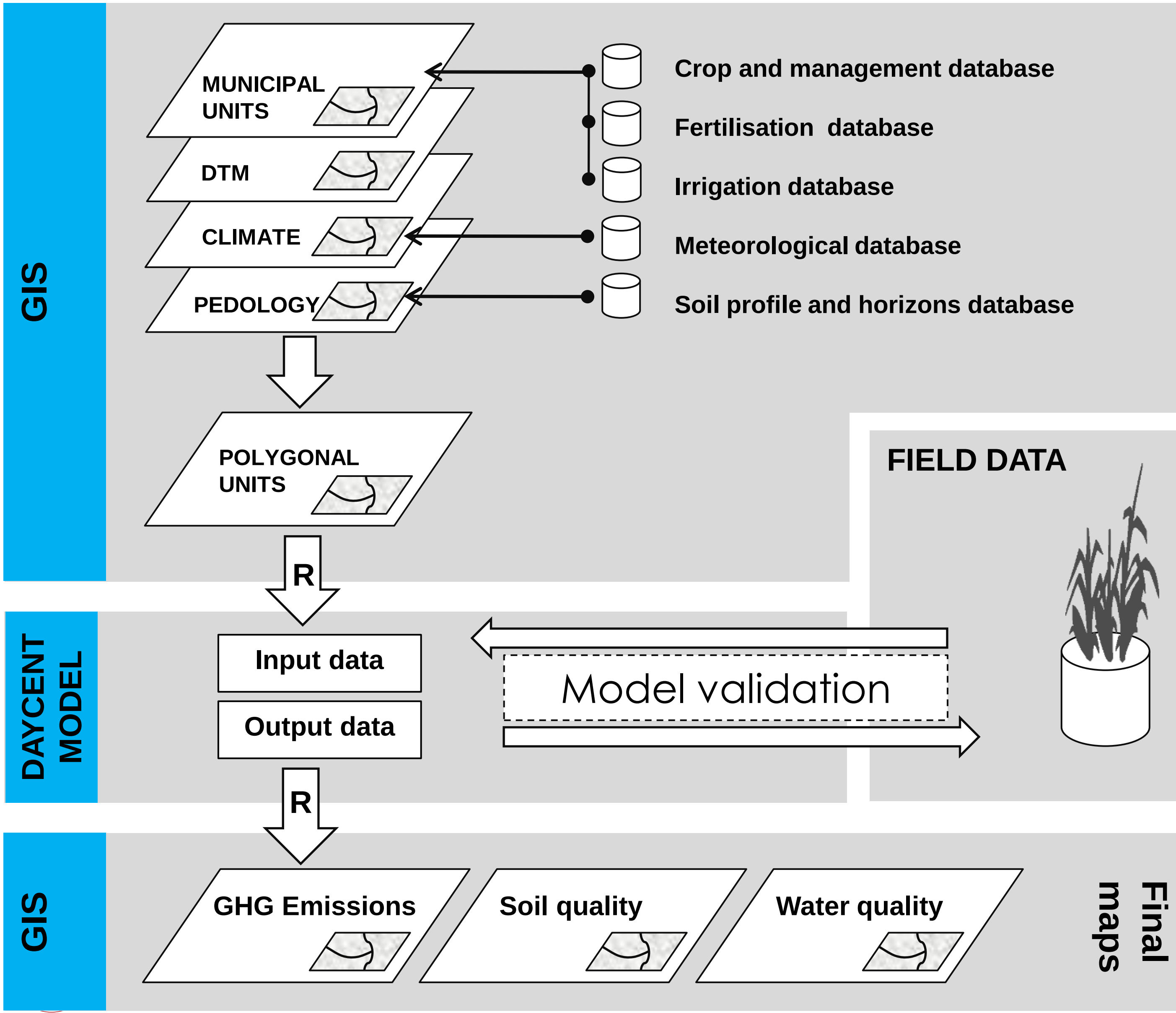
- Do the AEMs improve agro-ecosystems?
- Are AEMs effective regardless the geographical variability ?
- Is the «action-oriented» approach satisfactory in terms of ecological benefits?

AIMS

- Evaluate the overall effectiveness of AEMs to reduce N pollution across Veneto Region
- Test a model-GIS platform to approach a «spatial targeting» scheme that considers the pedo-climatic and management variability

MATERIAL AND METHODS

Methodological Approach



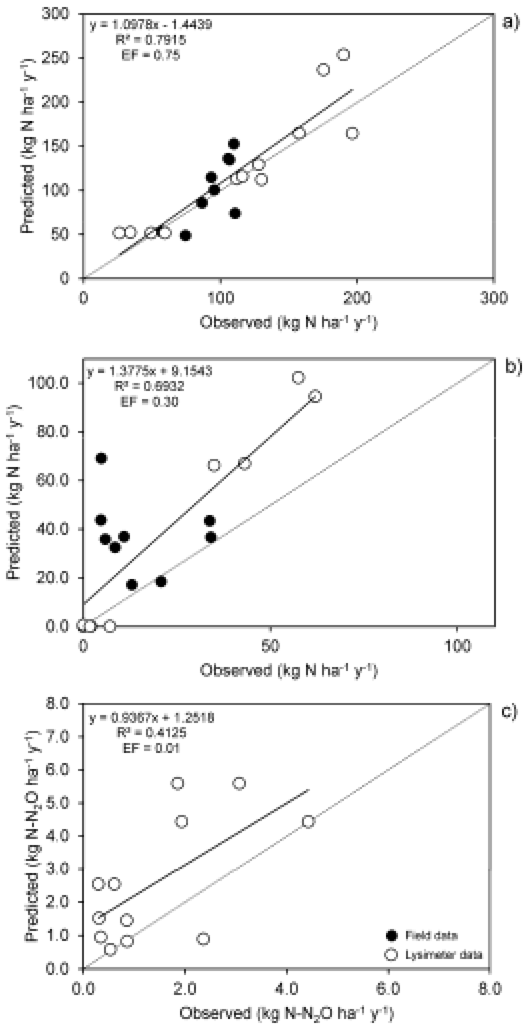
Model-GIS platform integrates management and pedo-climatic information

Totally 1341 polygonal units

DAYCENT model

C-N-P cycles

Model validation



N in crop production

N leaching

N-N_2O emission

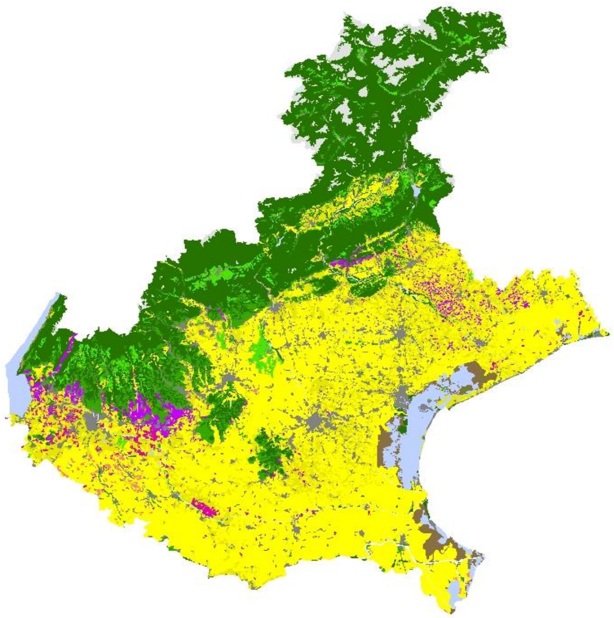
Simulated Scenarios

BASELINE scenario

- Conventional farming practices without the adoption of AEMs
- Simulated crops across Veneto covering 60% of UAA - *maize, wheat, soybean, sugar beet, sunflower, rapeseed, potato, pastures and meadows (permanent or in succession)*

CLC Veneto Region

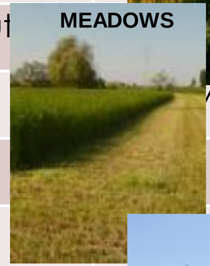
Arable land
Permanent crops
Pastures
Forests and seminatural areas
Artificial surfaces
Little / No vegetation



Simulated Scenarios

AEM scenario Based on spatial distribution data of AEMs - RDP 200

AEMs	Main management aspects	ID
Buffer strips – new	6-m wide, no fertilization	
Woodlands in arable lands – new	No fertilization, continuous soil cover	
Buffer strips – maint. (21 yrs)	6-m wide, no fertilization	
Woodlands in arable lands – maint. (21 yrs)	No fertilization, cont. soil cover	
Increase of SOM through farmyard manure input	N_{in} = 130 kg ha^{-1} y^{-1}	F
Organic farming – new	Organic instead of mineral input	O
Organic farming – maint. (21 yrs)	Organic instead of mineral input	
Pastures & permanent meadows – maint. (21 yrs)	No chemical fertilization	MEAD maint
Arable lands to permanent meadows	No fertilization	new
Conservation agriculture – new	No till, permanent soil cover, crop rotations	
Continuous soil cover – new	Cont. soil cover, green manure	C
Optimization of irrigation	Irrigation -25%	IR
Optimization of fertilization	Mineral fertilization -30%	FERT opt



AEMs Performance

- **Soil quality:** SOC stock (0-30 cm layer), soil erosion
- **Water quality:** total N leaching, P leaching, P runoff
- **GHG emissions:** CO2, CH_4, N_2O

Difference between agroecosystems adopting (Y_m) and not adopting (Y_0) the AEMs:

Δ Absolute $$\Delta Y = Y_m - Y_0$$

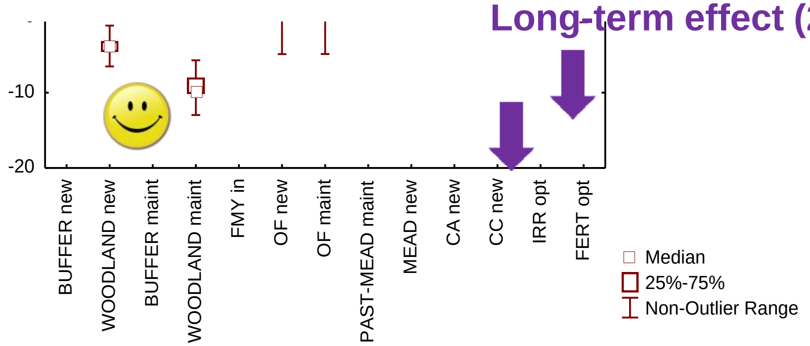
Δ Relative $$\Delta Y\% = \frac{Y_m - Y_0}{|Y_0|} \cdot 100$$

AEM effectiveness			
Agroecosystem quality	SOC stock	N leaching	N-N_2O
	(Mg ha^{-1})	(kg ha^{-1} y^{-1})	
High	>65	<10	<1
Medium	40-65	10-35	1-3
Low	< 40	>35	>3

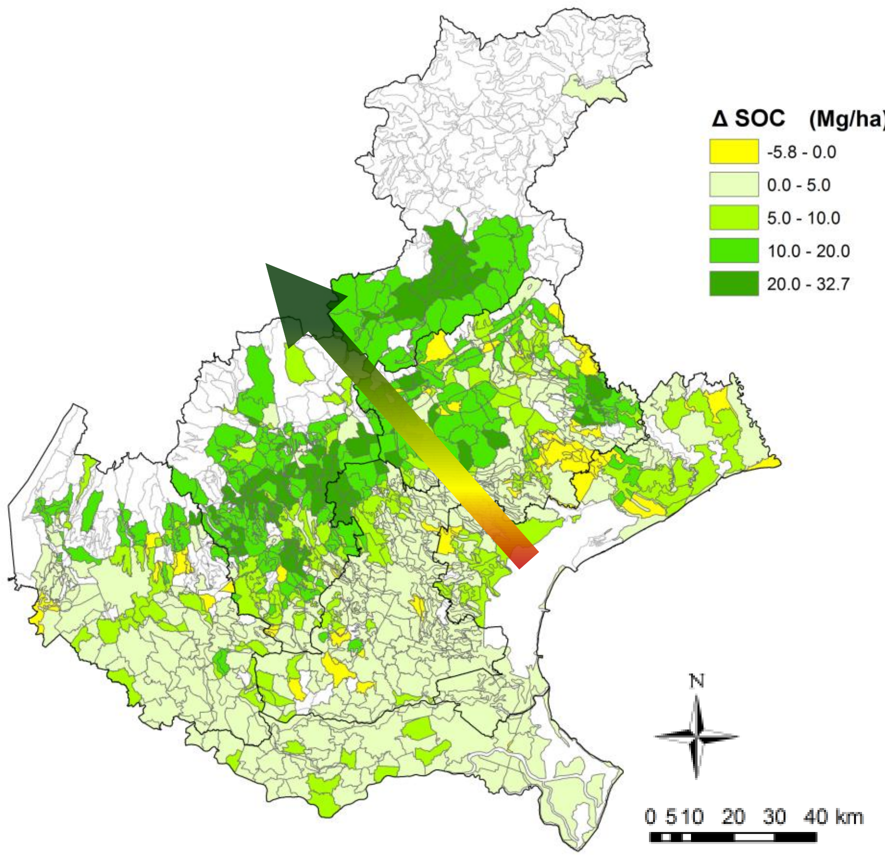
RESULTS

ΔSOC

Long-term effect (21 yrs)

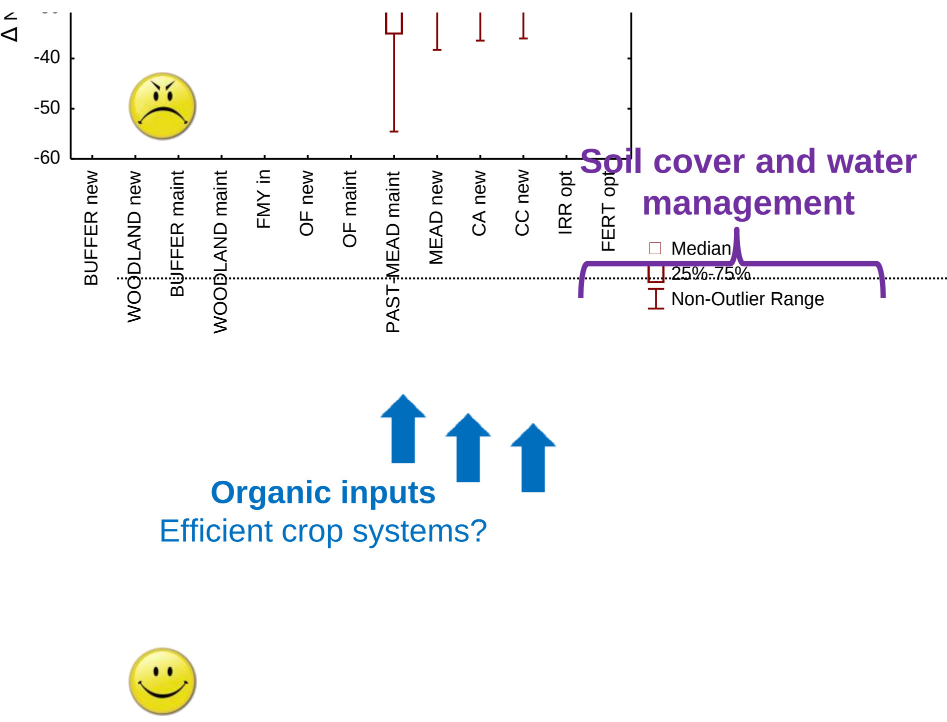


Permanent soil cover



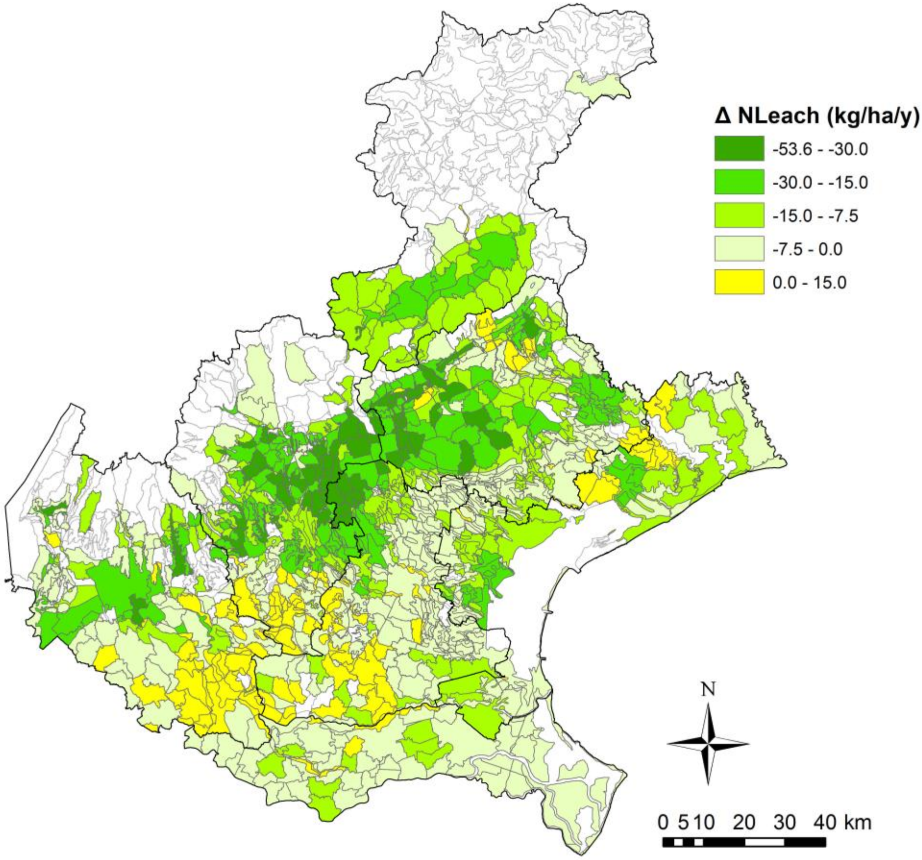
+ 15% in the low plain
+ 45-75% in the piedmont areas

ΔN LEACHING



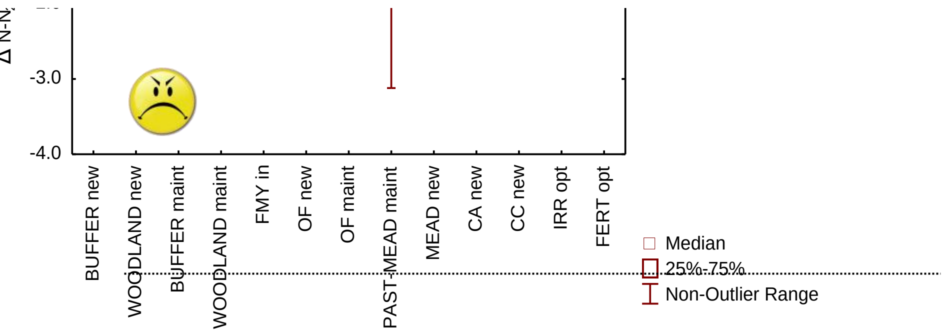
Soil cover and water management

Organic inputs
Efficient crop systems?

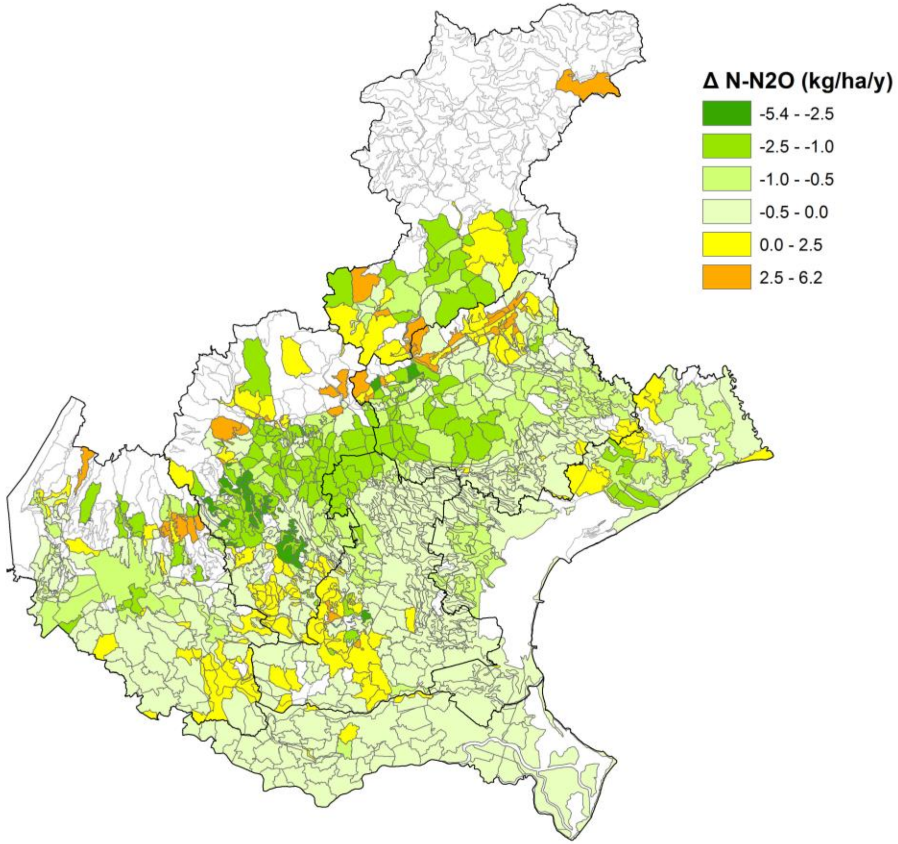


Surplus of N in sandy & silty soils + 0-80%

ΔN$_2$O EMISSIONS

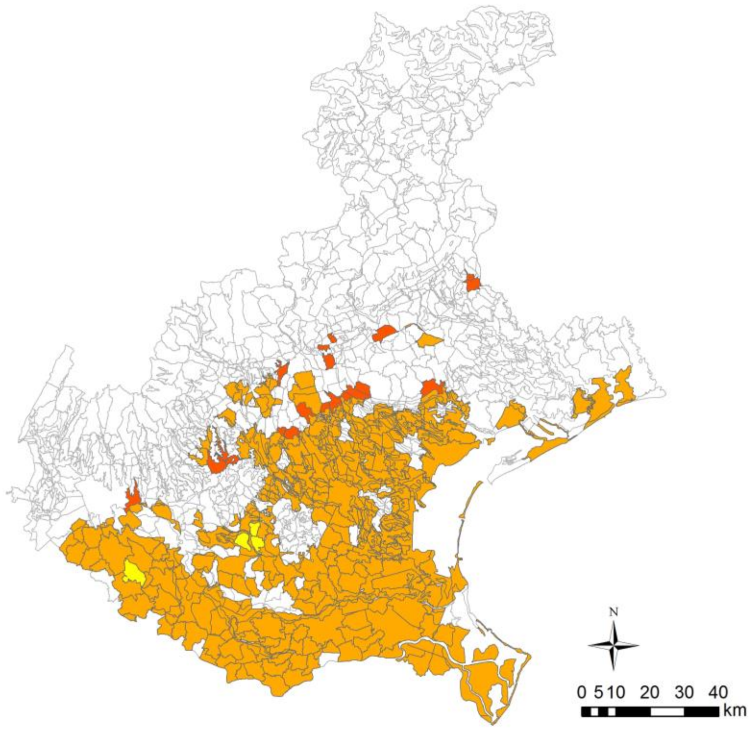


Need to enhance fertilization efficiency

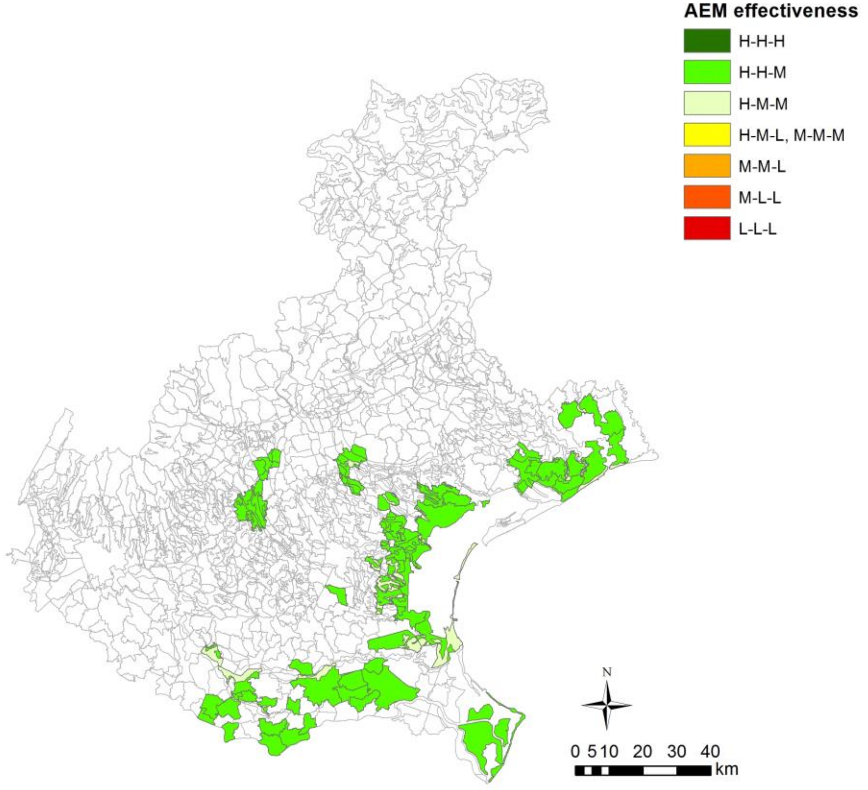


AEMs effectiveness

Reduced N mineral input

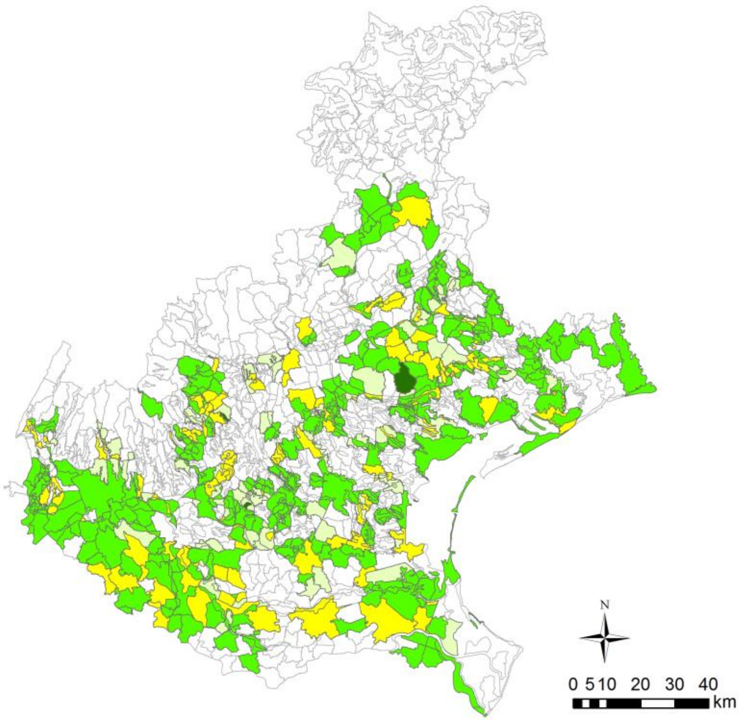


Conservation agriculture

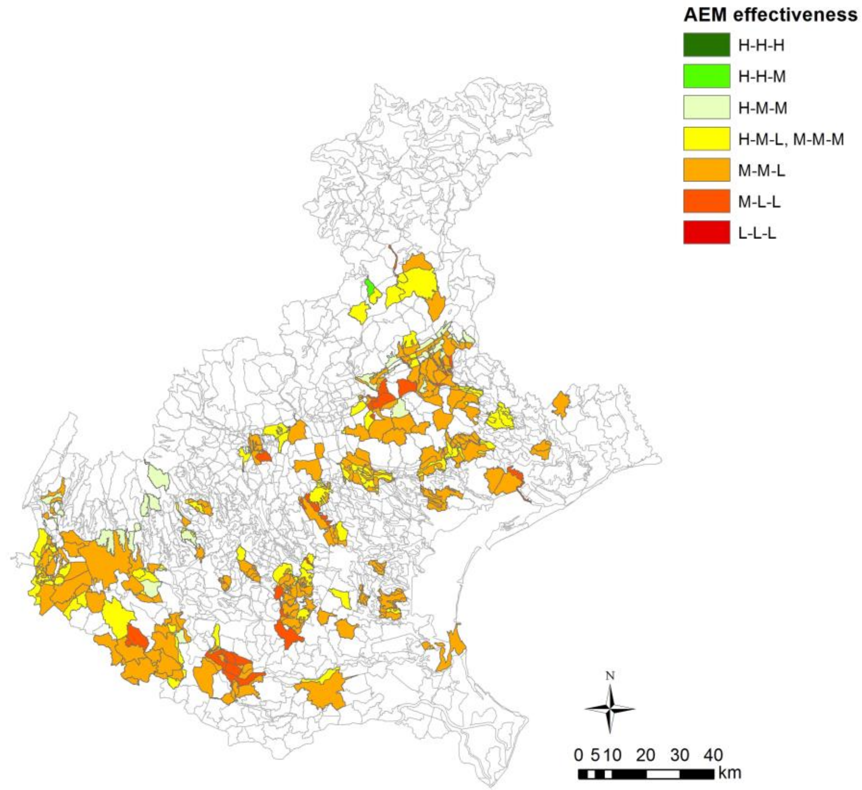


AEMs effectiveness

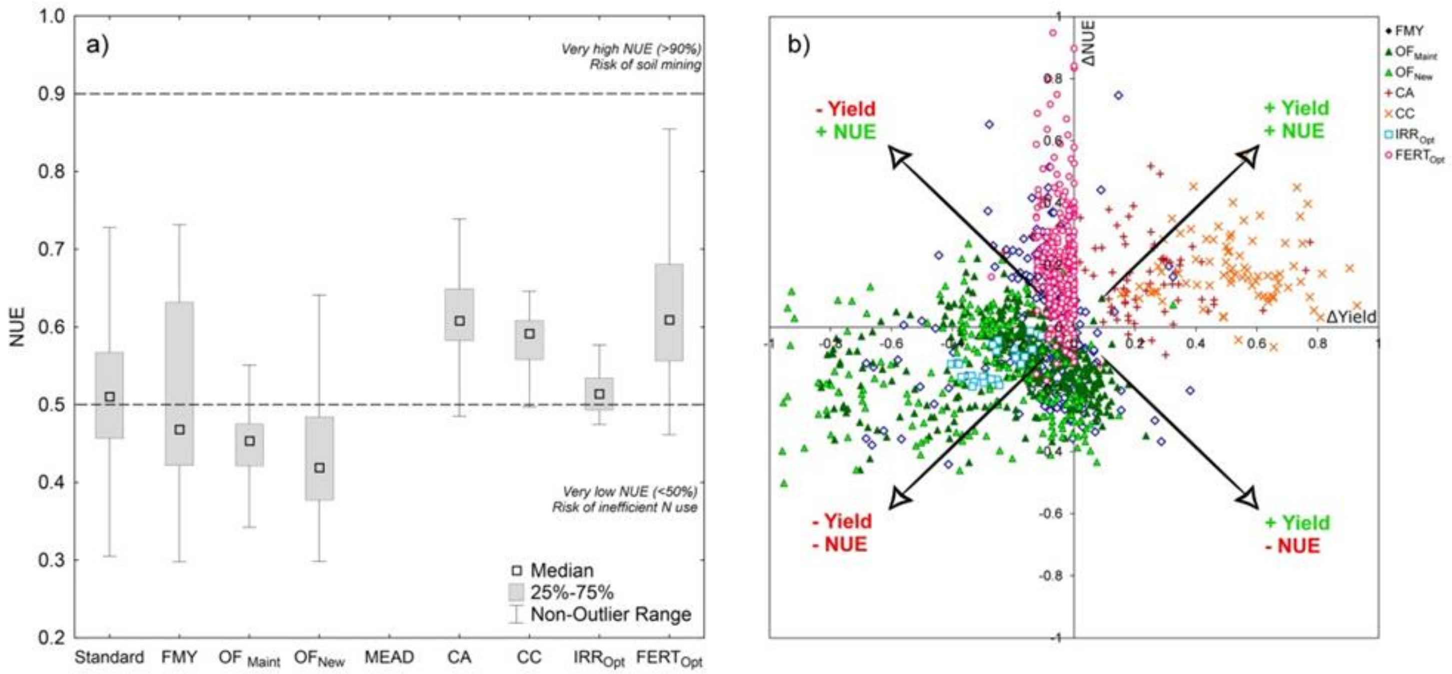
Organic farming - maintenance



Organic farming - new



AEMs effectiveness



Conclusions

- DAYCENT is a sensitive model but is not able to represent the total complexity of the agro-ecosystems (e.g. weed effect, soil compaction)
- The effectiveness of AEMs was different in a spatiotemporal perspective → address agro-environmental policies towards a spatial target (result-oriented) approach instead of a generalized support to farmers (action-oriented)
- Long-term evaluation of AEMs is sometimes required (e.g. organic farming)
- N fertilizer management (reduced mineral N, change to organic N) is sometimes inefficient unless combined with others
- Best strategies for N cycle improvement include i) permanent soil cover; ii) minimum soil disturbance

Questions?

REGIONE DEL VENETO

PROGRAMMA 2007 2013 PSR VENETO SVILUPPO RURALE

Acknowledgments:
This research was co-financed by the Rural Development Programme for the Veneto 2007-2013