

Producing food for humans – from animals or crops?

Tackling competition for freshwater use between crop and animal production

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Challenge

- The demand for livestock products is expected to double by 2050 resulting from population growth, urbanization and rising incomes (1,2)
- The major part of the increase will take place in developing countries (3)
- About one third of global water evaporated over agricultural lands can be attributed to livestock (4)

A new approach to water assessments for livestock

The aim of this study, is to develop a new approach to livestock water use that determines the environmental impact associated with resource outtake, while accounting for the competition for freshwater use between production of food and feed crops. The conceptual approach is illustrated in figure 1.

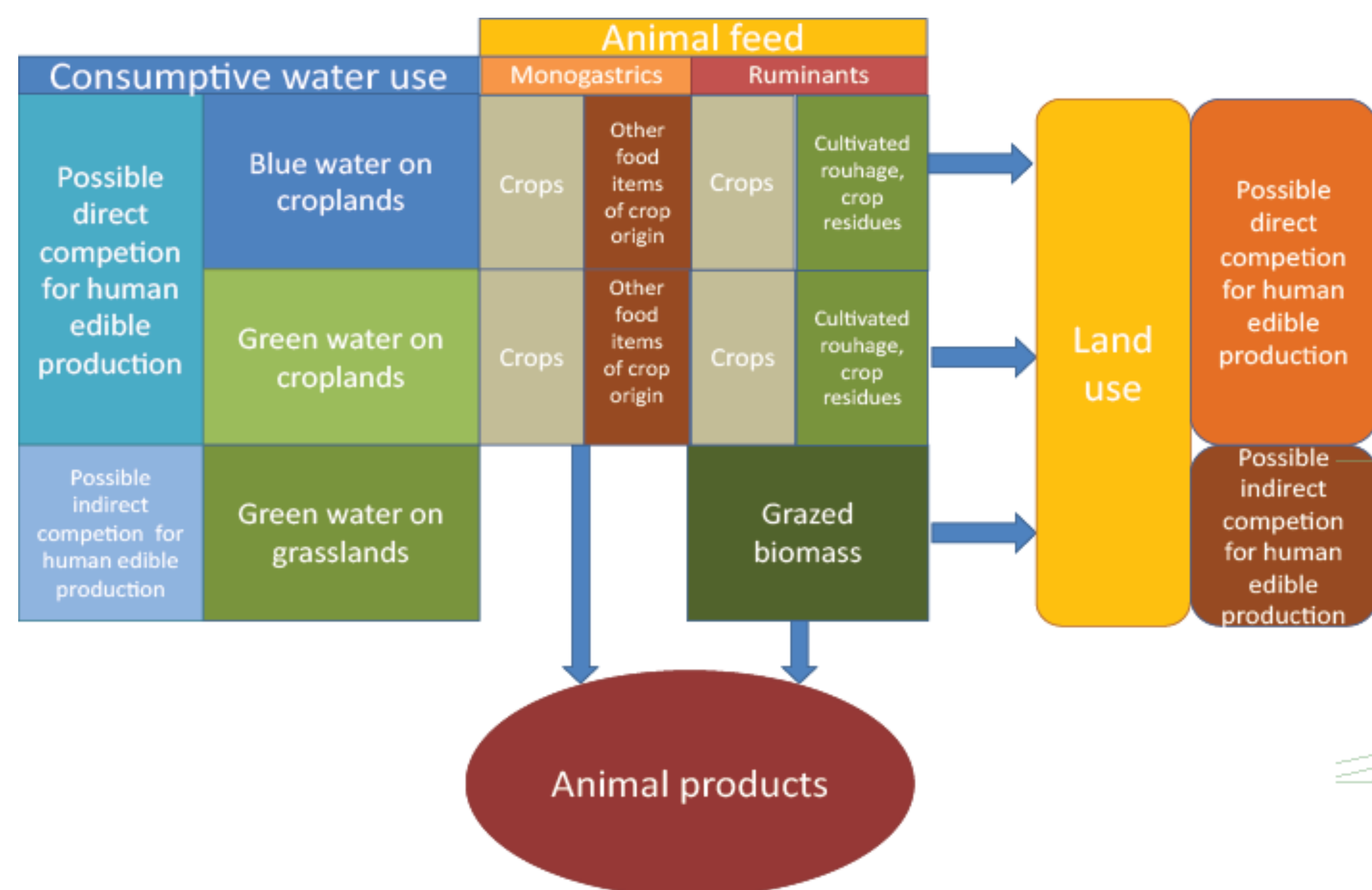


Figure 1: The conceptual approach to categorize water use in livestock production, considering feed and water differences by monogastric and ruminant animals and possible trade-offs between feed and food crops adapted from Lannerstad and De Boer et al (4, 5)

Response

Five Uruguayan beef production systems were studied for estimation of consumptive water use and potentiality of land and water resources to contribute to human digestible protein, HDP.

HDP is produced either by livestock production directly, or cultivation of suitable food crops for human consumption directly. The water resources consumed for each system was then compared to the ratio of potential to contribute to HDP from food or livestock production on the current spatial occupation of that livestock system (6).

Consumptive water use, CWU, for different feed crops in the Uruguayan cattle meat production was computed with the global dynamic model LPJmL (4),

Evidence

Results from this study, illustrated in figure 2, show that:

- Extensive beef requires the most water per kg of beef
- The more intensive systems relying on seeded pasture, rather than natural, and finishing on feedlot require less water than the natural pasture system
- All systems depend almost entirely on green water, only 1,5 percent of total CWU originates as blue water
- The green water on croplands is a substantial part of the feedlot systems finishing on seeded and natural pasture; 31 and 48 percent respectively
- The two more intensive systems would contribute more to HDP by cultivation of crops for human consumption instead of feed crops for beef cattle

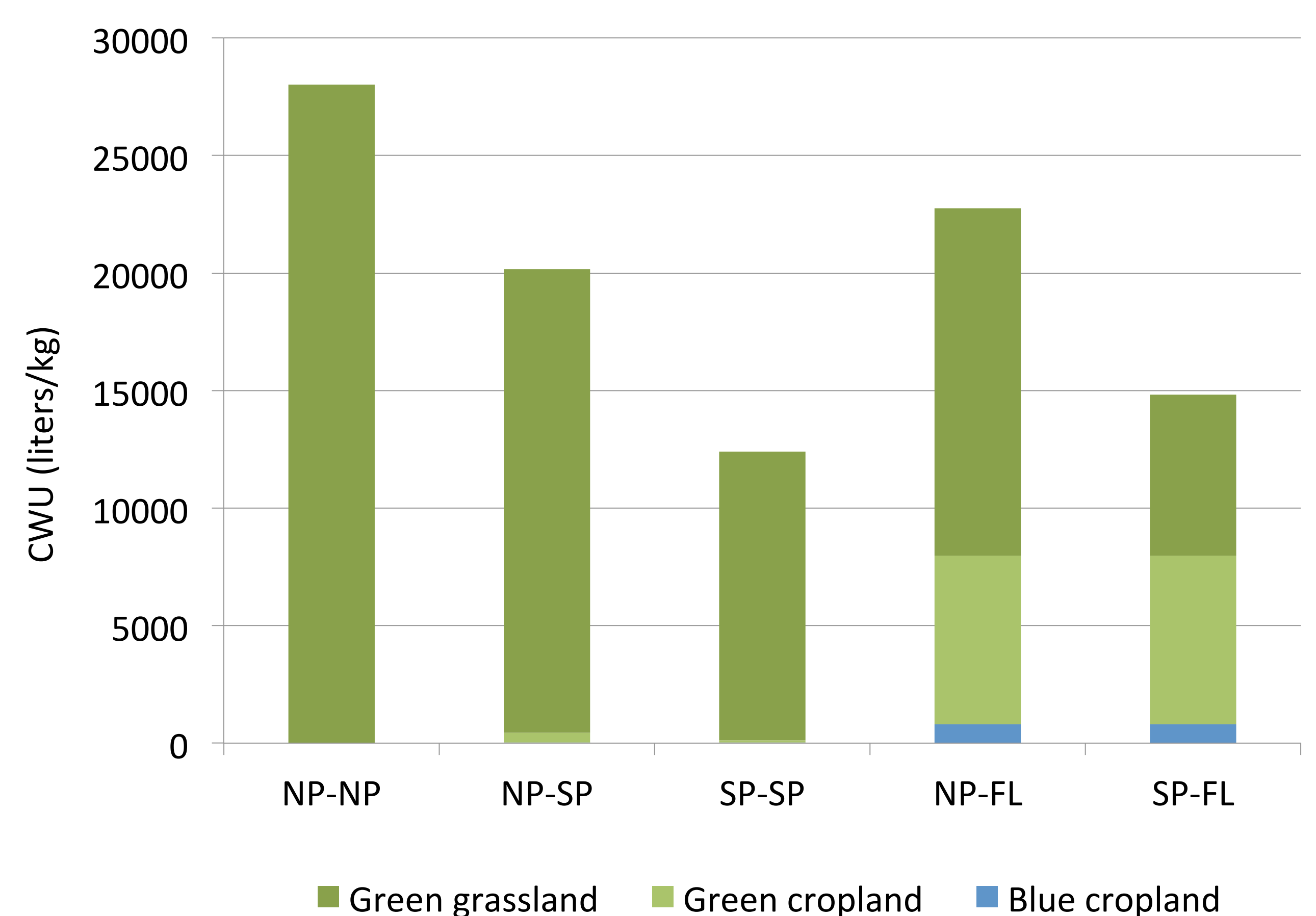


Figure 2 CWU for five different beef production systems fed on natural pasture (NP), seeded pasture (SP), and feedlot (FL) in Uruguay. Water resources are categorized in blue and green water over crop and grasslands.

Conclusions

The methodology developed here goes beyond assessment of livestock CWU and aims at capturing local impacts of freshwater use in the landscape and competition over resources. This highlights the importance of considering water resources from a perspective of competition and potentiality, rather than as a quantitative value.

Literature cited:

1. IAASTD (2008) Agriculture at a crossroads: Global report, International assessment of agricultural knowledge, science and technology for development (IAASTD). Island Press, Washington, D.C., US.
2. Delgado, C., Rosegrant, M., Steinfeld, H., Ehui, S., Courbois, C., (1999) Livestock to 2020. The next revolution. Food, agriculture, and the environment discussion paper 28. IFPRI, Washington, USA, p. 74
3. Alexandratos, N., (2009) World food and agriculture to 2030/50: Highlights and views from mid-2009. FAO, Rome, Italy, p. 32.
4. Heinke, J., Lannerstad, M., Hoff, H., Muller, C., Herrero, M., Havlik, P., Gerden, D., Notenbaert, A., Ran, Y., Peden, D., Rockstrom, J. (Manuscript) Livestock and water: A blue, green and green continuum. Manuscript
5. De Boer, I.J.M.M., H., van Middelaar, C.E., van Zanten, H.H.E., Klootwijk, C.W., (2014) Measuring land use efficiency by livestock to produce human food: past, present and future, in: Animal Production Systems group, W.U.



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