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Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

Research Centre for Animal Production and Aquaculture

Direct water consumption and water scarcity footprint of beef meat in relation to available freshwater resources

International expert-workshop focused on "water use assessment of livestock production systems and supply chains" sponsored by OECD co-operative Research Programme: Biologica Resources Management for Sustainable Agricultural Systems

Leibniz Institute for Agricultural Engineering and Bioeconomy

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Cattle meat production in Italy

Culled dairy cows

Heifers or bulls from beef cattle

Veals from dairy cattle

Beef production in Italy

Import of beef calves

Domestic beef production 10 to 18 months

Domestic calf production

Fattening system

Maize silage
and
maize grain

Imported soybean meal

Charolais, Limousin, Blonde d'Aquitaine French crosses

From 10 to 18 months of age

Irrigation systems

Floating

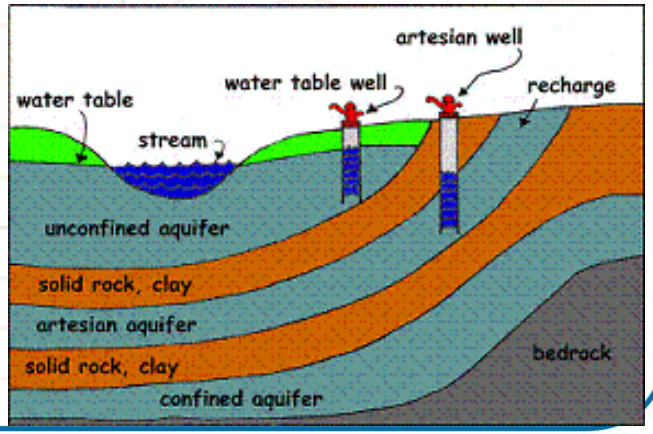
Rain

Precision

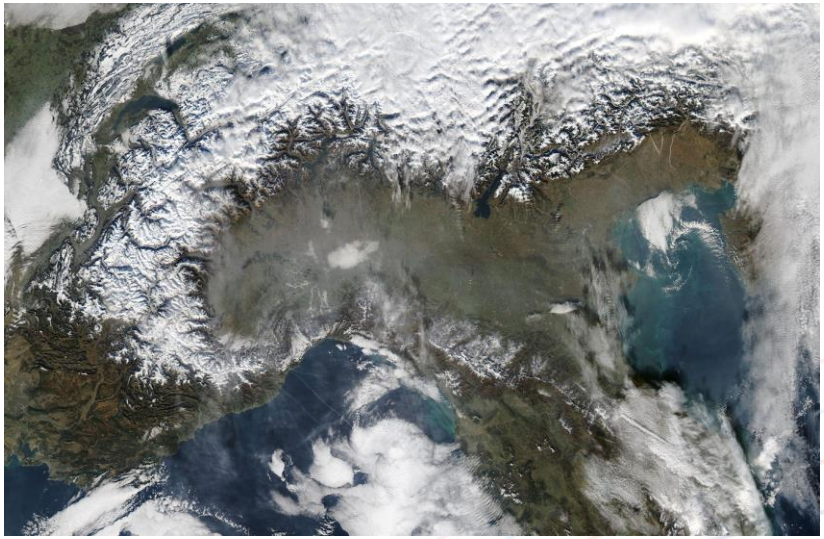
Water sources

From Alpine glaciers, lakes, rivers through channels to fields

Groundwater from aquifer



Pianura Padana or Po Valley



- Four main regions: Piemonte, Lombardia, Veneto, Emilia Romagna
- 40% of the Italian population
- Two large cities: Tourin and Milan
- Industries, services, tourism
- Agriculture: vineyards. orchards, arable lands….
- Livestock:

  cattle 64 %

  pigs 85%

  poultry 61%

Piemonte and Venetoare are the regions with most of the beef farms

WF of beef

Bragaglio et al., 2017 (IT); Dick et al., 2015, 2021 (BR)

WSF of milk

Usva et al., 2019 (FI)

Ridoutt and Hodges, 2017 (AS)

Payen et al., 2018 (NZ) with month variability

WSF of beef

Lathuillière et al., 2019 (BS)

Murphy et al. 2018 (IR) water stress footprint

Objective

Considered the competition for water resource in the Po Valley, goal of the study was:

- to quantify direct water consumption
- and to estimate the impacts on freshwater availability

Materials and methods

18 beef farms in Piemonte and Veneto

Fattening phase (10 to 18 months)

3 irrigation systems: floating, rain and precision

3 forage system: S SW SWM

FU: 1 kg of LWG

Periods: 2 years (2016 and 2018)

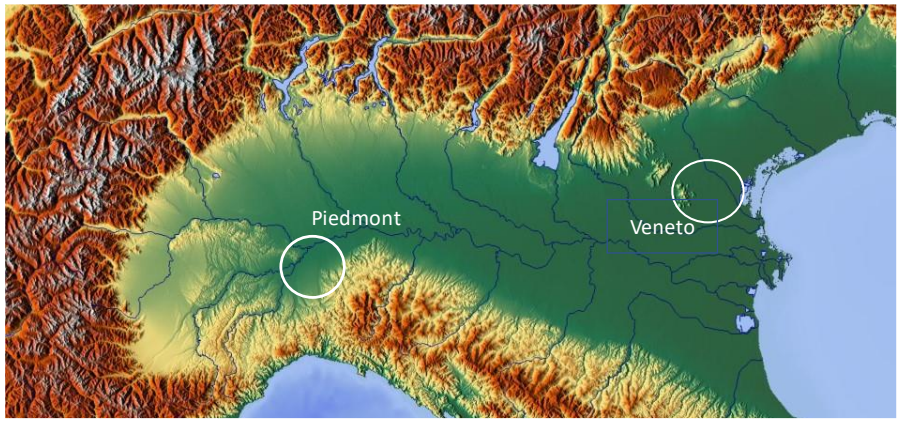
Evapotranspiration: Cropwat 8.0

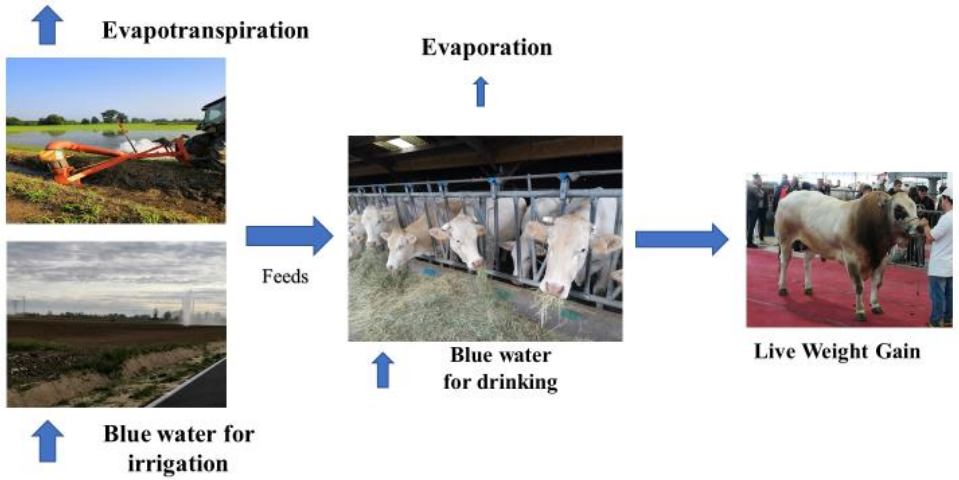
Irrigation efficiency: D'Odorico et al., 2020

System boundary: to farm gate. Not considerd: purchad animals and feeds produced out of the area and other inputs

Water scarcity footprint (WSF) ISO 14046, LEAP (FAO, 2019), for CF of Piemonte and Veneto AWARE (Boulay et al., 2018)

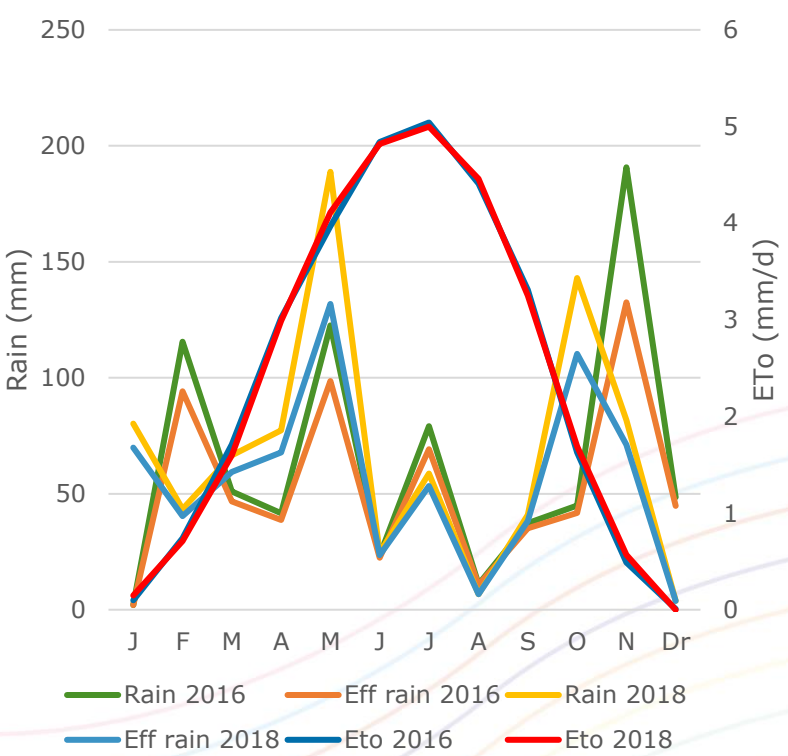
Areas of study and system boundary



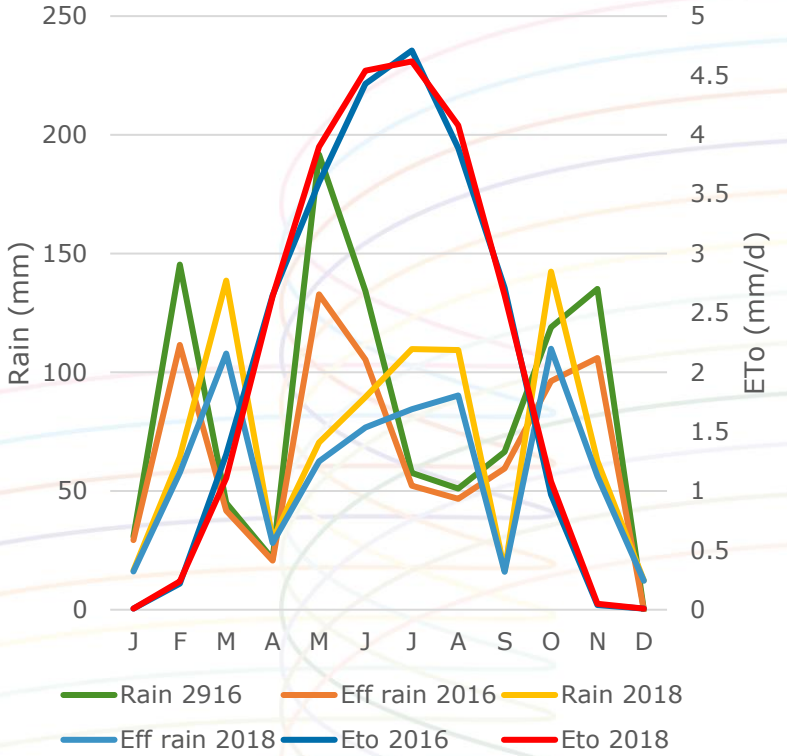


Results - evapotranspiration

Piemonte



Veneto



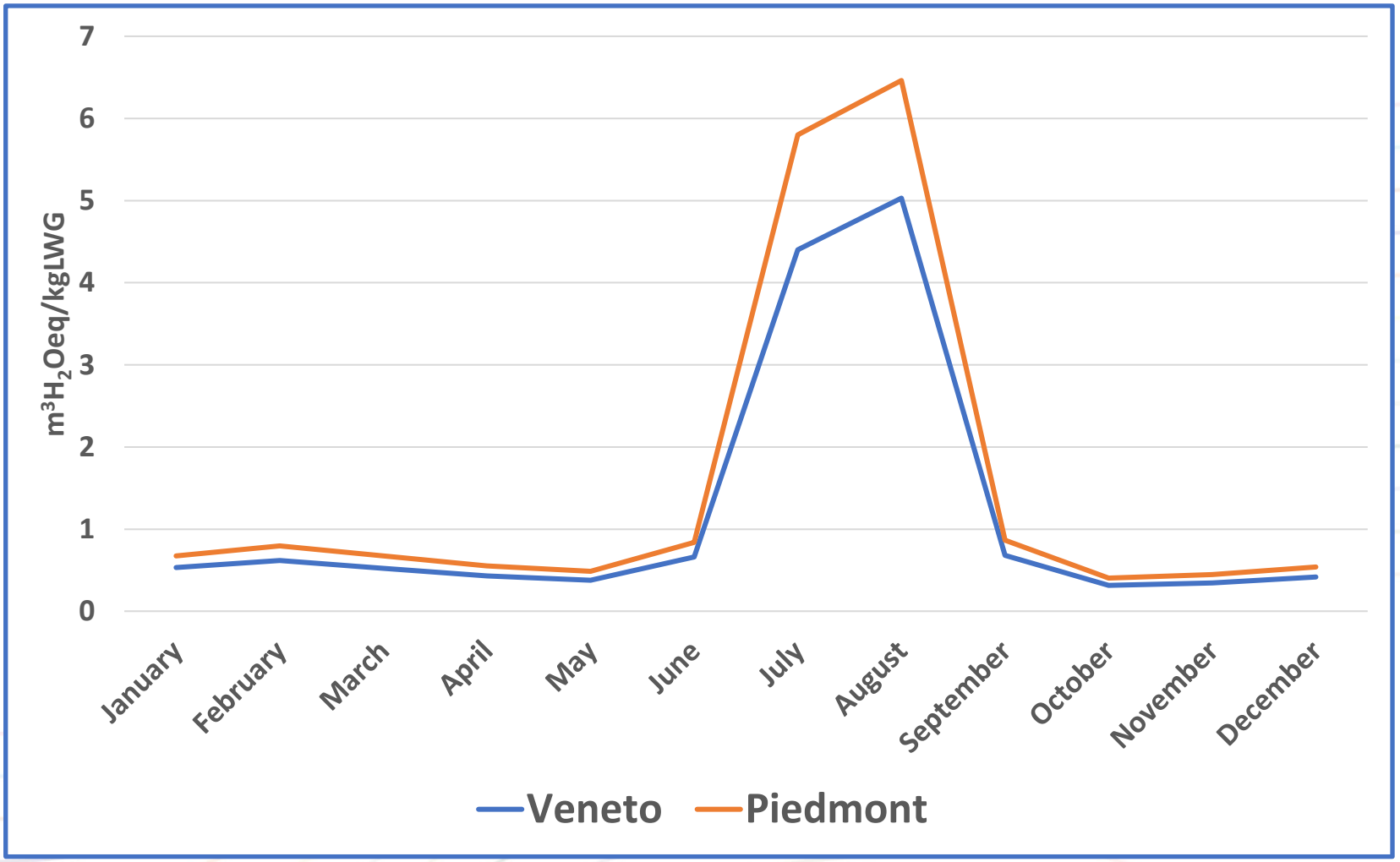
Results Direct blue water consumption

Year	n	l/kg LWG	SD	Probability
2016	18	1238	993	NS
2018	18	1063	690	
Region				
Piedmont	6	1352	973	< 0.001
Veneto	12	1048	813	
Forage system				
S	5	1240	901	<0.05
SW	9	1164	871	
SWG	4	1193	873	
Irrigation system				
Floating	7	1193	873	<0.001
Rain	7	1156	859	
Precision	4	1083	830	

WSP on yealy basis

- Piemonte CF 2.91 WSF **3.93** m^3eq/kg LWG
- Veneto CF 2.03 WSF **2.22** m^3eq/kg LWG

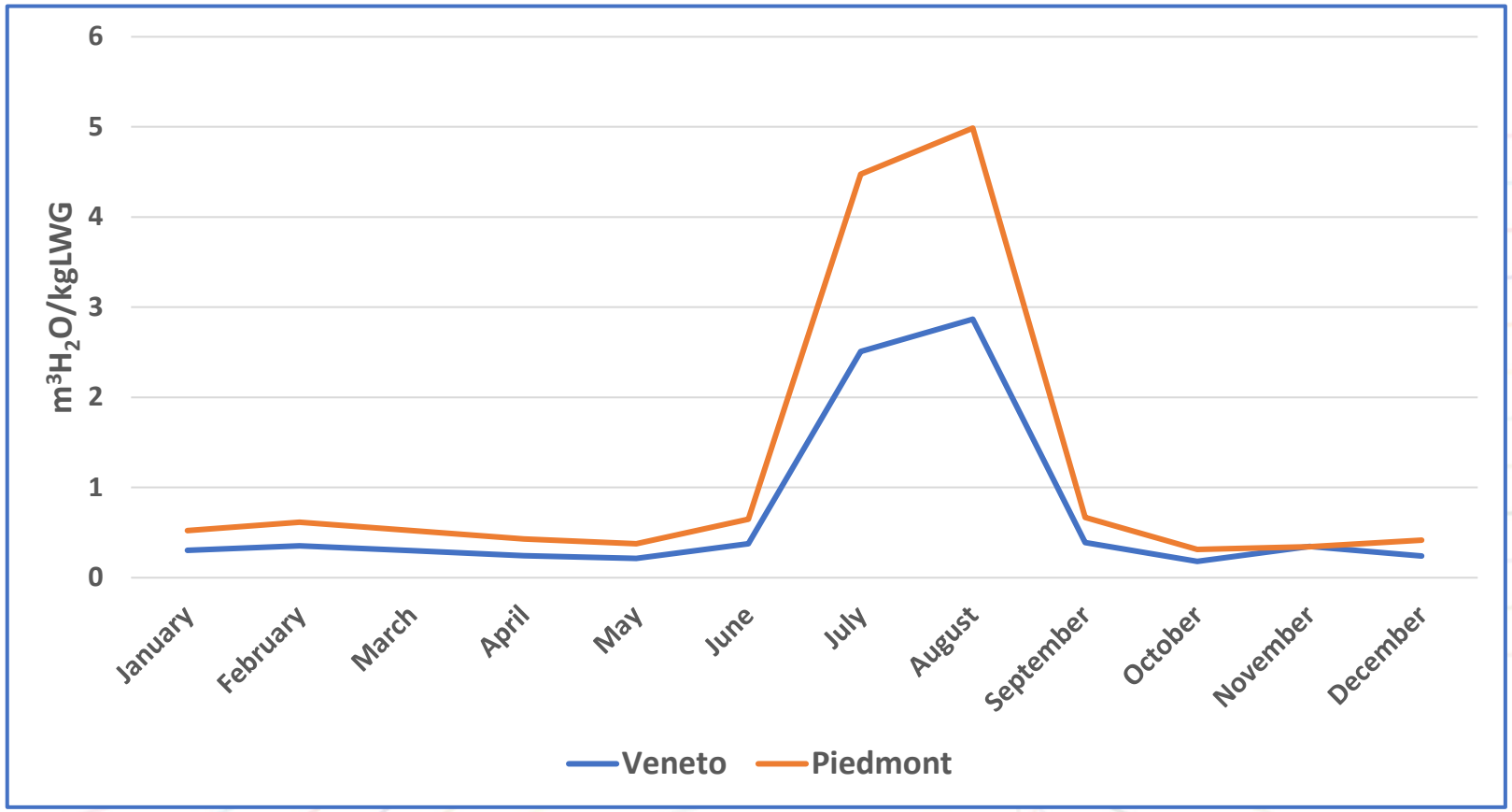
Results WSF monthly basis



Results Pfister's method – Italian and yearly basis

Region	Water Stress m^3 water	EQ m^2 yr/m^3	RD MJ/m^3
Piemonte	0.37	0.18	0.27
Veneto	0.29	0.14	0.21

If all farms adopt precision irrigation



A significant reduction of WSF, expecialy in Veneto, where floating system is more common

Conclusions

- The values of direct water consumption are much higher than those it is possible to find in the literature
- This is because the production system we analyzed is based on the large availability of freshwater in north Italy and the crops at the base of the feeding systems are very water demanding
- Significant differences were found in WSF between **areas**, albeit they are close
- **Forage systems** influences blue water consumption and, consequently, WSF
- There are many obstacles that halt adoption of more efficient **irrigation systems**
- However, adoption of **more efficient crops and irrigation systems** are required to make a sustainable use of water resources in the Po Valley
- A systematic recognition of water availability and consumption at basin or regional level is necessary to follow the **societal and climatic trends**

Laudato si’, mi’ Signore, per sor’acqua, quale è molto utile et humile et pretiosa et casta

Praise be you, my Lord, through sister water, which is very useful and humble and precious and chaste

From «Cantico delle creature»

By San Francesco

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Thank for your attention

Questions are welcome

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