



# italian testimony on livestock agroforestry systems

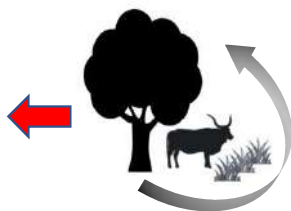
*Tenuta di Paganico Soc. Agr. SpA*



CDG ON ANIMAL PRODUCTION - BEEF SECTOR - 31 march 2023







EU level

regional territory

local district



concept, design and making of prototypes



Regione Toscana





↓ 2 a 8°C temperature

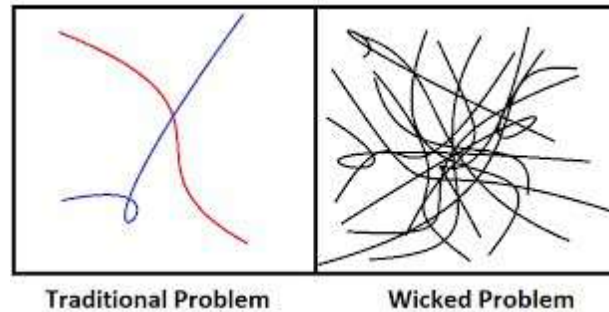
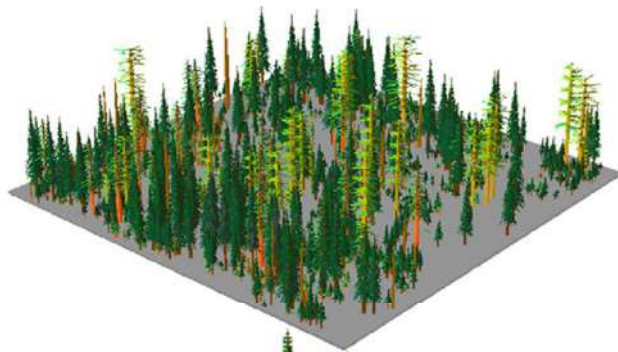
↓ 26% e ↓ 61% wind speed

↓ 80% solar radiation

↓ 30% radiant thermal load



(Contosta et al., 2022; Mele et al., 2019; Karvatte et al., 2015)



## Integrated crop-livestock-forest systems promoted beneficial microclimate changes to grazing animals

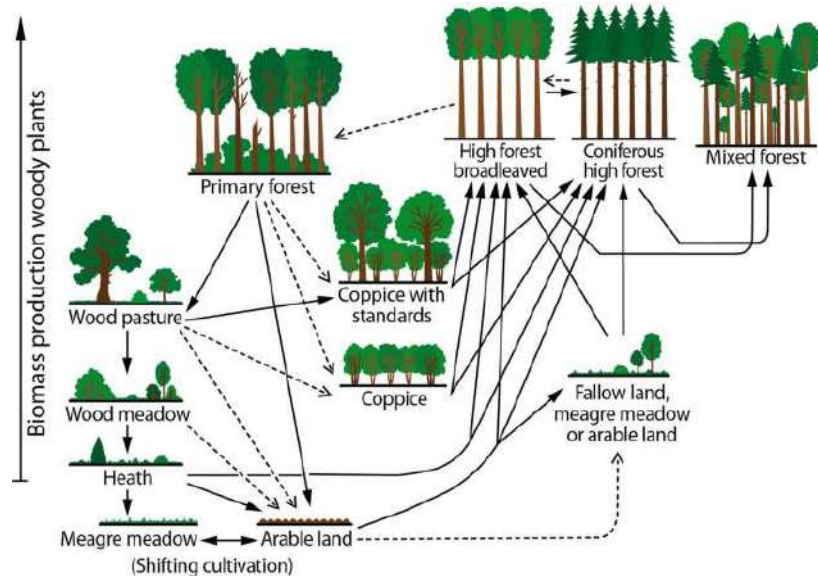
The highest spacing between trees (lower density):

- better circulation of winds,
- reduction in air temperature,
- lower black globe temperature,
- increase in relative humidity in the shade,
- better animal welfare.

It is observed that with the presence of trees in pastures, there were possible:

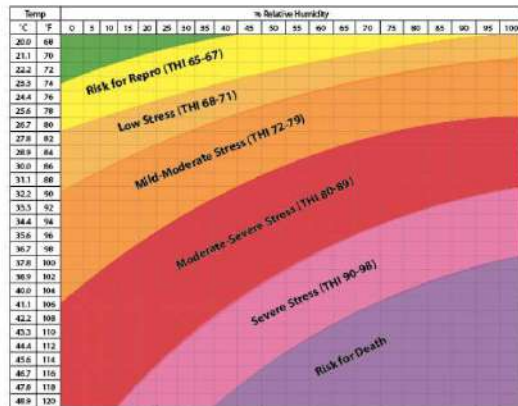
- reductions in Temperature and Humidity Index,
- decreases in the Black Globe Temperature,
- reductions of the Radiant Thermal Load in the shade in relation to areas of full sun.

(Mele et al., 2019; Karvatte et al., 2015; Rambo and North, 2009)





# Black Globe-Humidity Index (BGHI)



+

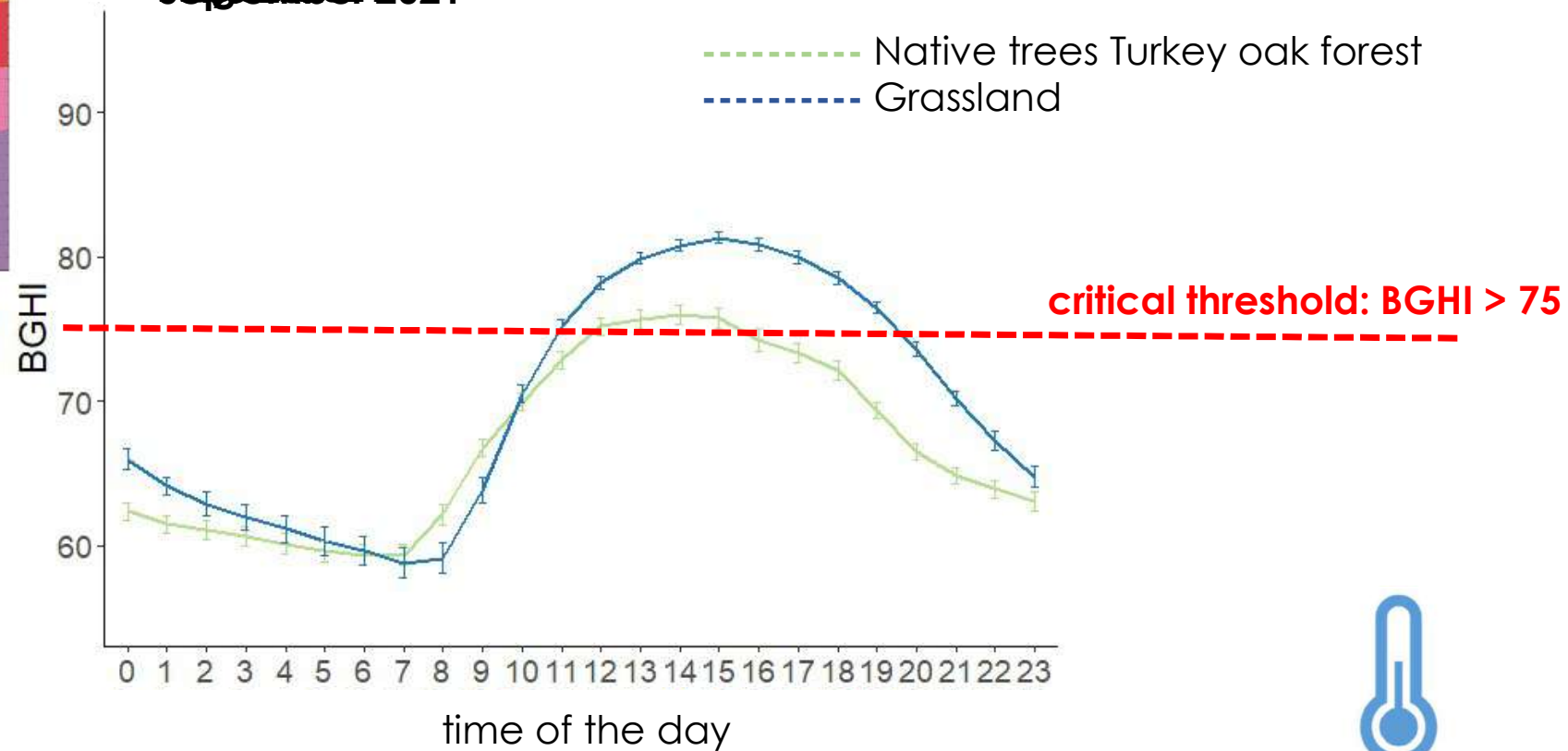
dry-bulb temperature  
&  
net radiation

+



air movement

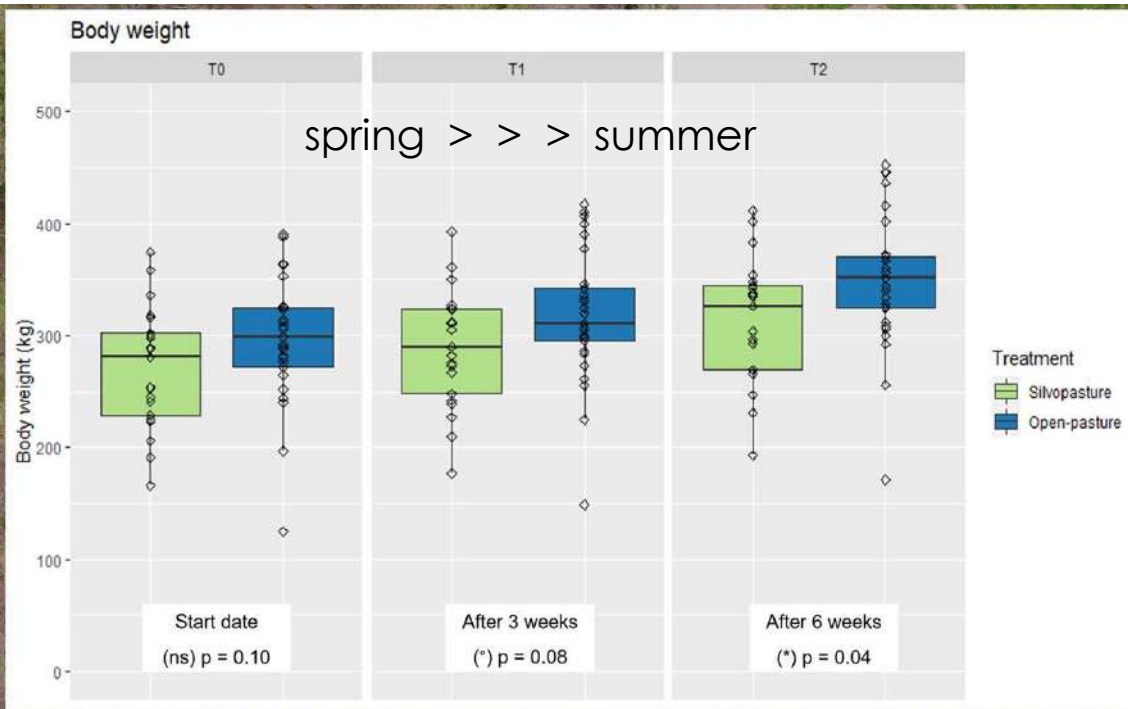
September 2021



critical threshold: BGHI > 75



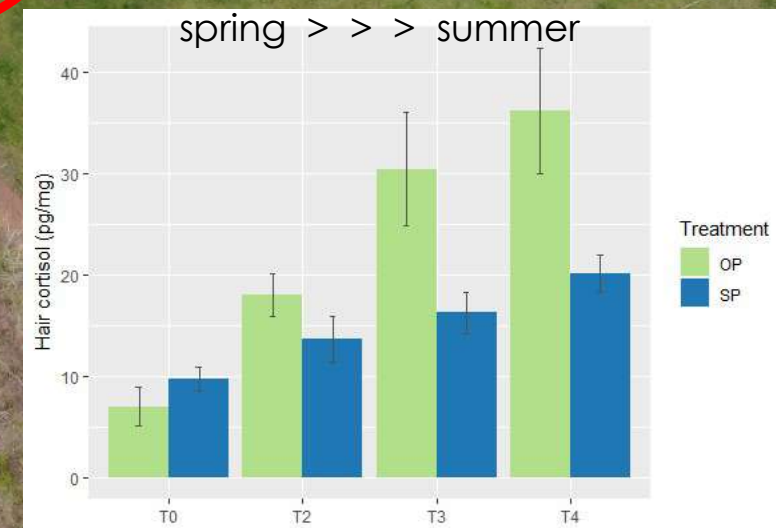
(Ripamonti et al., 2023; Ripamonti et al., 2022)



- forest helps to << animal stress (summer)
- forest helps to << pasture depletion preserving forage resources
- rotational grazing helps to >> cattle productivity

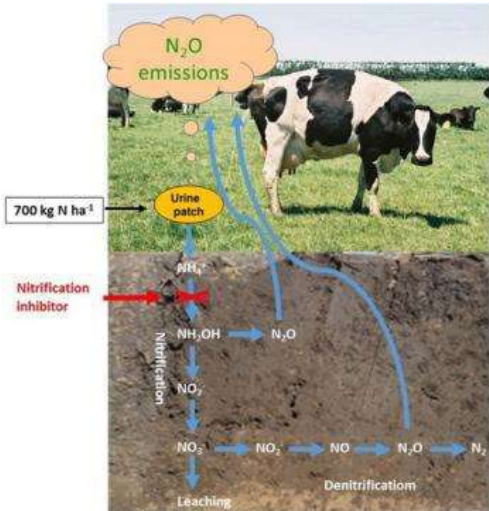


(Ripamonti et al., 2022)





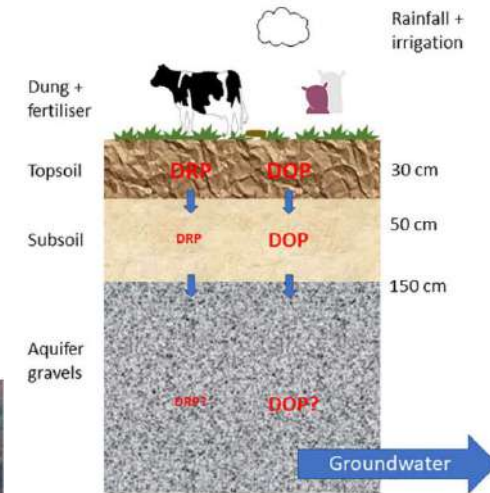
# silvopasture & nutrient loading of surface water



agricultural systems >> concentrations nitrate & phosphorus (soil, ground/surface water)

husbandry + fertilizers

leaching = accumulation in soil profile than period of high drainage



P concentrations were in the order: pasture > silvopasture on plantation > silvopasture on «native» forest  
N concentrations were >> in the surface horizon of the treeless pasture

differential rooting zones of the trees and forage crops = absorb more nutrients in silvopastures than in the treeless system  
silvopasture >> treeless pasture in reducing nutrient loss from soil to the surface water

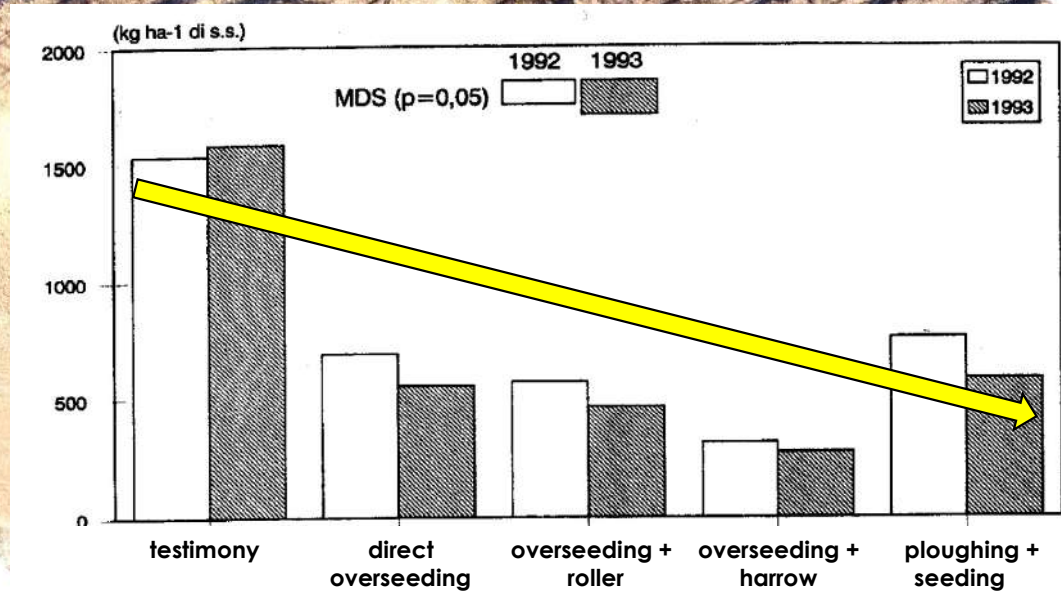
(McDowell et al., 2021; Di and Cameron, 2017; Nair and Kalmbacher, 2004)



## subterranean clover & grazing



(Pardini et al., 1995)



### subterranean clover

evolution of the covering, of the % and of the quantity of biomass produced and consumed; the soil losses; the presence and structure of inflammable biomass in summer



## subterranean clover & grazing

- reduced the inflammable biomass in comparison with the natural canopy;
- overseeding with no ploughing has given the best control and, during summer, has shown a very low and very compact grazed canopy, requesting a longer time for effective burning.

>> presence of subterranean clover in compact dry material in lower layers of plant cover >> fire resistance

>> presence of standing grass weeds in the canopy has resulted in a higher, less compact and more dry surface, increasing fire vulnerability >> more air circulation, with

Fire time for no overseeding and ploughing & seed: 2 min; for overseeding & mow: 57 min (with two re-ignitions).

Plant Type	Fire Time (min)
Legume alone	38
Mixed Species	57
Grass alone	38





## grazing & browsing in ruminant feeding = qualifying factor for nutritional characteristics of milk and meat

↑  
Lipids with bioactive action  
Conjugated linoleic acid  
Vaccenic acid  
Omega-3  
Omega 6/Omega 3 ratio  
Vitamin A  
Vitamin E

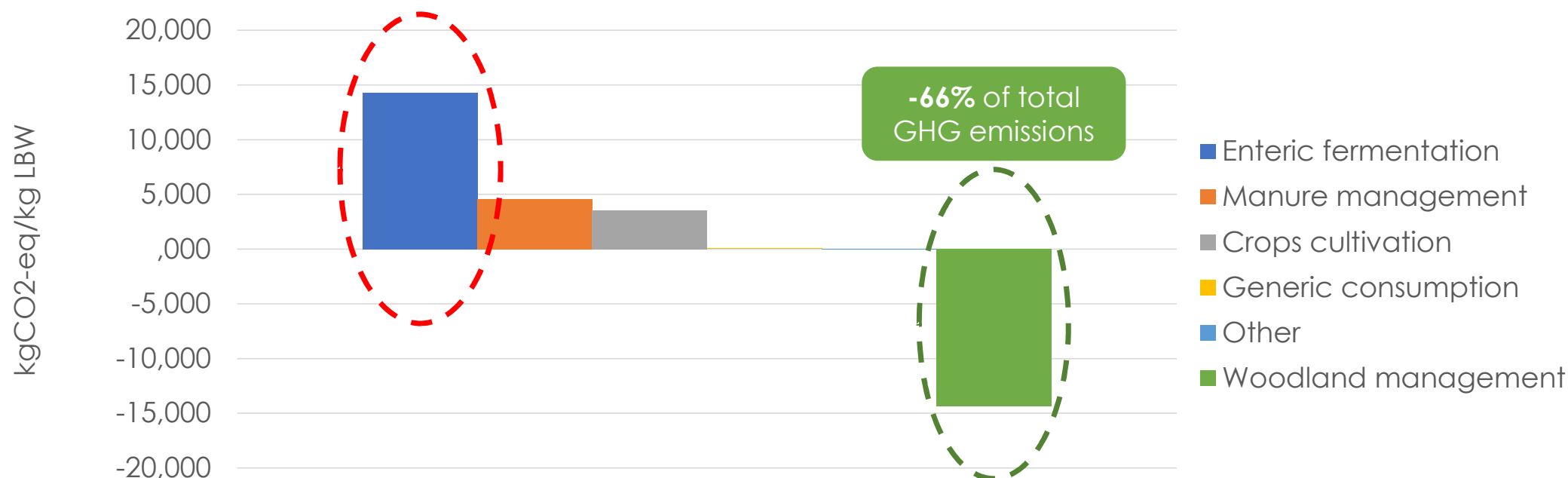


↓  
Lipids with negative repercussions  
Saturated fatty acids  
Trans fatty acids

Maremma cattle breed			
	Parameters	Pasture-based	Feedlot
Slaughter traits	Carcass weight (kg)	301	300
	Resa (%)	59	60
	SEUROP carcass grading	R-/2.2	R-/2.6
Meat quality	Lipids	2.8	3.2
	Protein	21.2	21.1
	Ashes	4.1	3.8
	Moisture	72.0	71.4
Intramuscular lipid composition	SFA	36.2	33.5
	MUFA	36.6	41.7
	PUFA	5.5	5.5
	n-6	4.1	4.9
	n-3	1.0	0.4
	n-6/n-3	3.9	12.4

(Mele, personal communication; Ciucci, 2013)

## GWP of beef cattle - semi-extensive agrosilvopastoral system (kg CO<sub>2</sub>-eq/kg LBW sold)



Without the mitigation effect of the C sink of woodlands **grazed** by cattle, the **GWP would be 22.44 kg CO<sub>2</sub>eq per kg of LBW sold**

The largest contributor to GWP was **enteric fermentation** (14.27 kg of CO<sub>2</sub>-eq/ kg LBW sold) followed by **manure management** (4.56 kg of CO<sub>2</sub>-eq/ kg LBW sold), and crops cultivation (3.54 kg of CO<sub>2</sub>-eq/ kg LW sold)

The **global warming potential** (GWP) of organic Maremmana beef was estimated at **8.05 kg CO<sub>2</sub>eq per kg of LBW sold**

**C sequestration by grazed woodland has the potential to mitigate a large portion of the overall GHGs emitted by cattle rearing in the studied system**

(Tranchina et al., 2020)