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Editorial: Animal-environment interactions

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Editorial on the Research Topic
Animal-environment interactions

Animal-environment interaction is a very complex topic with ancient origins. This multifaceted relationship, across a great diversity of natural environments and animal species, has helped develop a variable picture of livestock systems (Casasús et al., 2012). Animals interact with the environment in which they are integrated by establishing reciprocal relationships. Environmental conditions, such as climate, nutrition, structures, management, and relationships with conspecifics and humans, affect the characteristics, health, and productivity of animals (Rust, 2019; Cheng et al., 2022). In turn, animals influence aspects and quality of the environment such as water, air, and soil (Opio et al., 2011; Grossi et al., 2019). Over the past three decades, the processes and effects of this interaction changed as animals, the environment, technology, and consumer demands evolved. Therefore, it is essential to understand how to design and manage farming systems to make them increasingly suitable to respond to the needs of a rapidly expanding world population (Nardone et al., 2010; Opio et al., 2011) and to the climate changes that already affect many areas of our planet (Weiskopf et al., 2020; Bednar-Friedl et al., 2022; Trisos et al., 2022), while simultaneously ensuring an adequate balance among animal welfare, animal production, and the impact livestock systems have on the environment.

The articles accepted for this Research Topic concern three species: cattle, mainly dairy cows, pigs, and poultry. The authors represent seven countries from four continents: Africa, Australia, Europe, and North America. The scientific contributions propose approaches, problems, and investigative tools related to issues in animal-environment interactions, focusing on the effects of climate change, especially the effect of global warming on animals, on the environmental impact of farms, and on animal welfare.

The article by Maggiolino et al. shows that heat waves (HWs) of different durations adversely affect productive traits in Italian Brown Swiss cows. HWs negatively affect fat-corrected milk, energy-corrected milk, protein and fat yield, protein percentage, 24-hour cheese yield, and cheese yield in general. Furthermore, primiparous cows are more sensitive than multiparous to HWs and also to shorter durations of HWs. Ouellet et al. outline how it is incorrect to use the same THI threshold for each physiological phase of a dairy cow. The authors observed that, in a subtropical climate, in the absence of active cooling, dry dairy cows show heat stress when THI exceeds the threshold of 77, generating a significant increase in rectal temperature and respiratory rate, and reducing feed intake. Therefore, to

avoid heat-stress problems, during the dry period, it is important to control cows before THI reaches 77 to mitigate potential negative effects.

Toledo et al. focus their attention on the effects of heat stress (HT) on nulliparous heifers with cooling systems (CL) and without CL, in the 60 days pre- and postpartum, using devices to monitor the number of steps, the standing periods, daily time lying down, rectal temperature, and respiratory rate. This study demonstrates that HT modifies the heifer's behavior by increasing feeding time at night and reducing rumination, whereas these effects were attenuated in CL. Therefore, heat stress influences heifer behavior, and cooling systems can reduce the negative effects caused by heat stress.

Ramirez et al. carry out a review, from 2003 to 2020, on the effects of heat production (HP) of swine on the overall sustainability of production. Nowadays, there is no standardized HP value for swine and there is no data on growing pigs greater than 150 kg. The authors also suggested that it is necessary to provide constant updates and standard models to design and increase swine production efficiency.

The next two articles focus on different approaches to reducing greenhouse gas emissions from the livestock sector. Jordaan et al. assess the carbon footprint of calf-cow line production in four indigenous African breeds. All breeds showed a productivity improvement expressed in the weight of calves (weaned/UBA). Differences in phenotypic and genetic trends between breeds have been linked to changes in production environment, production system, and production region. Improving cow productivity is a key component to reducing the environmental impact of beef production.

Peterson and Mitloehner show that the research to improve gas emissions in dairy cows is still incomplete. The changes in the diets of dairy cattle could change and reduce CH4 emissions. Moreover, bacterial inoculum, biochar, plant compounds, and additives are under evaluation to reduce the amount of CH4. In particular, the bacterial inoculums can be used to trap CH4 and transform manure into biofuels, the combination of biochar and bacterial inoculum added to bovine fresh manure may substantially reduce CH4 production, and the gypsum can reduce N losses in manure.

Lastly, some articles deal with the improvement of animal welfare in livestock production systems. The Grandin study emphasizes the importance of visual, auditory, and physical stimuli in the breeding environment and the importance of the ability and ease of animals to move during veterinary treatment, loading trucks, or in slaughterhouses. The author provides a method to evaluate animal welfare in these phases through indicators such as slipping and falling, stopping, turning back, and vocalization. Therefore, through the results obtained from the indicators, it is possible to evaluate the farm management of the animals and evaluate the efficiency of any environmental modifications.

Taylor et al. explore, through behavioral tests, whether the variable behavior in the area used by free-range laying hens depends on ranging, curiosity, or fear. The observations showed that the hens did not change the number of vocalizations and approached new spaces faster. Above all, curiosity to explore increased when hens were reared in enriched environments.

Demba and Rose consider the changes in the stereotypic behavior of Jersey cows with or without pasture access. The stereotyped behavior was monitored for 15 minutes once a week for four weeks in winter and summer counting the number and duration of periods. The results demonstrated significant differences between the two treatments. Cows with pasture access had a reduction in stereotypic behavior compared to those without pasture access. Therefore, pasture access could improve the welfare of dairy cows.

Ogbonna et al. performed a comparison between the effects of dietary vitamin D3 and ultraviolet (UVB) light exposure in broilers to determine their degree of improvement in physiological, metabolic, and welfare indices when subjected to the stress of social isolation. The results highlighted an increase in production parameters, such as feed conversion ratio, and improved health and welfare of UVB-treated broilers. If the efficiency of UVB light is confirmed in large-scale studies it may provide an important improvement of stressors in commercial broiler production reared indoors.

Gessesse et al. explore the growth performance and mortality rate of Fogera calves and their crosses with Holstein Friesian. For each calf born, birth weight, pre-weaning, and post-weaning weight were recorded. This study showed that F1 crosses were better in growth performance than the Fogera breed, and management practices should be improved to avoid variability in productivity and survival rates. The article by Abeni shows the importance of diet effects, housing type, microorganisms, and climate effects on rumination in different ruminant species. Efforts are aimed at using rumination records to reveal animal welfare and health issues. However, the author points out that there is still a lack of knowledge on this topic and that there is a need for more research, especially on some breeds (such as the buffalo breeds) as the research is underdeveloped.

In conclusion, the articles included in this Research Topic are interdisciplinary: this demonstrates the complexity of animal production systems and encourages research for new solutions to respond to many challenges in the livestock sector. Research in the field shows an attempt to combine economic sustainability with environmental and social sustainability.

Author contributions

LB, FA, and PP conceptualized the editorial. LB led the writing. All authors edited and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Bednar-Friedl, B., Biesbroek, R., Schmidt, D. N., Alexander, P., Børsheim, K. Y., Carnicer, J., et al. (2022). "Europe," in *Climate change 2022: impacts, adaptation and vulnerability. contribution of working group II to the sixth assessment report of the intergovernmental panel on climate change*. Eds. H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem and B. Rama (Cambridge, UK and New York, NY, USA: Cambridge University Press), 1817–1927. doi: 10.1017/9781009325844.015

Casasús, I., Rogosić, J., Rosati, A., Stoković, I., and Gabiña, D. (2012). Animal farming and environmental interactions in the Mediterranean region. *EAAP Sci. Ser.* 131, 276. doi: 10.3920/978-90-8686-741-7

Cheng, M., McCarl, B., and Fei, C. (2022). Climate change and livestock production: a literature review. *Atmosphere* 13 (1), 140. doi: 10.3390/atmos13010140

Grossi, G., Goglio, P., Vitali, A., and Williams, A. (2019). Livestock and climate change: impact of livestock on climate and mitigation strategies. *Anim. Front.* 9 (1), 69–76. doi: 10.1093/af/vfy034

Nardone, R., Ronchi, B., Lacetera, N., Ranieri, M. S., and Bernabucci, U. (2010). Effects of climate changes on animal production and sustainability of livestock systems. *Livestock Sci.* 130, 57–69. doi: 10.1016/j.livsci.2010.02.011

Opio, C., Gerger, P., and Steinfeld, H. (2011). Livestock and the environment: addressing the consequences of livestock sector growth. *Adv. Anim. Biosiences* 2, 601–607. doi: 10.1017/S204047001100286X

Rust, J. M. (2019). The impact of climate change on extensive and intensive livestock production systems. *Anim. Front.* 9 (1), 20–25. doi: 10.1093/af/vfy028

Trisos, C. H., Adelekan, I. O., Totin, E., Ayanlade, A., Efitre, J., Gemeda, A., et al. (2022). "Chapter 9: Africa," in *Climate change 2022: impacts, adaptation and vulnerability. contribution of working group II to the sixth assessment report of the intergovernmental panel on climate change*. Eds. H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem and B. Rama (Cambridge, UK and New York, NY, USA: Cambridge University Press), 1285–1455. doi: 10.1017/9781009325844.011

Weiskopf, S. R., Rubenstein, M. A., Crozier, L. G., Gaichas, S., Griffis, R., Halefsky, J. E., et al. (2020). Climate change effects on biodiversity ecosystems, ecosystem services, and natural resource management in the united states. *Sci. Total Environ.* 733. doi: 10.1016/j.scitotenv.2020.137782