Ad Hoc Action: Transhumance and local breeds, 20/06/2024, Navarredonda de Gredos, Avila, Spain

The environmental values of transhumance.

Pablo Manzano

BC3 BASQUE CENTRE FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

ikerbasque
Basque Foundation for Science

Importance of large mammal herbivores

Current Biology

CellPress

Review

The role of large wild animals in climate change mitigation and adaptation

Yadvinder Malhi[1,*], Tonya Lander[2], Elizabeth le Roux[1,3], Nicola Stevens[1], Marc Macias-Fauria[4], Lisa Wedding[4], Cécile Girardin[1], Jeppe Ågård Kristensen[1,3], Christopher J. Sandom[5,6], Tom D. Evans[7], Jens-Christian Svenning[3], and Susan Canney[8]

[1]Environmental Change Institute, School of Geography and the Environment, University of Oxford, Oxford OX1 3QY, UK
[2]Christ Church College, University of Oxford, Oxford OX1 1DP, UK
[3]Center for Biodiversity Dynamics in a Changing World (BIOCHANGE) and Section for Ecoinformatics and Biodiversity, Department of Biology, Aarhus University, Ny Munkegade 114, DK-8000 Aarhus C, Denmark
[4]School of Geography and the Environment, University of Oxford, Oxford OX1 3QY, UK
[5]Life Sciences, University of Sussex, Brighton BN1 9QG, UK
[6]Sussex Sustainability Research Programme, University of Sussex, Brighton BN1 9QG, UK
[7]Wildlife Conservation Society, Global Conservation Program, Bronx, New York, NY 10460, USA
[8]Department of Zoology, University of Oxford, Oxford OX1 3SZ, UK
*Correspondence: yadvinder.malhi@ouce.ox.ac.uk
https://doi.org/10.1016/j.cub.2022.01.041

nature climate change

Perspective

https://doi.org/10.1038/s41558-023-01631-6

Trophic rewilding can expand natural climate solutions

Received: 20 April 2022

Accepted: 13 February 2023

Published online: 27 March 2023

Check for updates

Oswald J. Schmitz[1], Magnus Sylvén[2], Trisha B. Atwood[3], Elisabeth S. Bakker[4,5], Fabio Berzaghi[6], Jedediah F. Brodie[7], Joris P. G. M. Cromsigt[8,9], Andrew B. Davies[10], Shawn J. Leroux[11], Frans J. Schepers[12], Felisa A. Smith[13], Sari Stark[14], Jens-Christian Svenning[15], Andrew Tilker[16,17] & Henni Ylänne[18]

Current Biology

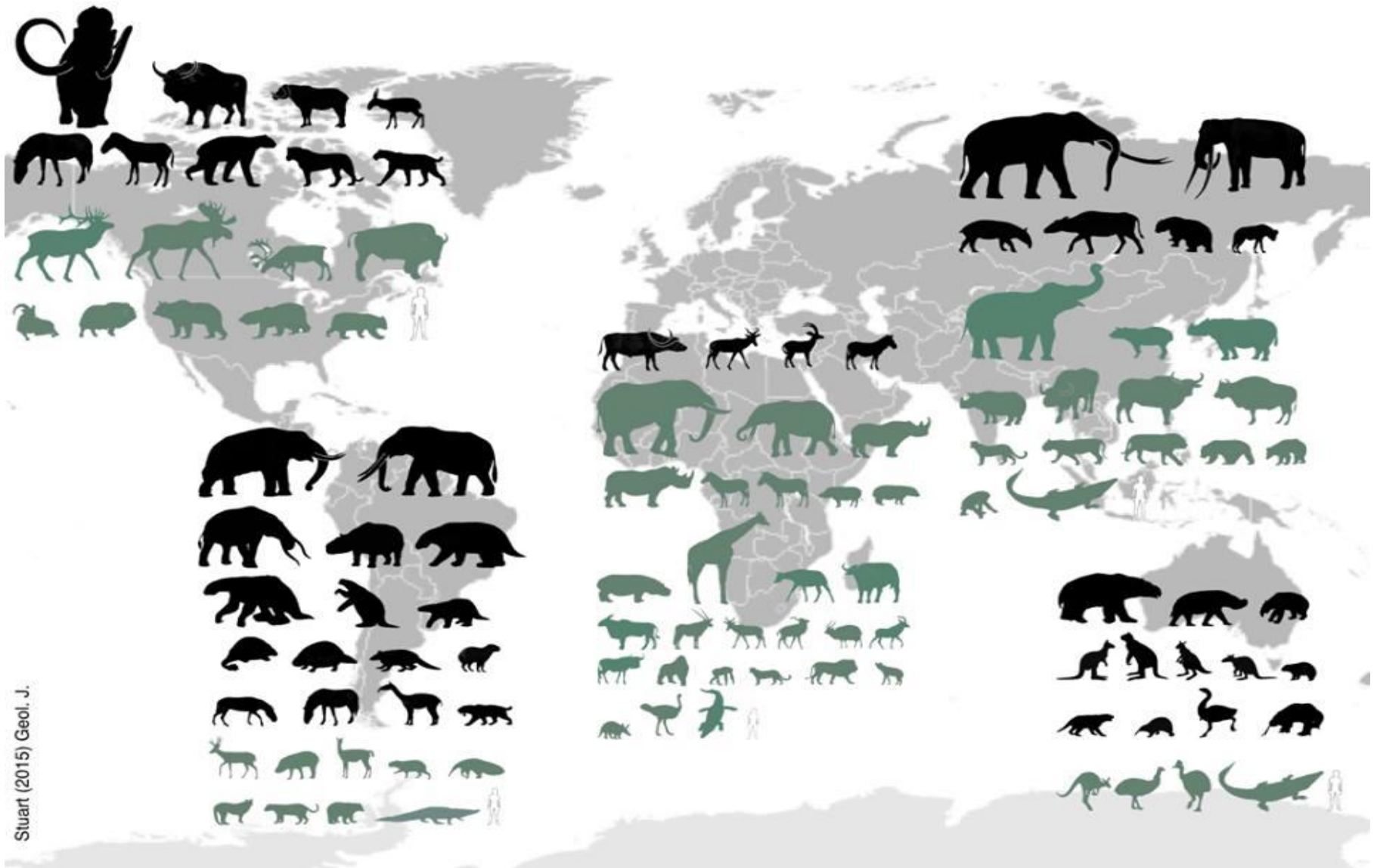
CellPress

Review

Trophic rewilding as a restoration approach under emerging novel biosphere conditions

Jens-Christian Svenning[1,*], Robert Buitenwerf[1], and Elizabeth Le Roux[1,2]

[1]Center for Ecological Dynamics in a Novel Biosphere (ECONOVO), Department of Biology, Aarhus University, Ny Munkegade 114, DK-8000 Aarhus C, Denmark
[2]Department of Zoology and Entomology, Faculty of Natural and Agricultural Sciences, Mammal Research Institute, University of Pretoria, Pretoria 0028, South Africa
*Correspondence: svenning@bio.au.dk
https://doi.org/10.1016/j.cub.2024.02.044


Stuart (2015) Geol. J.

What ecosystems are we talking about?

- Bond

Journal of Vegetation Science 16: 261-266, 2005

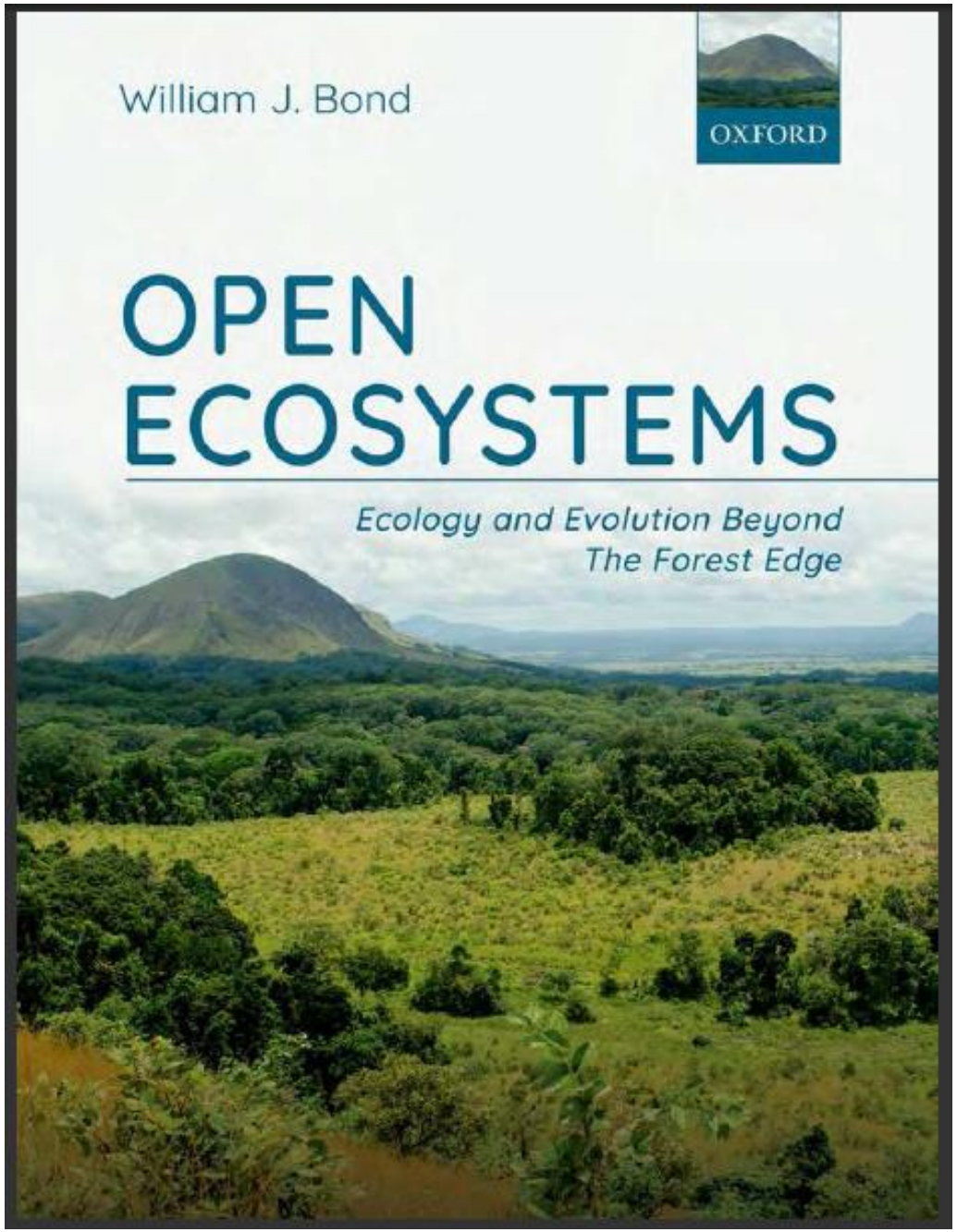
INVITED PERSPECTIVE

Large parts of the world are brown or black: A different view on the 'Green World' hypothesis

Bond, William J.

Botany Department, University of Cape Town, Private Bag, Rondebosch, 7701, South Africa; Fax +27 216504041; E-mail bond@botzoo.uct.ac.za

Abstract. Climate sets the limits to plant growth but does climate determine the global distribution of major biomes? I suggest methods for evaluating whether vegetation is largely climate or consumer-controlled, focusing on large mammal herbivores and fire as influential consumers. Large parts of the world appear not to be at equilibrium with climate. Consumer-controlled ecosystems are ancient and diverse. Their distinctive ecology warrants special attention.



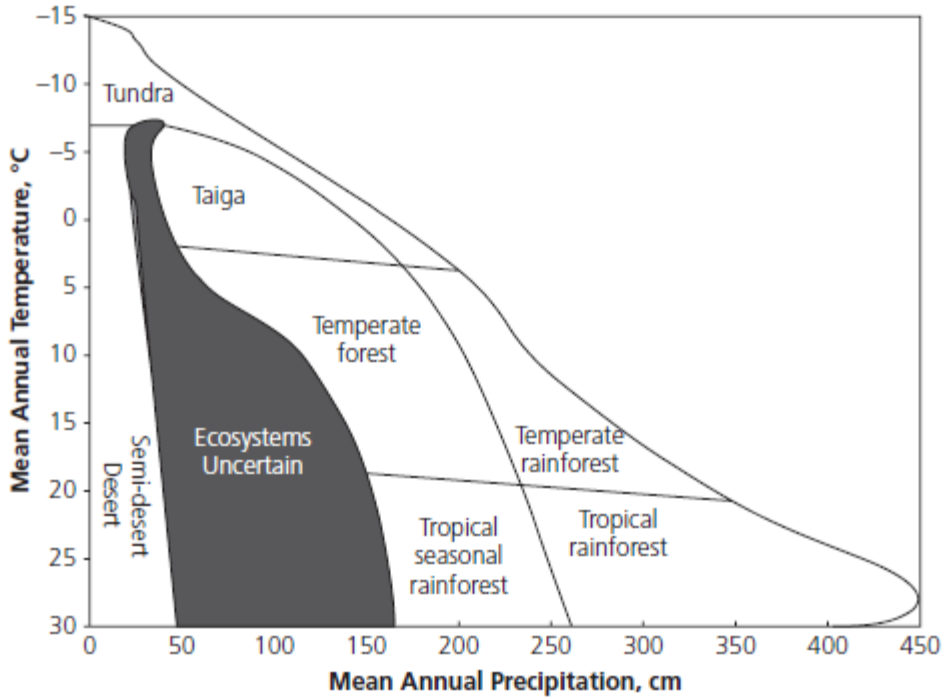


Figure 2.2 Whittaker's climate envelopes for major world vegetation formations. The shaded area is the climate envelope where ecosystems are uncertain and 'either grassland, or one of the types dominated by woody plants, may form the prevailing vegetation in different areas' (redrawn from Whittaker 1975, p. 65).

Extent of Open Ecosystems

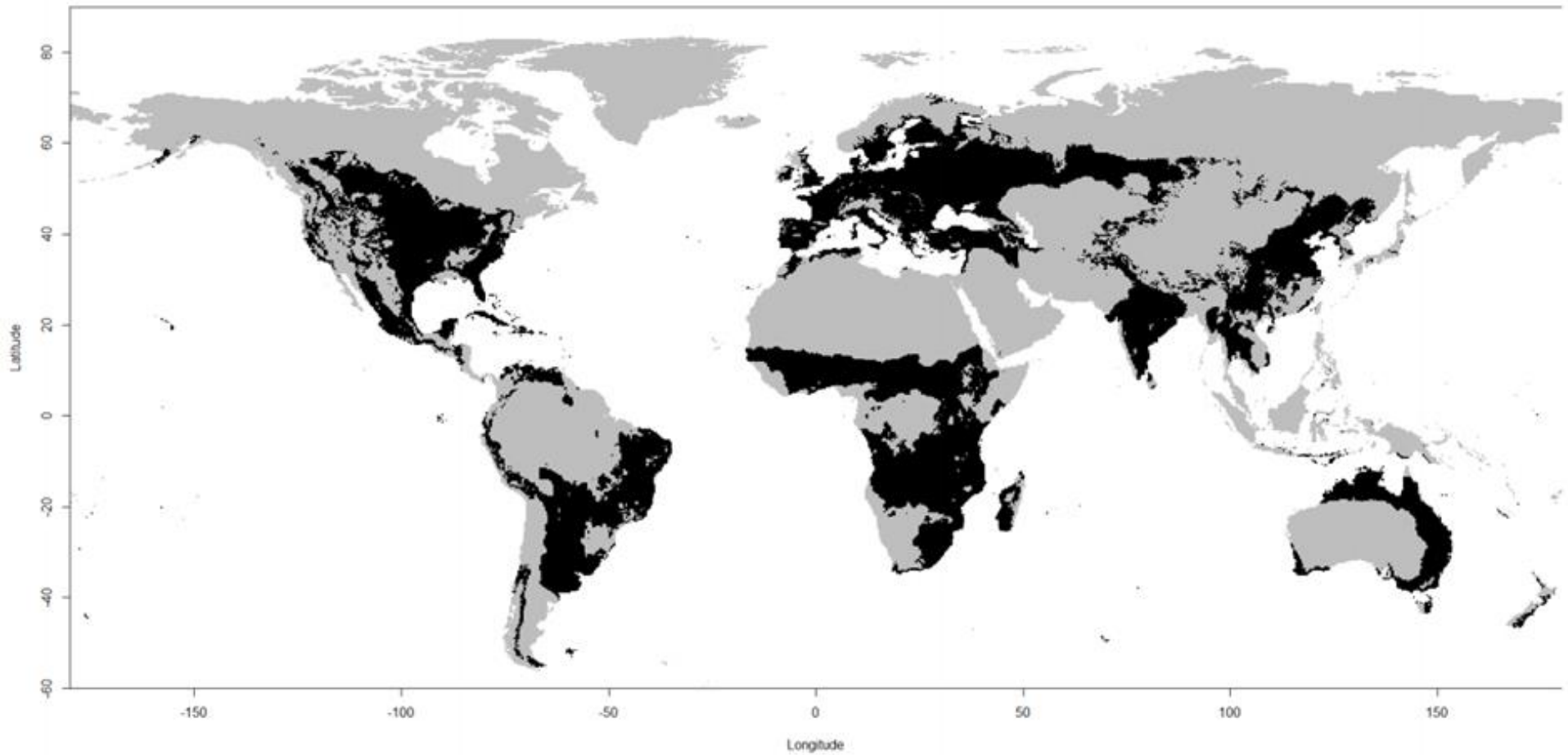


Image source
https://www.elespanol.com/eldigitalcastillalamancha/region/ciudad-real/20211208/plan-sostenibilidad-turistica-impulsa-recursos-parque-cabaneros/633186830_0.html

Image source
Pablo Manzano, own work

Images' source Pablo Manzano, own work

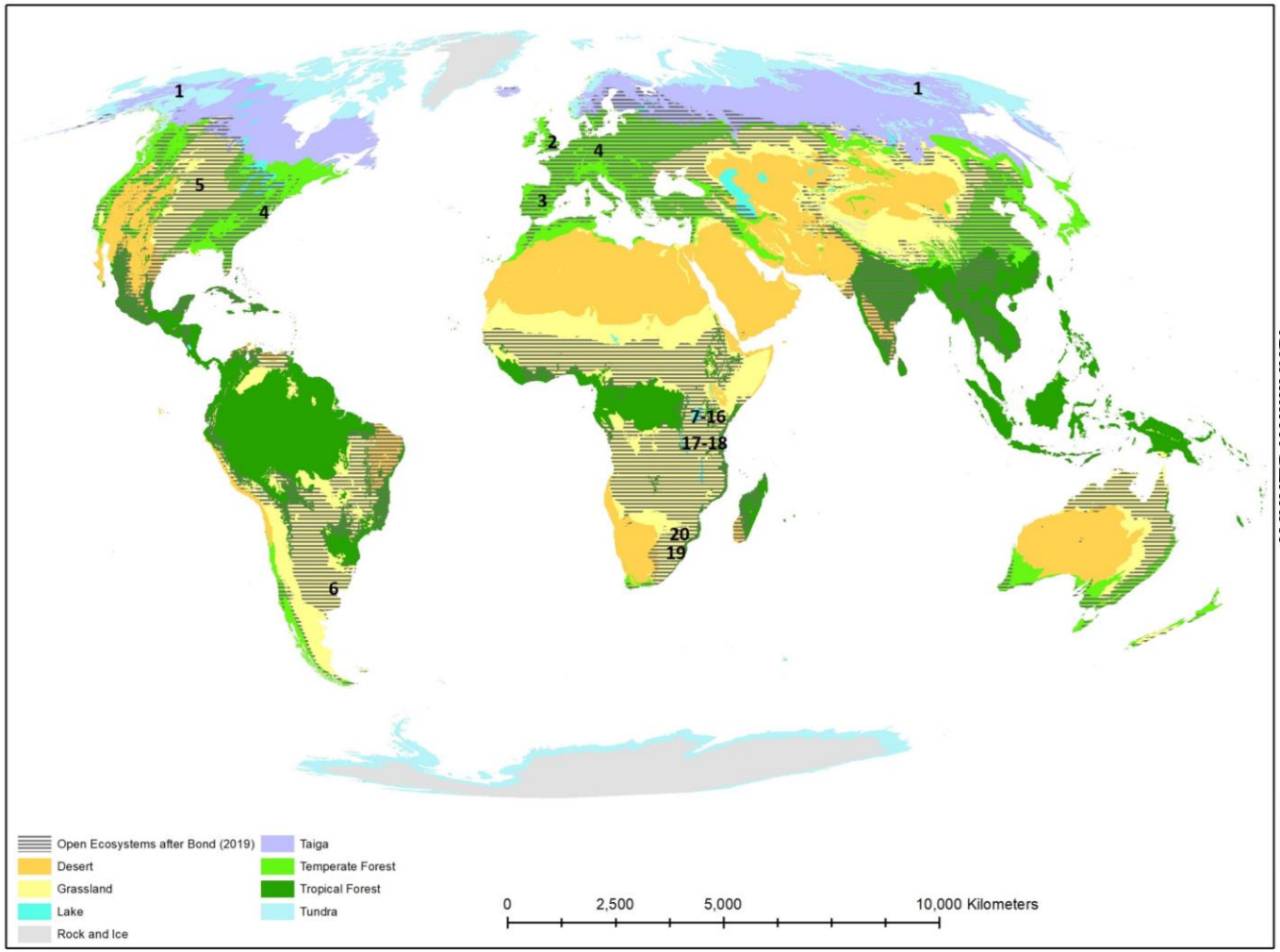
- Indigenous people's management

  - Hunter-gatherers

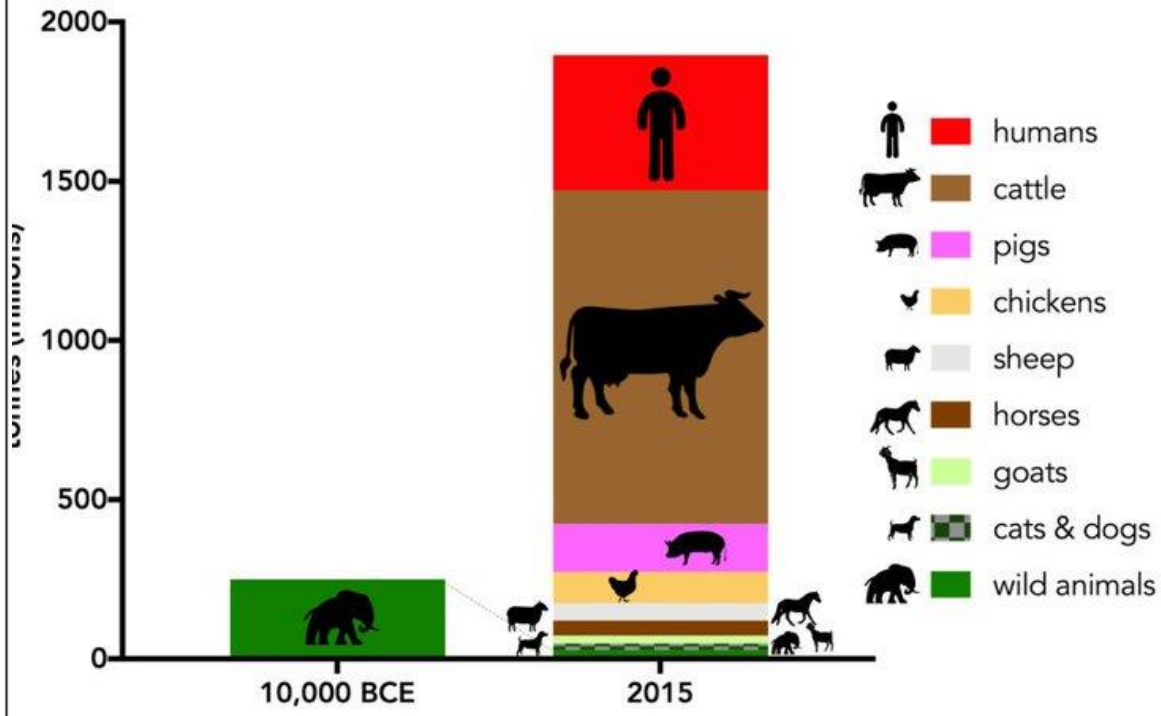
  - Pastoralists

  ⇒ All with the aim of creating pasture!

Overall biomass estimated through abundances in Open Ecosystems



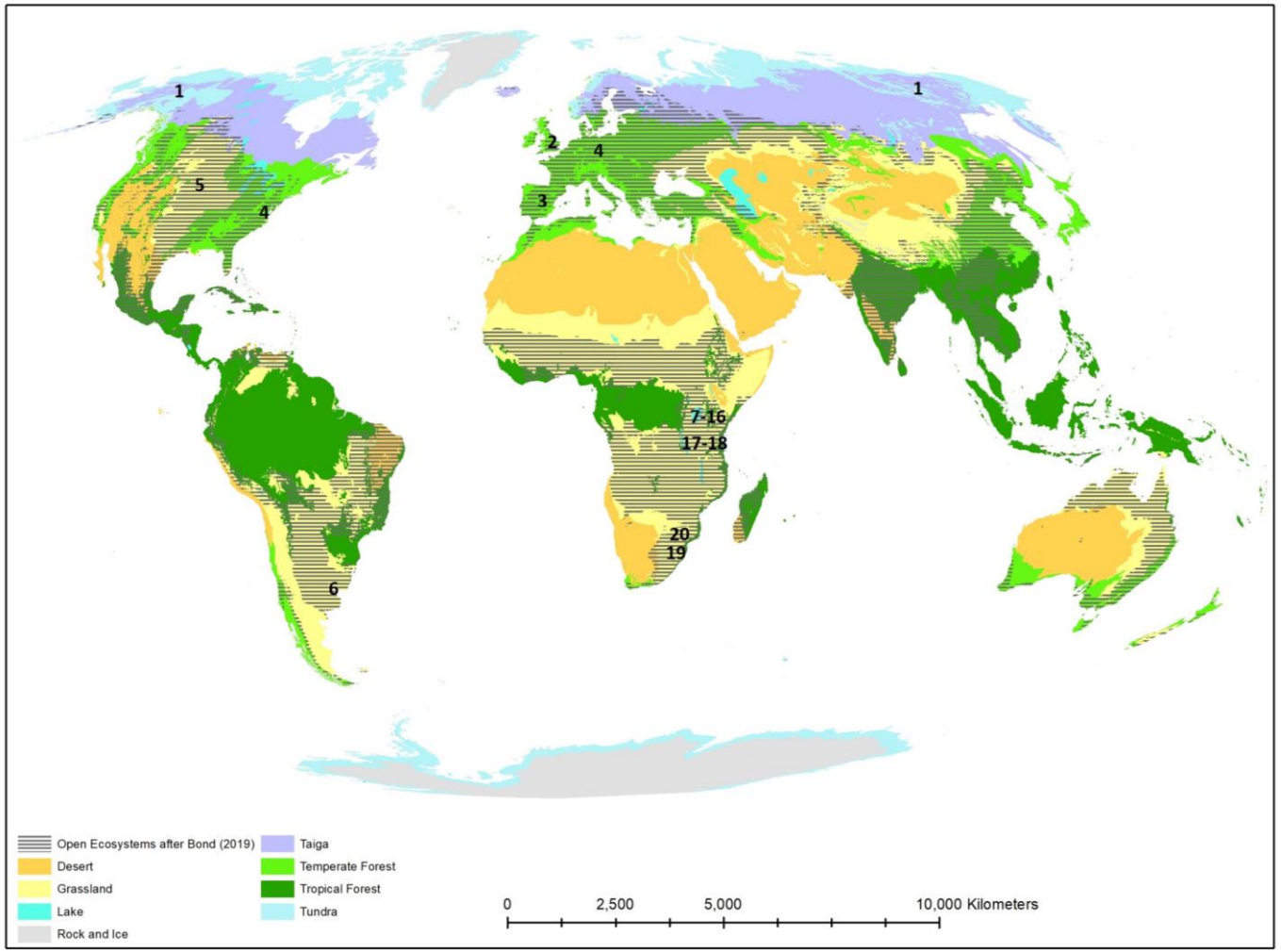
https://youtu.be/-9ku3t9JesM



https://conservationbytes.com/2020/01/24/the-state-of-global-biodiversity-its-worse-than-you-probably-think/ / Barnosky 2008 DOI 10.1073/pnas.0801918105

Manzano et al 2023 https://doi.org/10.1038/s44185-022-00005-z

Overall biomass estimated through abundances in Open Ecosystems



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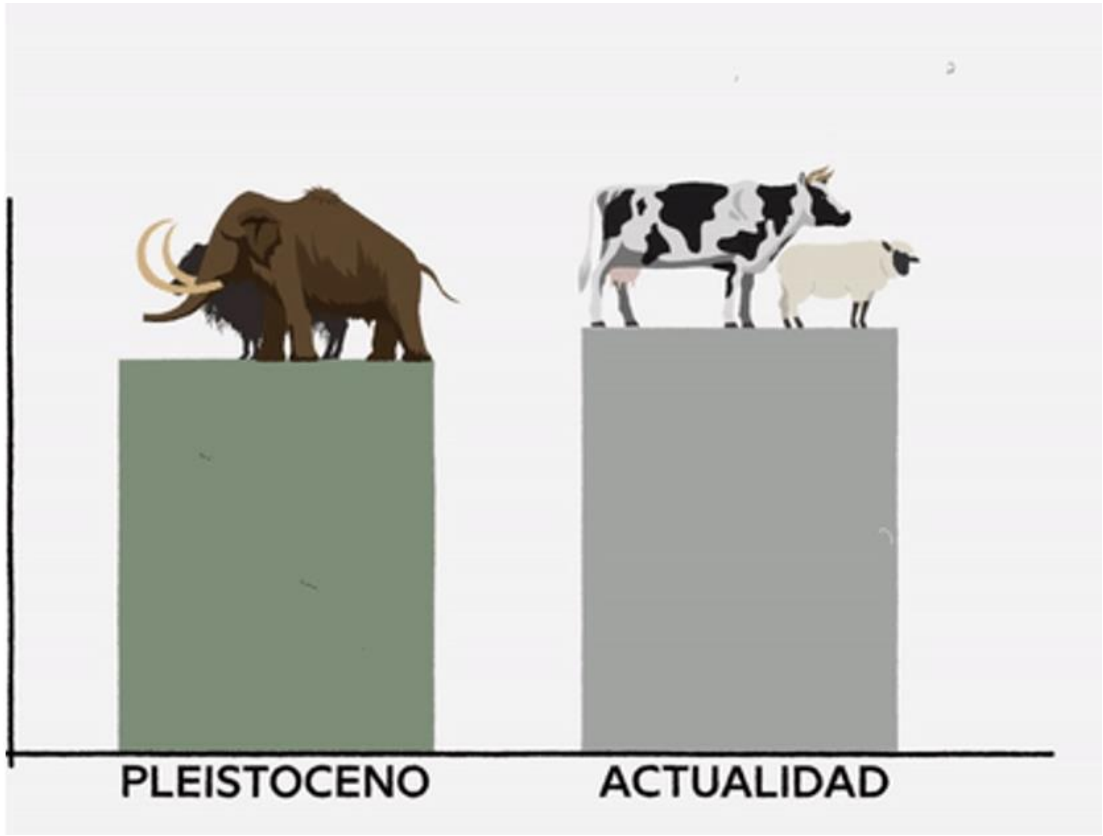


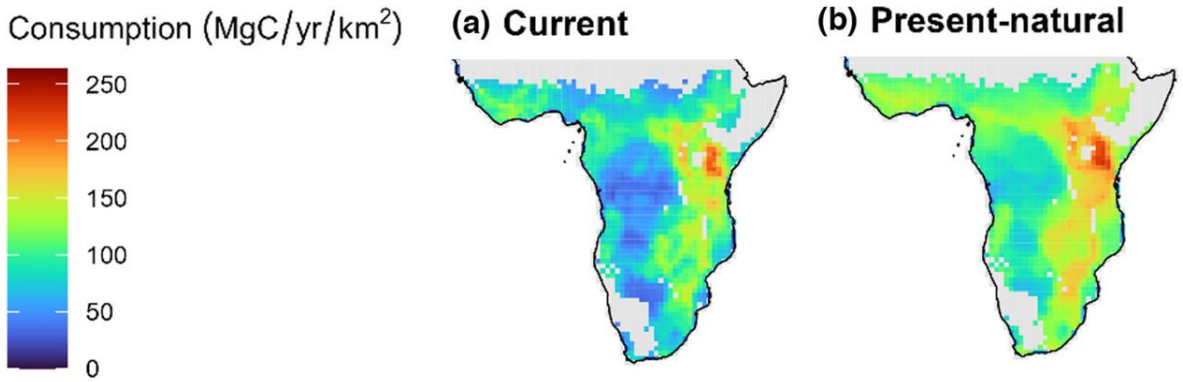
Manzano et al 2023 https://doi.org/10.1038/s44185-022-00005-z

Estimation by plant biomass consumption models

Difference in case studies

East Africa

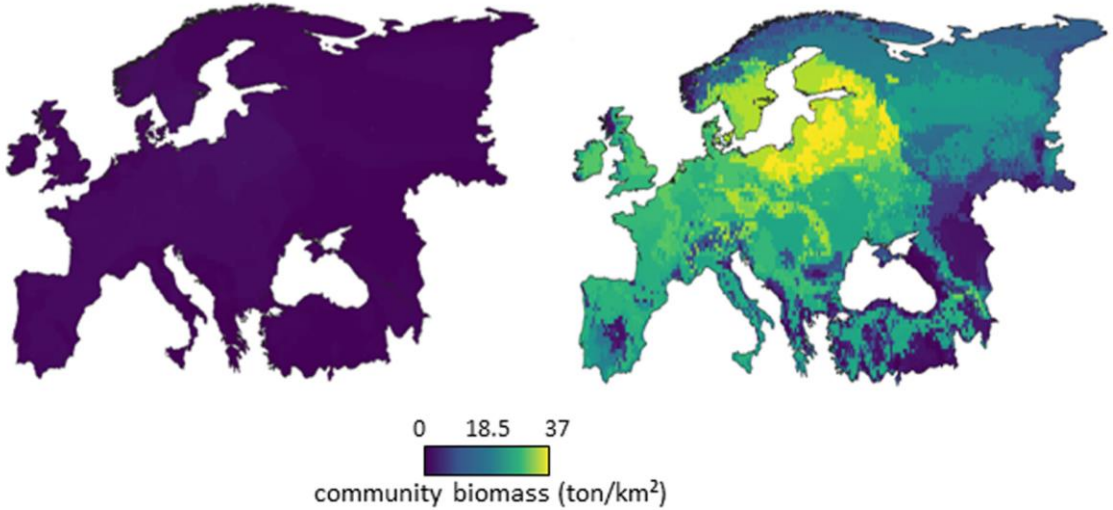
- Complete ecosystems



Pedersen et al 2023 https://doi.org/10.1111/geb.13723

Europe

- Ecosystems suffering from herbivore extinctions



Davoli et al 2023 https://doi.org/10.1111/geb.13778

Estimation by plant biomass consumption models

Difference in case studies

East Africa

- Complete ecosystems

⇒ High density of wild herbivores (14.3 t/km²)

- Negligible external inputs

⇒ Low productivity of domestic herbivores

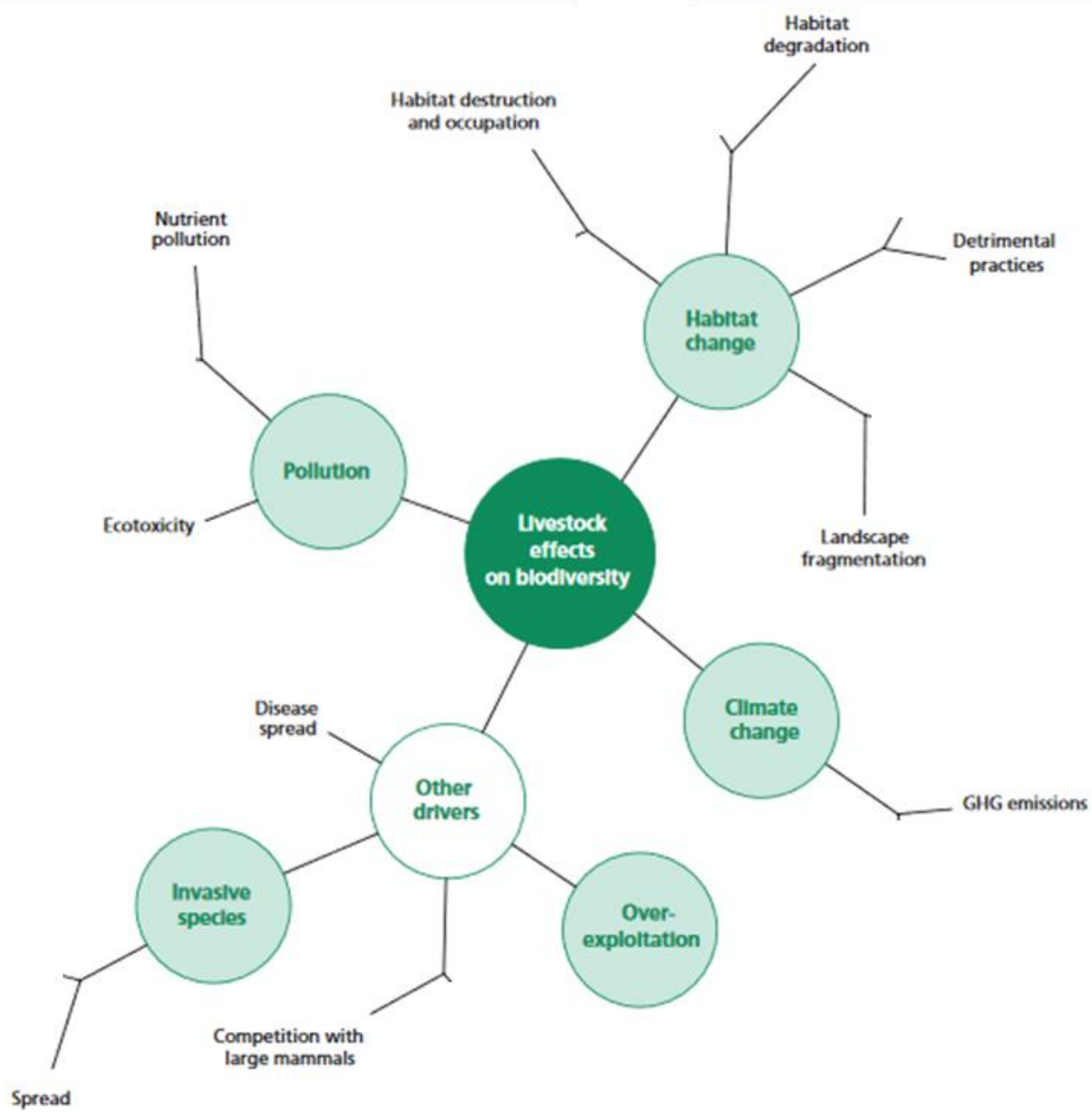
Europe

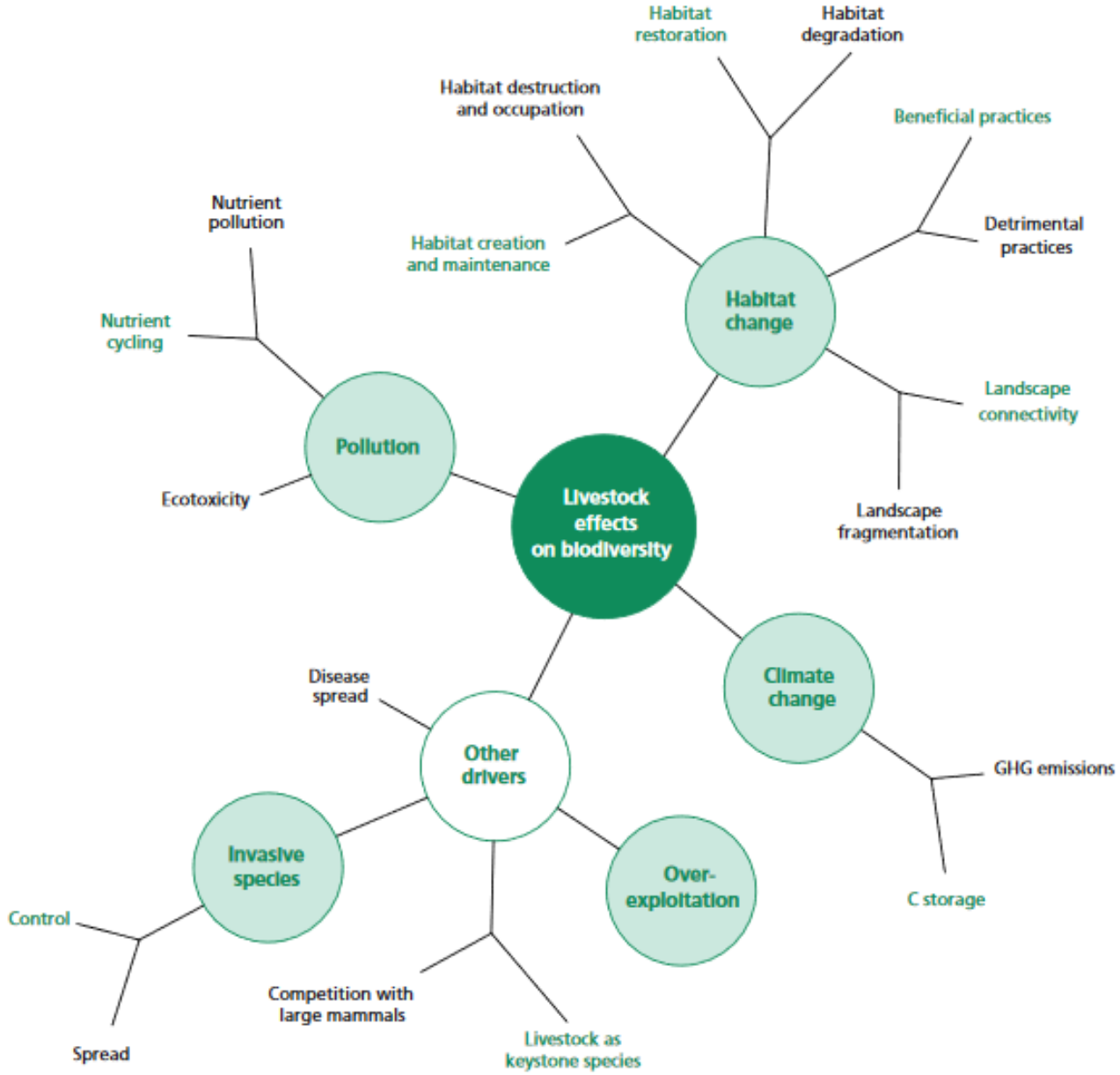
- Ecosystems suffering from herbivore extinctions

⇒ Low density of wild herbivores (4.8 t/km²)

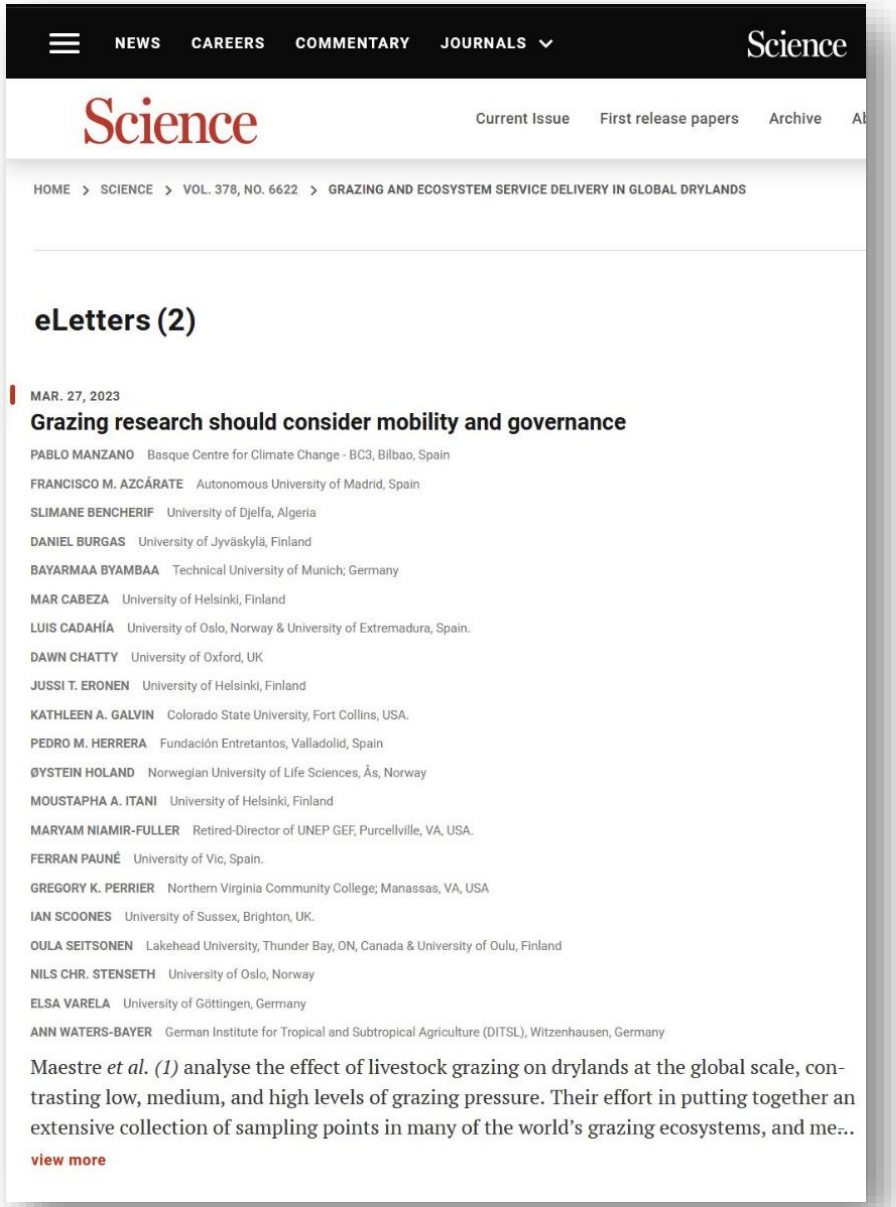
- Significant external inputs, even in the most extensive systems

⇒ High productivity of domestic herbivores


Habitat degradation
Habitat destruction and occupation
Nutrient pollution
Detrimental practices
Habitat change
Pollution
Ecotoxicity
Livestock effects on biodiversity
Landscape fragmentation
Climate change
Disease spread
Other drivers
GHG emissions
Invasive species
Over-exploitation
Competition with large mammals
Spread



Teillard et al 2016 https://www.fao.org/3/av151e/av151e.pdf#page=34



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HOME > SCIENCE > VOL. 378, NO. 6622 > GRAZING AND ECOSYSTEM SERVICE DELIVERY IN GLOBAL DRYLANDS

eLetters (2)

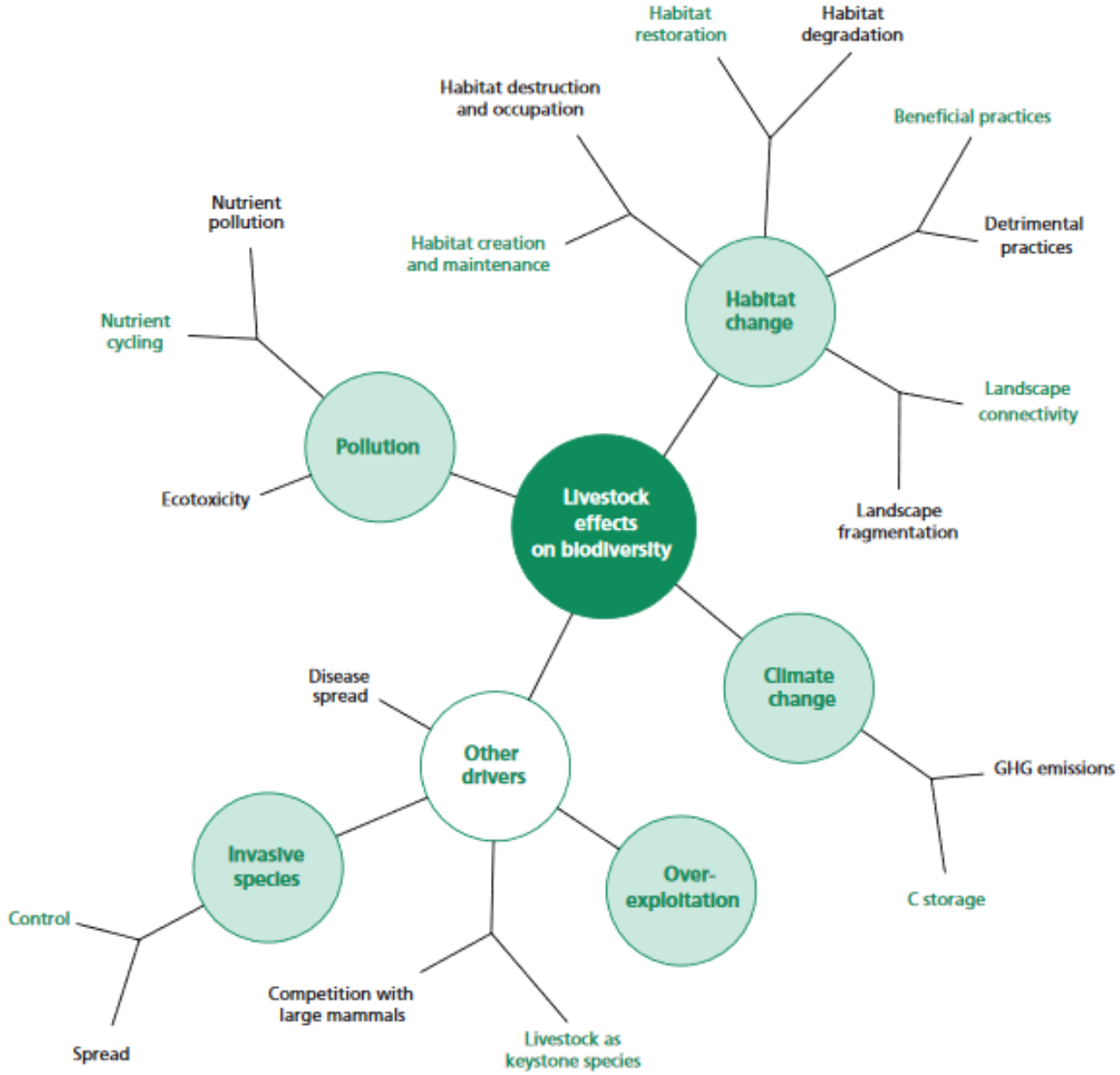
MAR. 27, 2023

Grazing research should consider mobility and governance

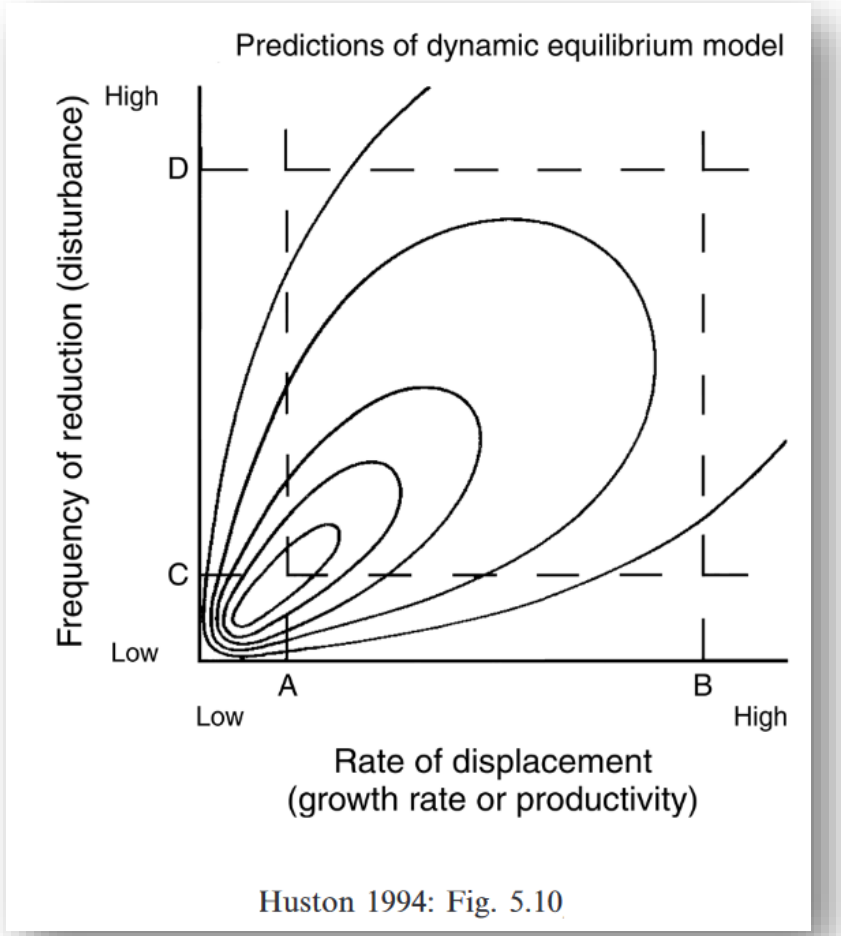
PABLO MANZANO Basque Centre for Climate Change - BC3, Bilbao, Spain
FRANCISCO M. AZCÁRATE Autonomous University of Madrid, Spain
SLIMANE BENCHERIF University of Djelfa, Algeria
DANIEL BURGAS University of Jyväskylä, Finland
BAYARMAA BYAMBAA Technical University of Munich; Germany
MAR CABEZA University of Helsinki, Finland
LUIS CADAHÍA University of Oslo, Norway & University of Extremadura, Spain.
DAWN CHATTY University of Oxford, UK
JUSSI T. ERONEN University of Helsinki, Finland
KATHLEEN A. GALVIN Colorado State University, Fort Collins, USA.
PEDRO M. HERRERA Fundación Entretantos, Valladolid, Spain
ØYSTEIN HOLAND Norwegian University of Life Sciences, Ås, Norway
MOUSTAPHA A. ITANI University of Helsinki, Finland
MARYAM NIAMIR-FULLER Retired-Director of UNEP GEF, Purcellville, VA, USA.
FERRAN PAUNÉ University of Vic, Spain.
GREGORY K. PERRIER Northern Virginia Community College; Manassas, VA, USA
IAN SCOONES University of Sussex, Brighton, UK.
OULA SEITSONEN Lakehead University, Thunder Bay, ON, Canada & University of Oulu, Finland
NILS CHR. STENSETH University of Oslo, Norway
ELSA VARELA University of Göttingen, Germany
ANN WATERS-BAYER German Institute for Tropical and Subtropical Agriculture (DITSL), Witzenhausen, Germany

Maestre *et al. (1)* analyse the effect of livestock grazing on drylands at the global scale, contrasting low, medium, and high levels of grazing pressure. Their effort in putting together an extensive collection of sampling points in many of the world's grazing ecosystems, and me...

view more

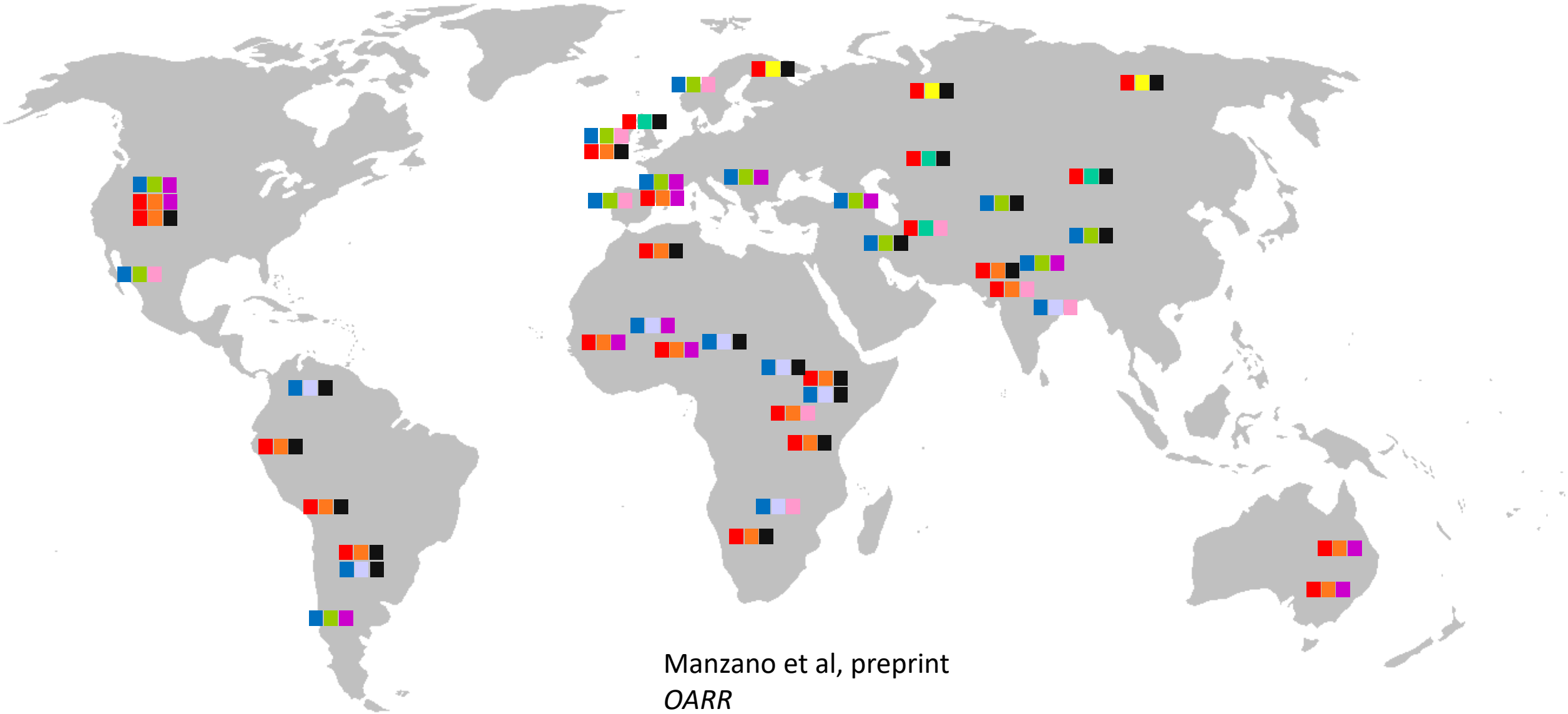


Teillard et al 2016 https://www.fao.org/3/av151e/av151e.pdf#page=34

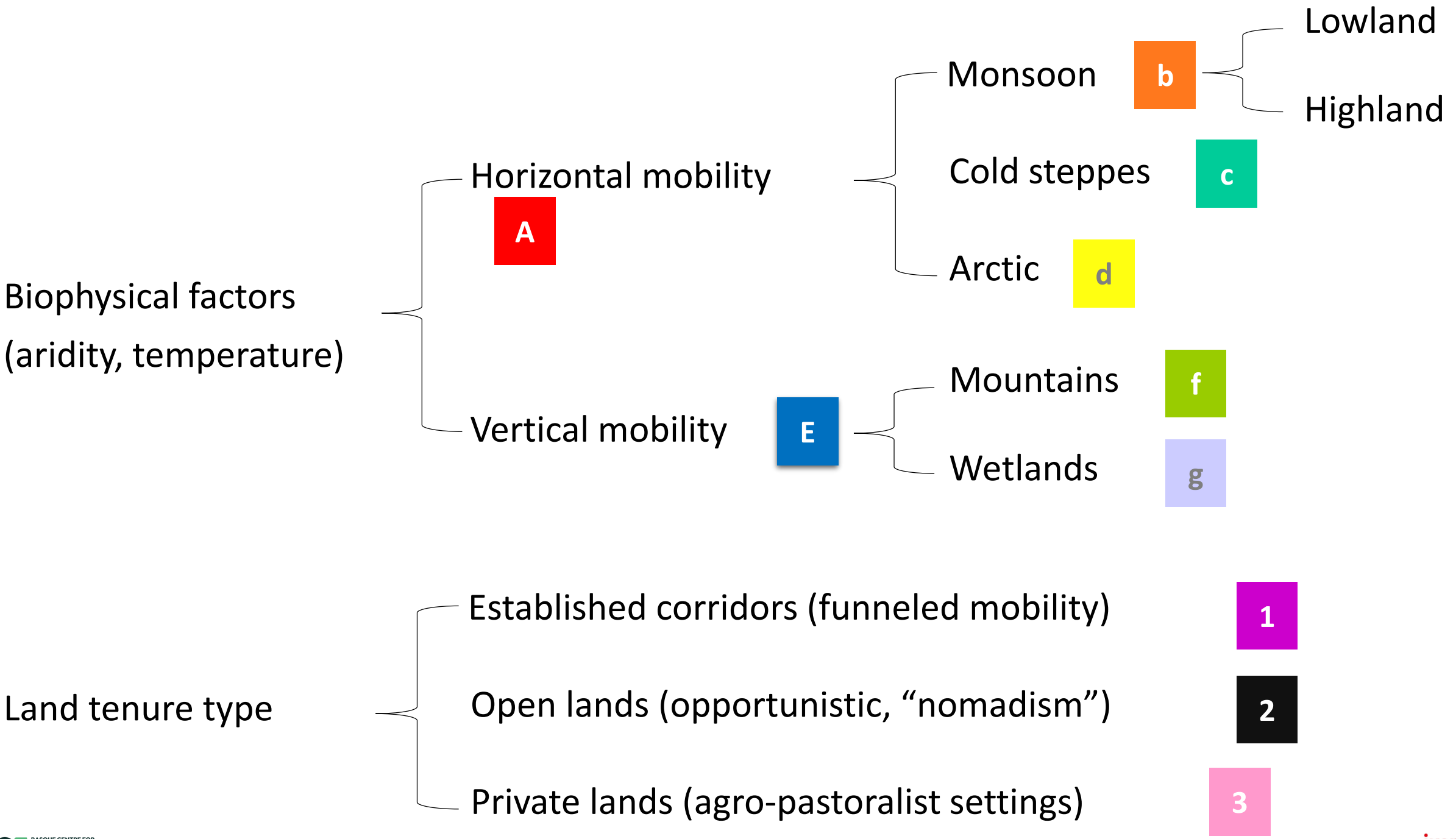


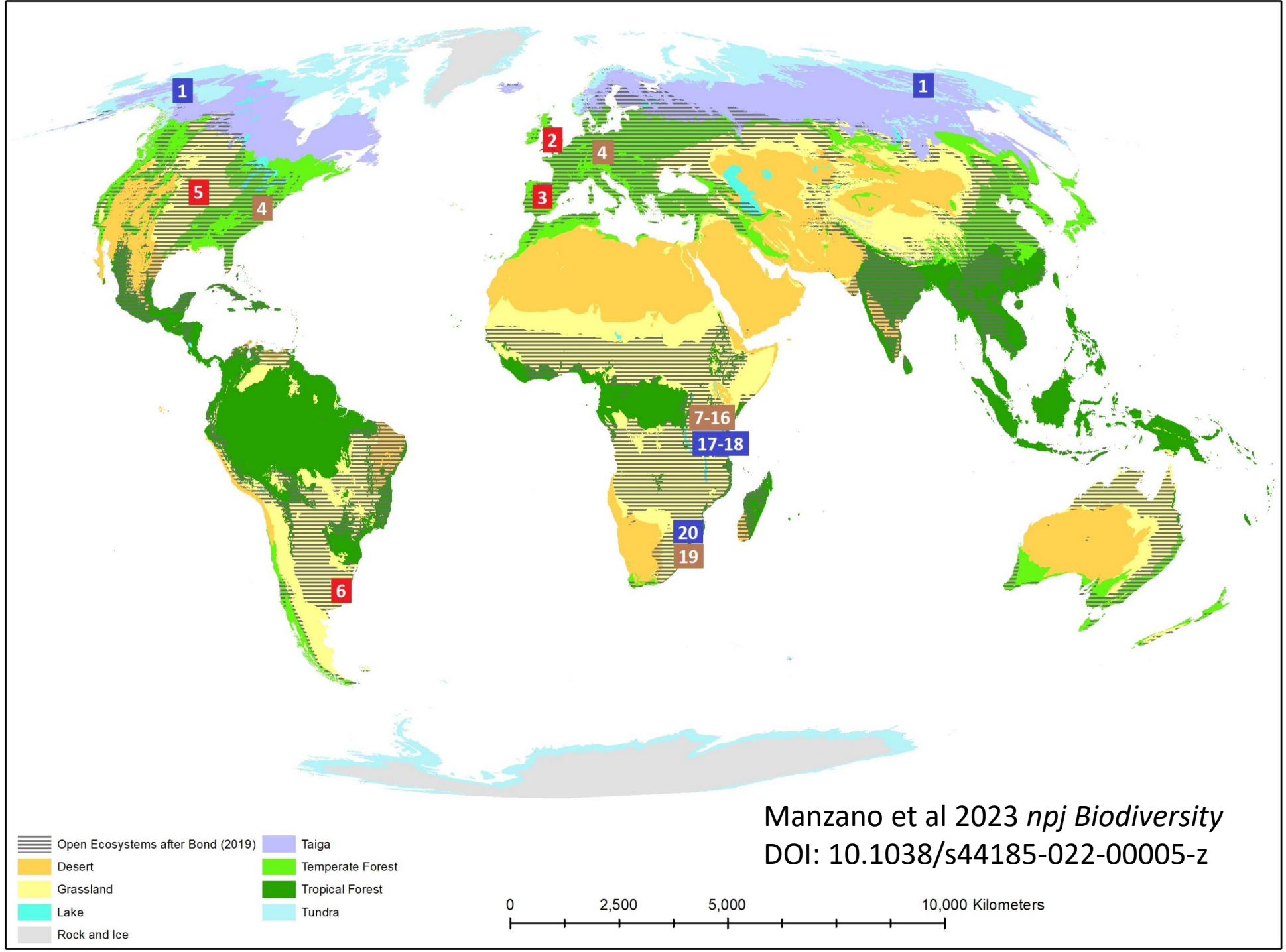
Huston 1994: Fig. 5.10

Types of mobile pastoralism



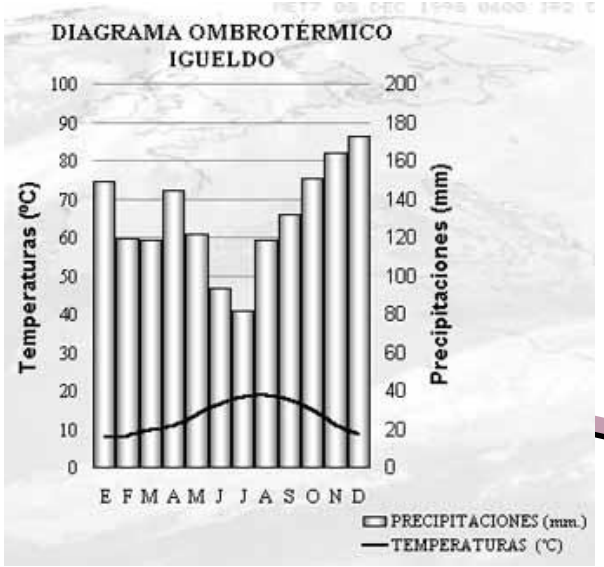
Manzano et al, preprint
OARR

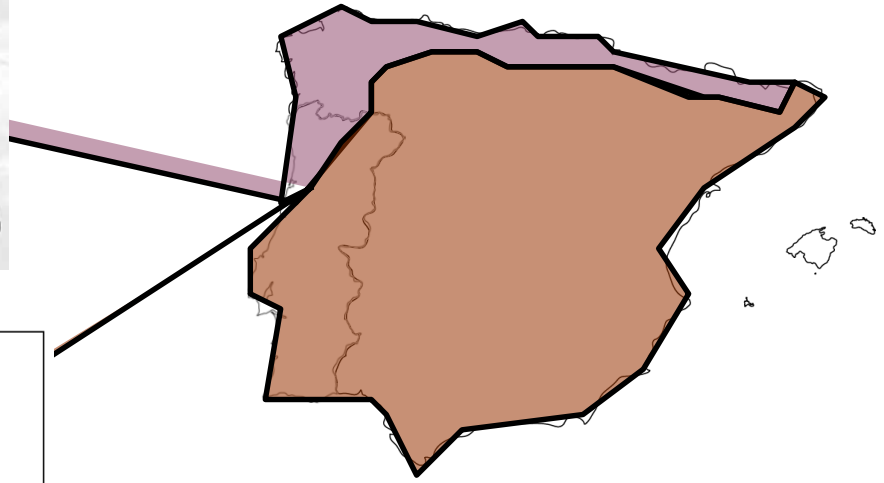

Biophysical factors
(aridity, temperature)
Horizontal mobility
A
Monsoon
b
Lowland
Highland
Cold steppes
c
Arctic
d
Vertical mobility
E
Mountains
f
Wetlands
g
Land tenure type
Established corridors (funneled mobility)
1
Open lands (opportunistic, “nomadism”)
2
Private lands (agro-pastoralist settings)
3

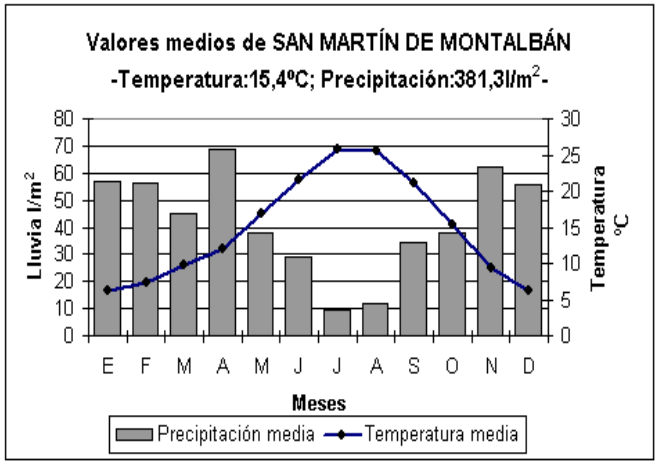


Manzano et al 2023 *npj Biodiversity*
DOI: 10.1038/s44185-022-00005-z

Example: Iberian climate…







Manzano Baena and Casas (2010)
https://doi.org/10.6084/m9.figshare.12253130

Serrano-Zulueta et al (in press) Nomadic Peoples

...and Iberian topography

Mild, humid winters

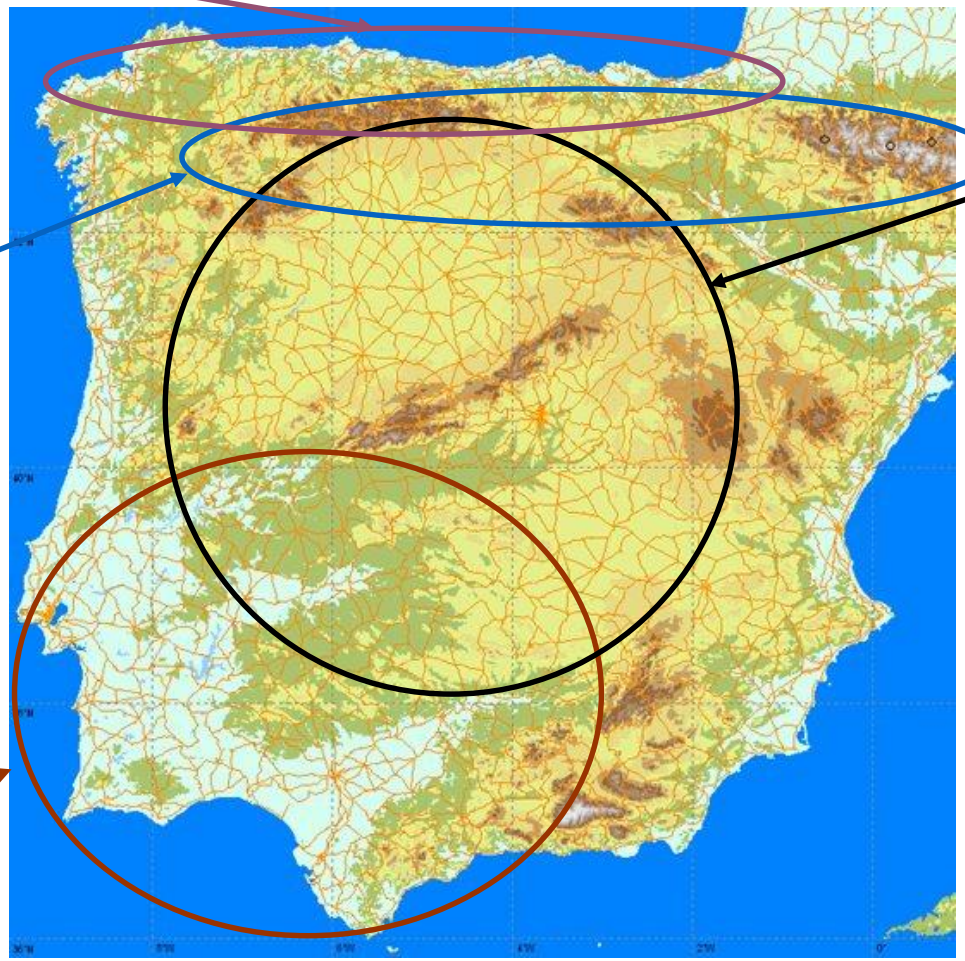
Fresh, moist summers

Very cold winters

Fresh, moist summers

Mild, humid winters

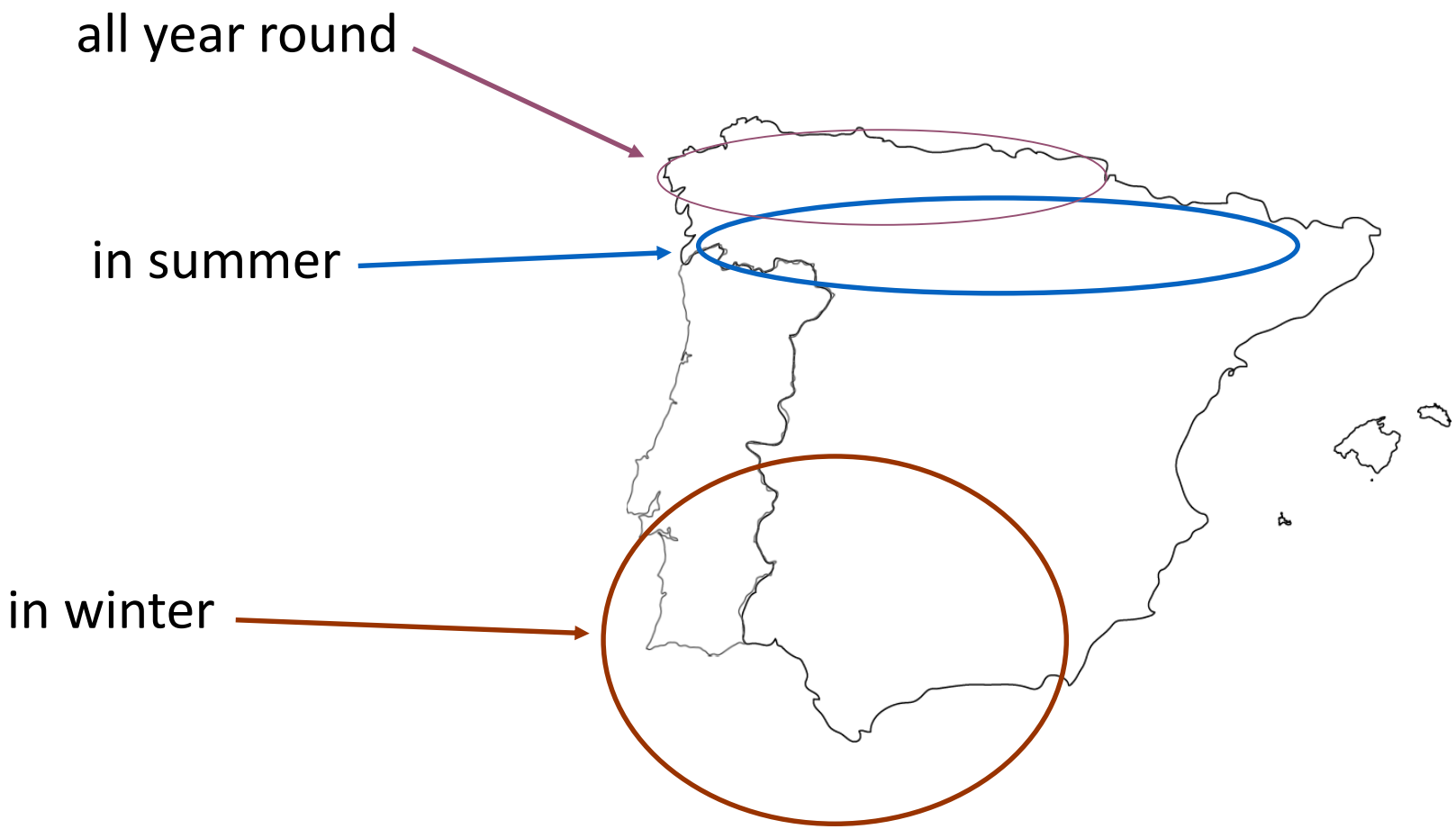
Hot, dry summers



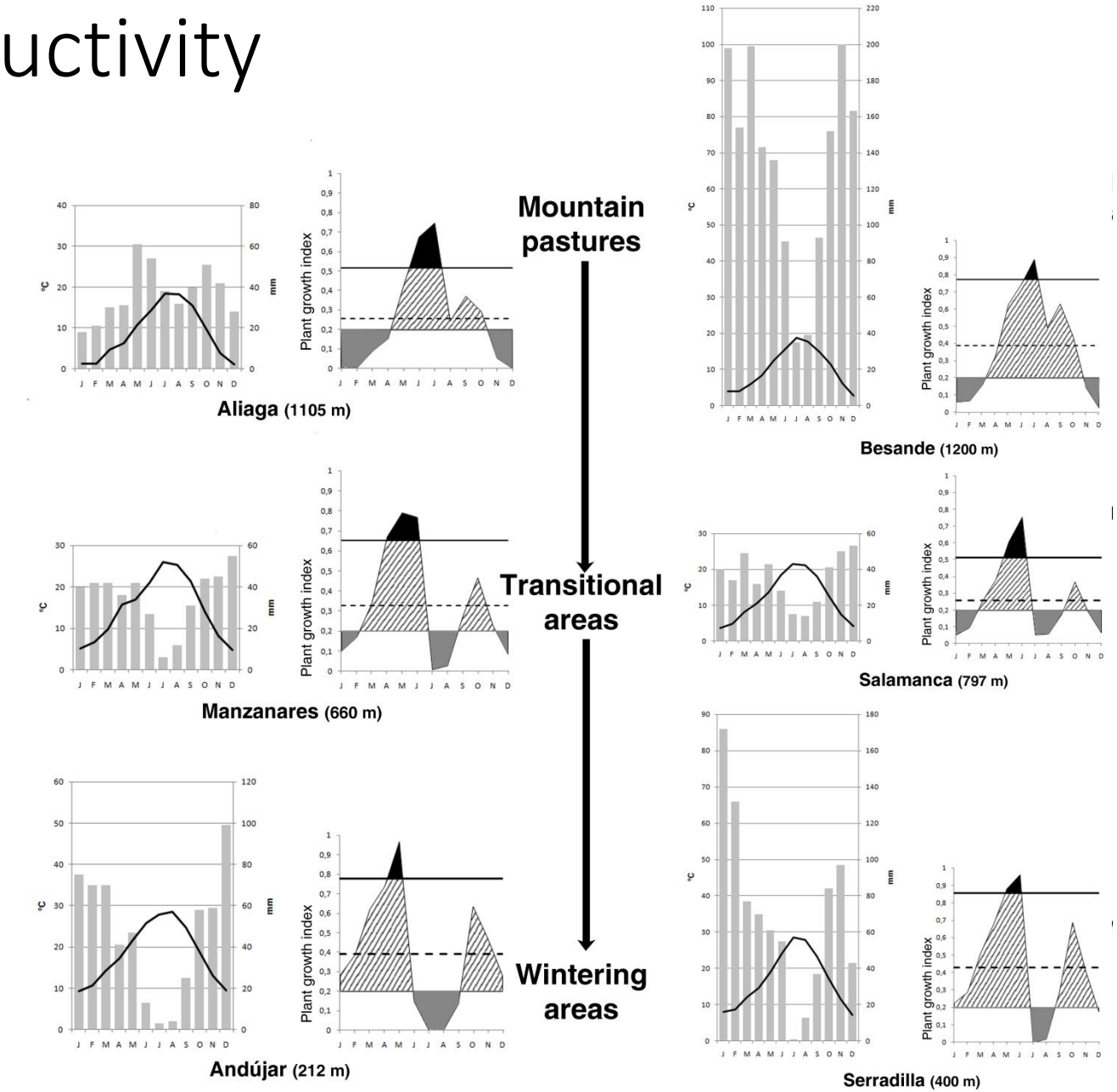
Cold winters

Hot, dry summers

=> Restricted high productivity areas



Plant productivity



=> Historic Transhumance: La Mesta

Featured Article

Ecosystem management using livestock: embracing diversity and respecting ecological principles

Logan Thompson,[†] Jason Rowntree,[‡] Wilhelm Windisch,[‖] Sinéad M. Waters,[§] Laurence Shalloo,[§] and Pablo Manzano[¶,*,**]

Journal of Environmental Management 328 (2023) 116966

Contents lists available at ScienceDirect

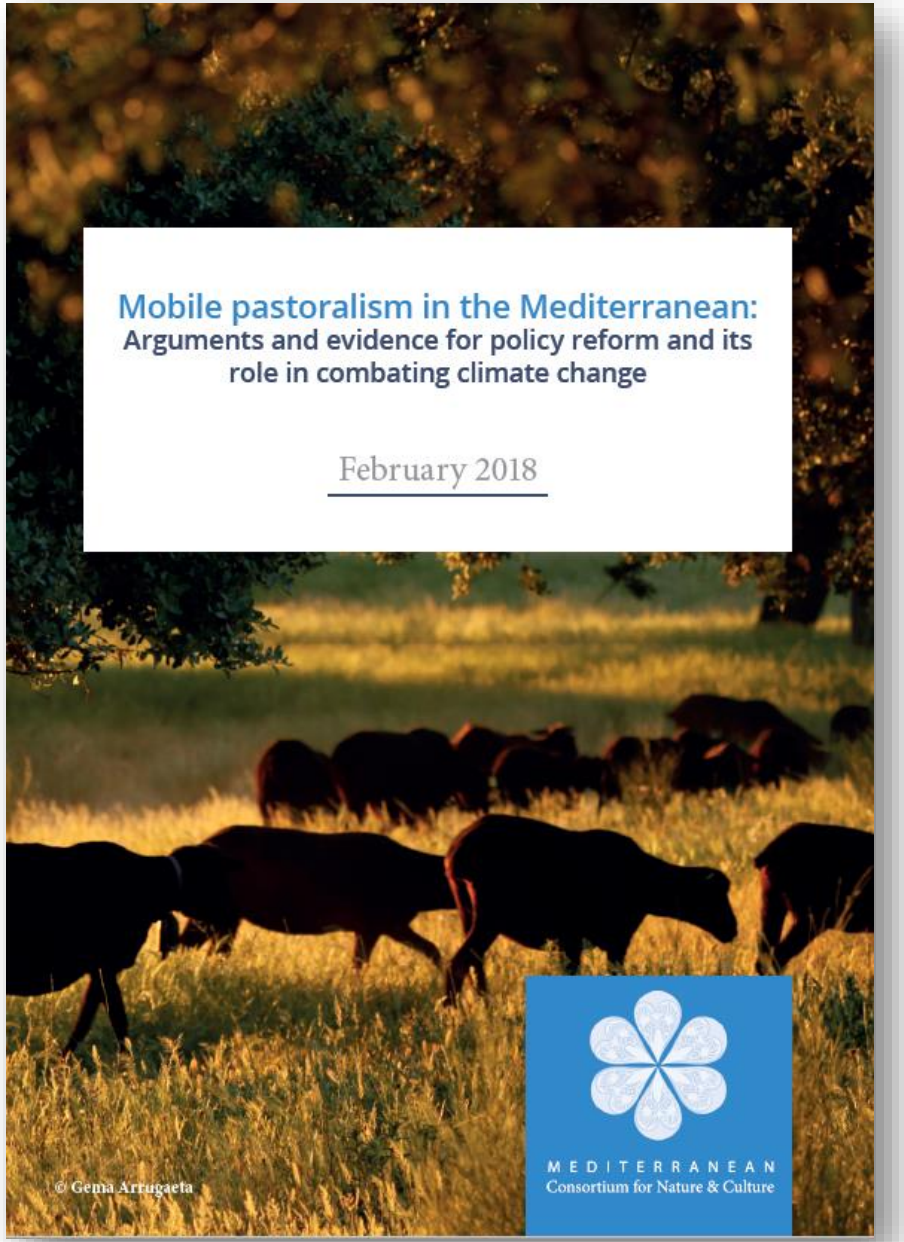
Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Review

Global principles in local traditional knowledge: A review of forage plant-livestock-herder interactions

Abolfazl Sharifian [a,b,f,*], Batdelger Gantuya [b,c], Hussein T. Wario [d], Marcin Andrzej Kotowski [e], Hossein Barani [a], Pablo Manzano [f,g,h,i], Saverio Krätli [j], Dániel Babai [k], Marianna Biró [b], László Sáfián [l], Jigjidsüren Erdenetsogt [m], Qorban Mohammad Qabel [n], Zsolt Molnár [b]



Ecological function: examples

⇒ Seed dispersal

https://doi.org/10.1890/1540-9295(2006)004[0244:ELSDVS]2.0.CO;2

⇒ Nutrient cycling

- Ecosystem senescence
- Associated fauna

https://doi.org/10.1111/j.1600-0706.2010.18602.x

PeerJ

Herbivore corridors sustain genetic footprint in plant populations: a case for Spanish drove roads

Alfredo García-Fernández[1], Pablo Manzano[2,3,4], Javier Seoane[3], Francisco M. Azcárate[3], Jose M. Iriondo[1] and Begoña Peco[3]

[1] Área de Biodiversidad y Conservación, Universidad Rey Juan Carlos, Móstoles, Madrid, Spain
[2] Commission on Ecosystem Management, International Union for Conservation of Nature, Nairobi, Kenya
[3] Terrestrial Ecology Group—Departamento de Ecología, Centro de Investigación en Biodiversidad y Cambio Global (CIBC), Universidad Autónoma de Madrid, Madrid, Spain
[4] HELSUS, Faculty of Biological and Environmental Sciences, University of Helsinki, Helsinki, Finland

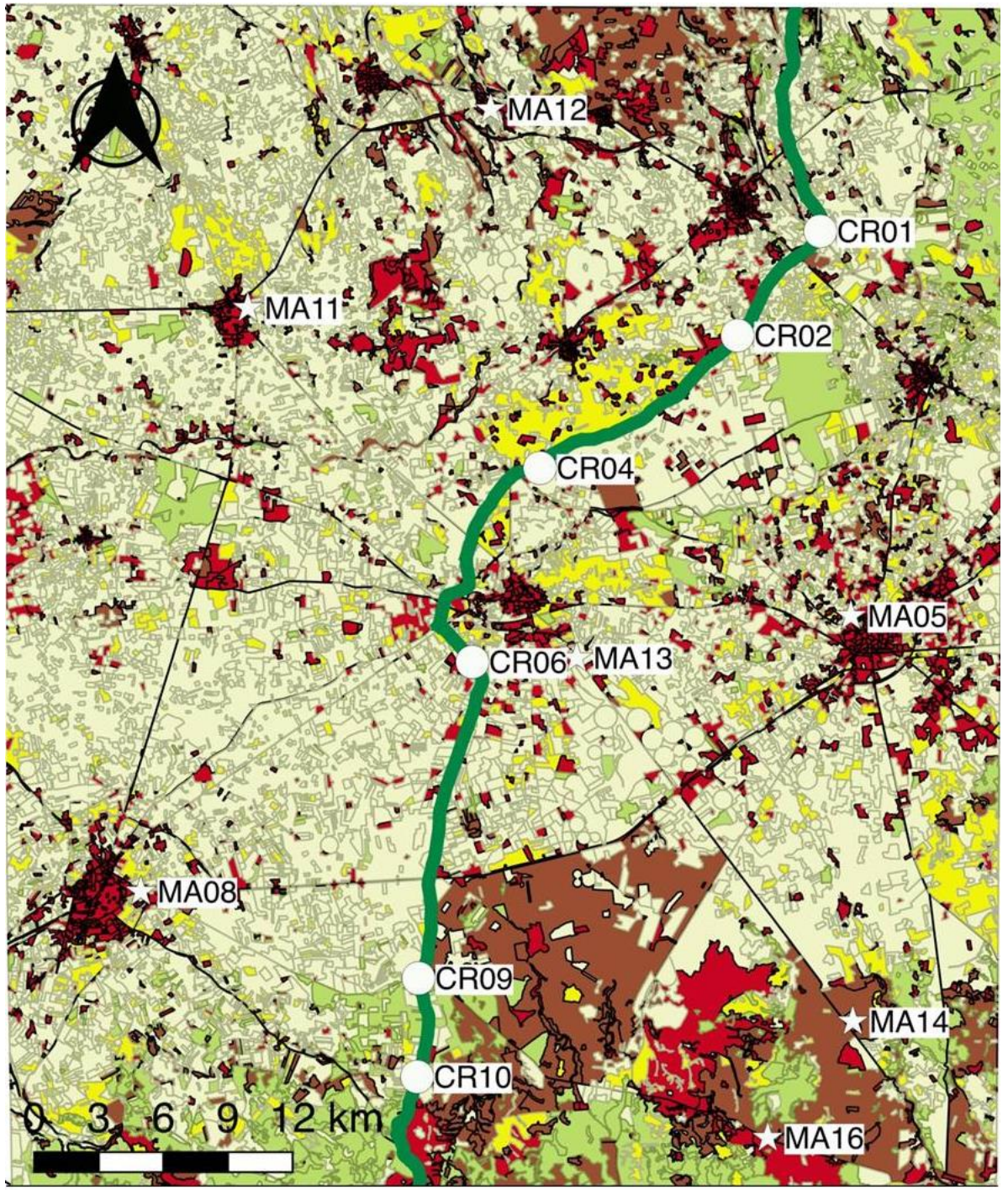
- Dispersal hotspots around settlements

⇒ invasives

- Tangential use by sedentary herds
- Transhumant livestock

⇒ pollen

⇒ seeds



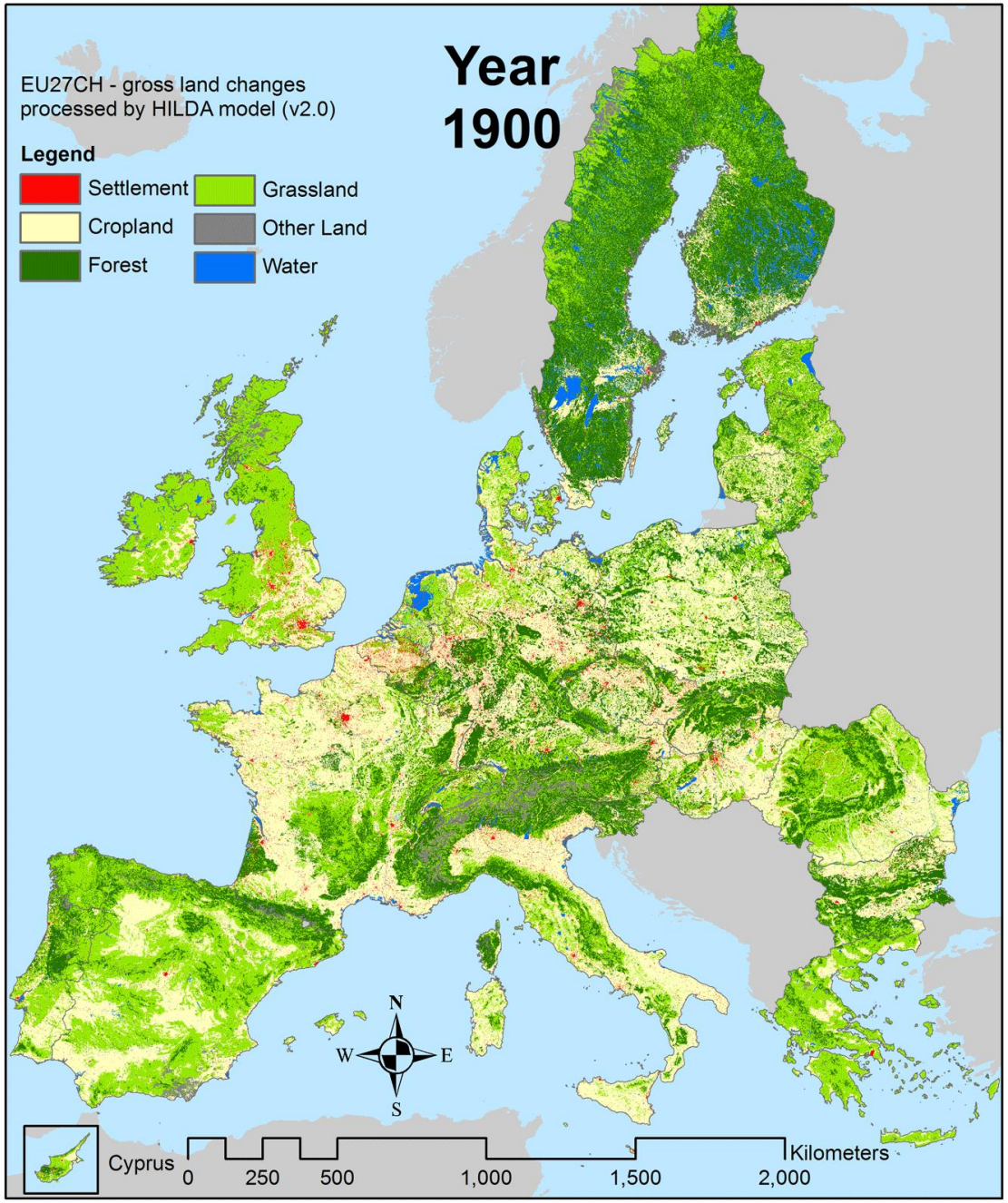
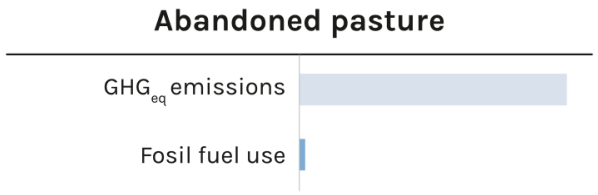


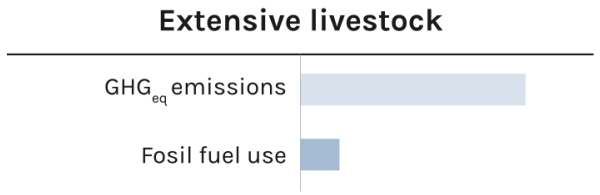
Image source: http://www.publicdomainfiles.com/show_file.php?id=13512805818722

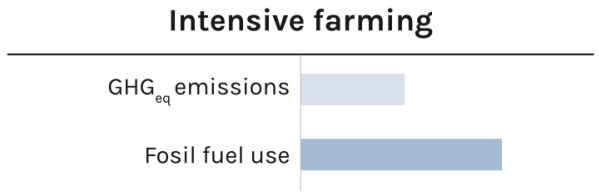
Climate change and livestock

Attributed with 12 % of anthropogenic climate change

Blame particularly on pasture-feed ruminants





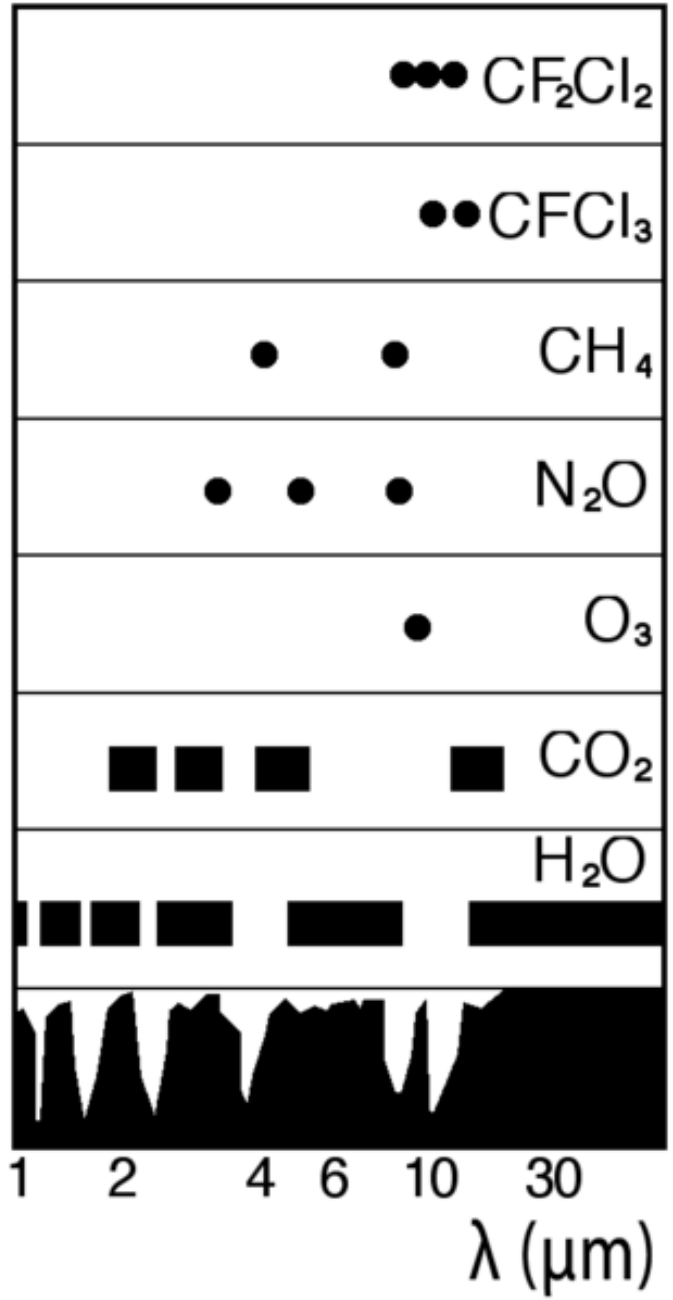


Manzano & White (2019) https://doi.org/10.3354/cr01555

- The main GHG is…

  Water vapor (H_2O)!!

Compound	Formula	Atmospheric concentration (ppm)	Contribution (%)
Water vapor and clouds	H_2O	10–50 000	36–72%
Carbon dioxyde	CO_2	~400	9–26%
Methane	CH_4	~1.8	4–9%
Ozone	O3	2–8	3–7%



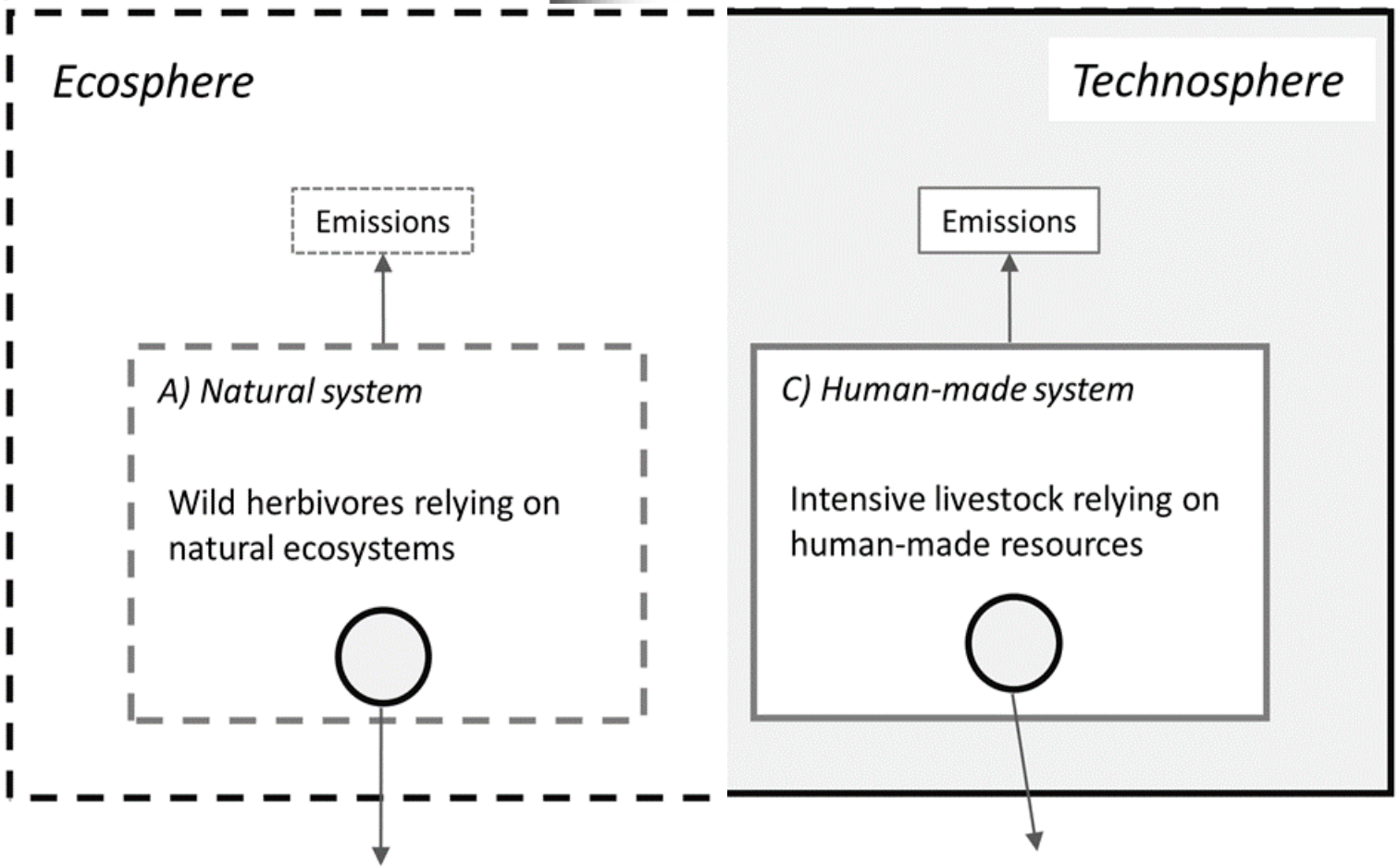
The International Journal of Life Cycle Assessment
https://doi.org/10.1007/s11367-023-02135-3

LCA FOR AGRICULTURE

Carbon footprint of transhumant sheep farms: accounting for natural baseline emissions in Mediterranean systems

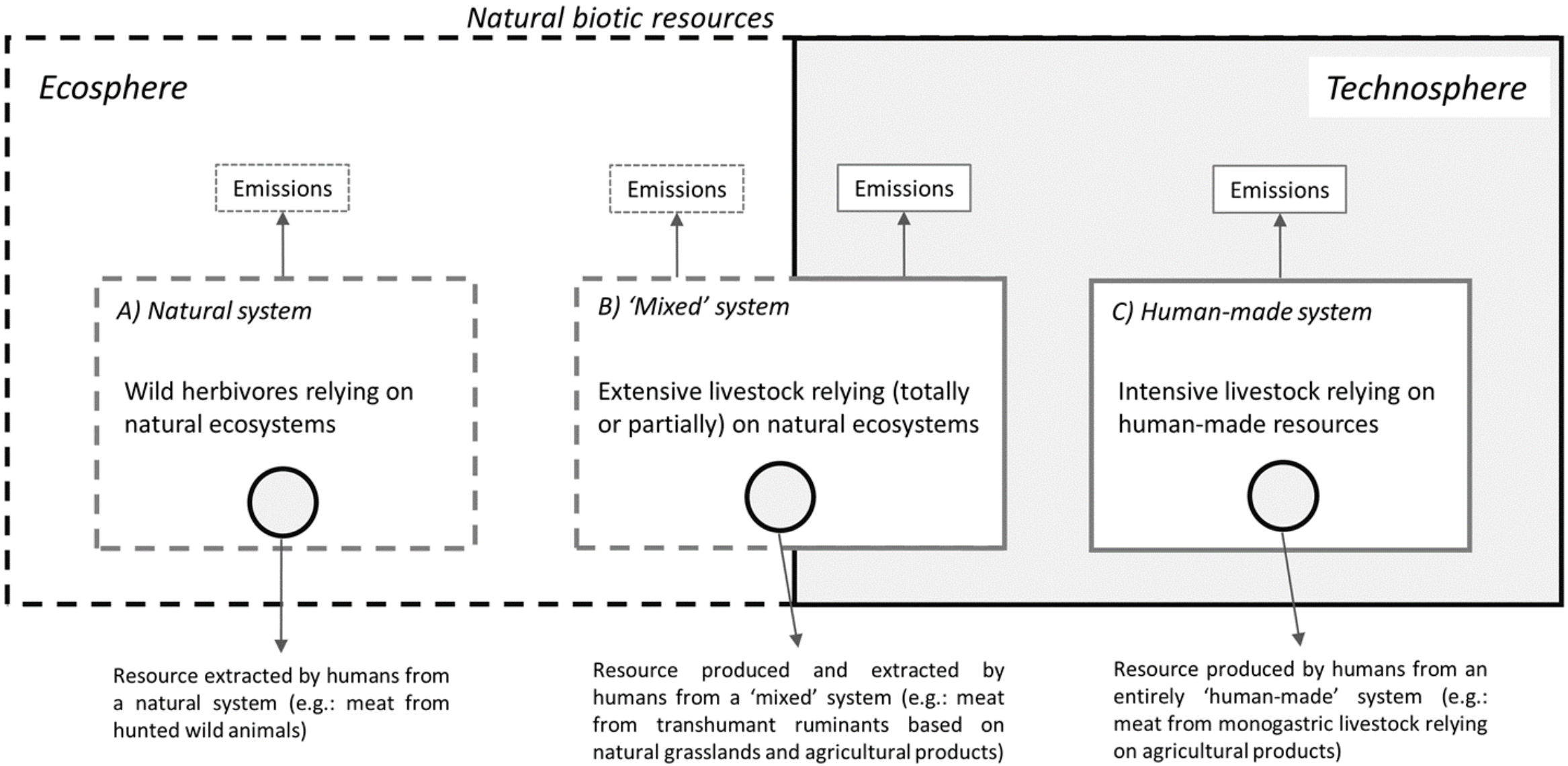
Guillermo Pardo[1] · Raquel Casas[2] · Agustín del Prado[1,3] · |

Received: 12 July 2022 / Accepted: 11 January 2023



The International Journal of Life Cycle Assessment
https://doi.org/10.1007/s11367-023-02135-3

LCA FOR AGRICULTURE



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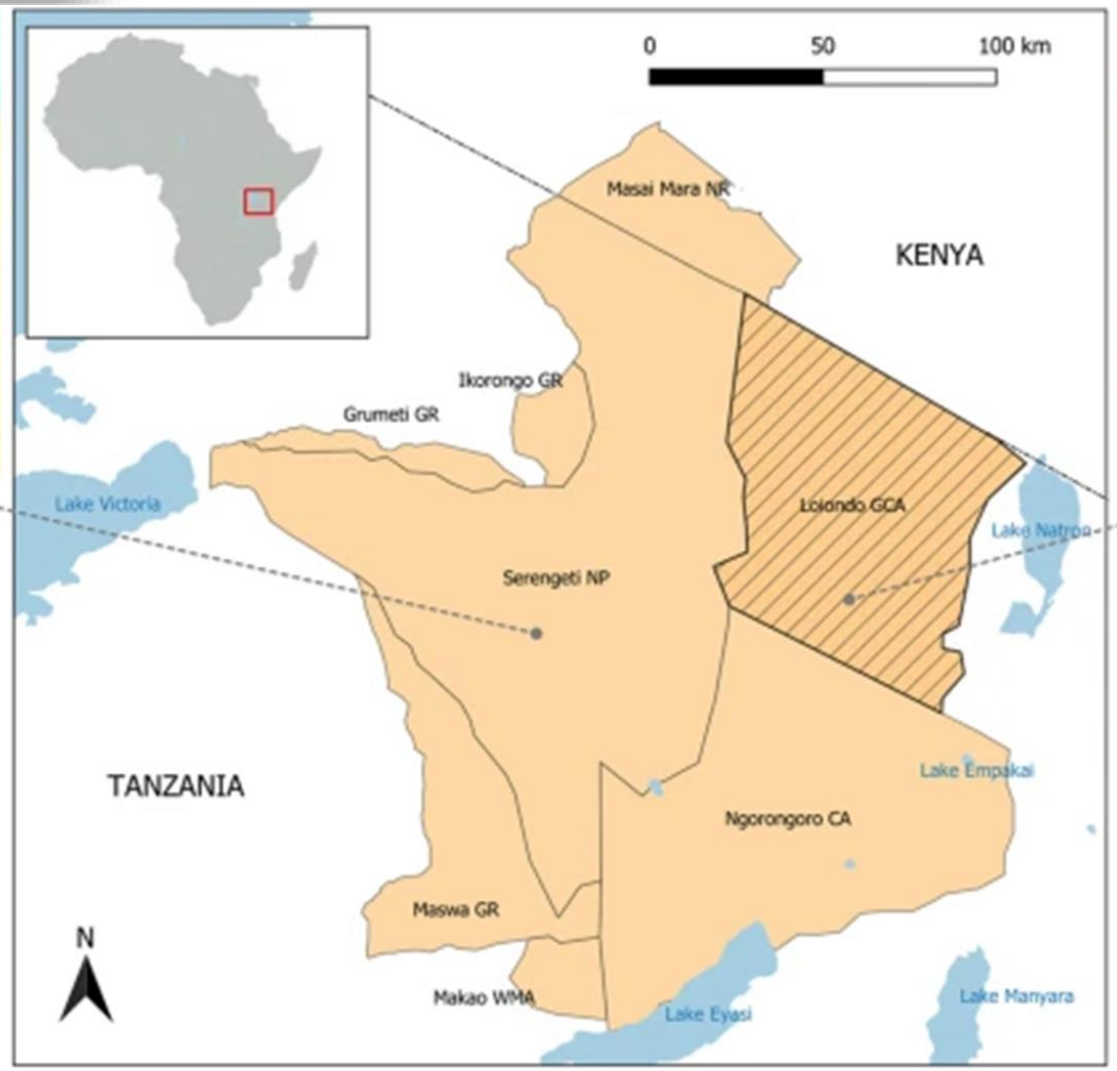
Check for updates

Comparable GHG emissions from animals in wildlife and livestock-dominated savannas

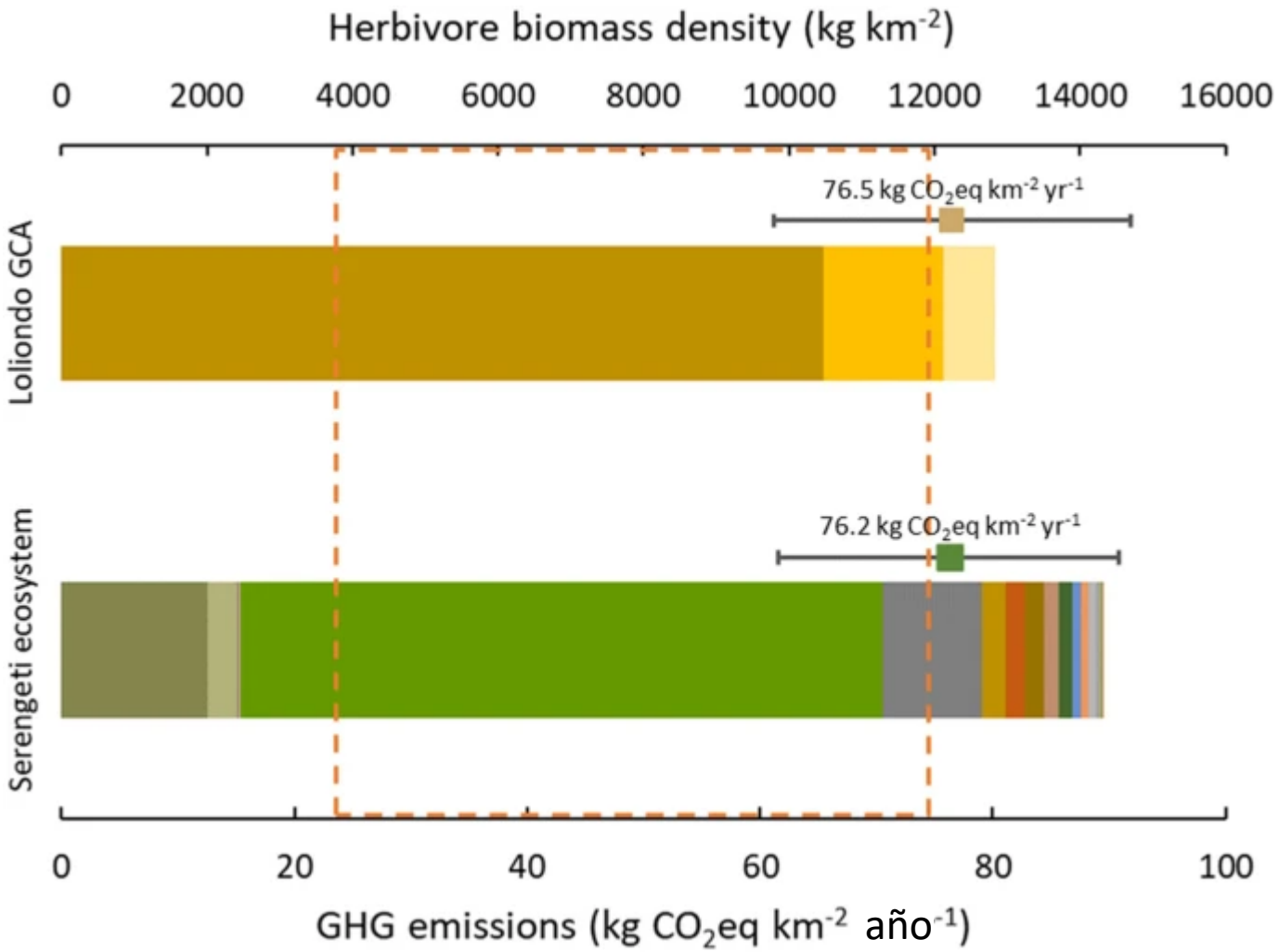
Pablo Manzano [1,2,3,4], Agustín del Prado [3,4] and Guillermo Pardo [3]✉

Case study in East Africa

Wild herbivores



Pastoralism


Herbivore biomass density (kg km-2)
0
2000
4000
6000
8000
10000
12000
14000
16000
76.5 kg CO2eq km-2 yr-1
Loliondo GCA
76.2 kg CO2eq km-2 yr-1
Serengeti ecosystem
0
20
40
60
80
100
GHG emissions (kg CO2eq km-2 año-1)


Wild hindgut fermenters
Zebra
Elephant
Black rhinoceros
Warthog
Wild ruminants
Wildebeest
Buffalo
Giraffe
Thomson's gazelle
Eland
Topi
Impala
Reedbuck
Grant's gazelle
Kongoni
Steenbok
Waterbuck
Duiker
Oribi
Dikdik
Wild non-ruminant foregut fermenters
Hippopotamus
Livestock
Cattle
Sheep & goats
Donkey

Case study in Europe

The International Journal of Life Cycle Assessment
https://doi.org/10.1007/s11367-023-02135-3

LCA FOR AGRICULTURE

Carbon footprint of transhumant sheep farms: accounting for natural baseline emissions in Mediterranean systems

Guillermo Pardo[1] · Raquel Casas[2] · Agustín del Prado[1,3] · Pablo Manzano[1,3,4,5]

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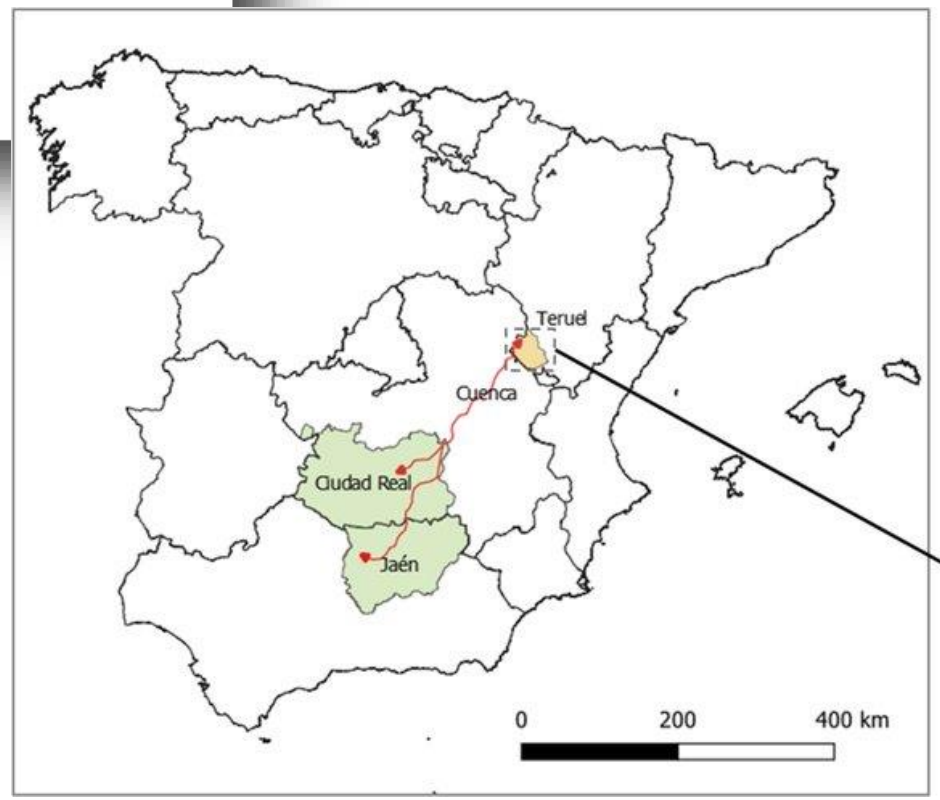
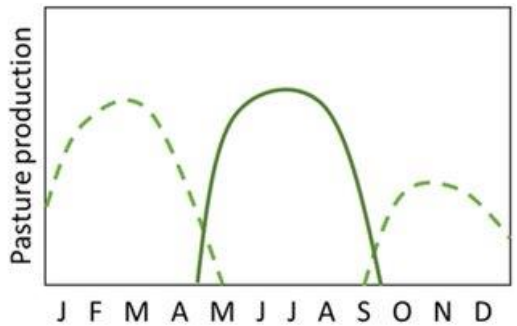




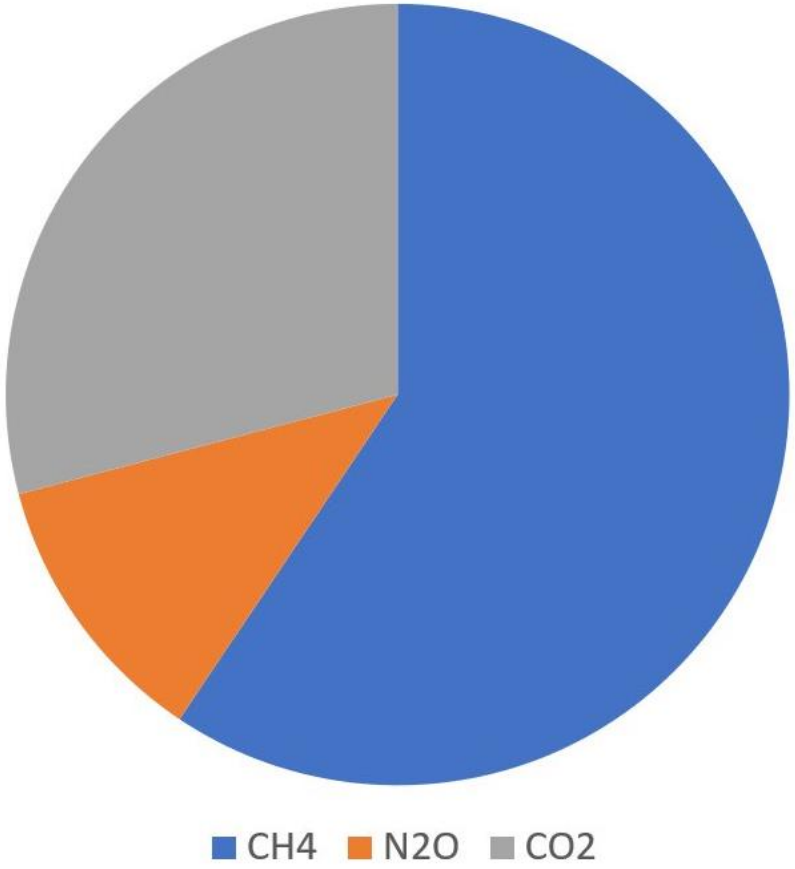
Carbon footprint of transhumant sheep farms:

Table 4 Estimated natural emissions from wild herbivores in Mediterranean grasslands ecosystem and comparison with transhumant grazing-based sheep.

Animal class	Density	Biomass	Enteric CH_4	Manure CH_4+N_2O	TOTAL
	No/km^2	kg/km^2		(Mg CO_2eq/km^2)	
Wild herbivores					
Red deer[1]	32.9	4814	20.5	4.7	25.3
Red deer[2]	32.9	4814	22.0	4.7	26.8
Domestic herbivores					
Transhumant sheep	105.0	5775	42.6	5.1	47.7

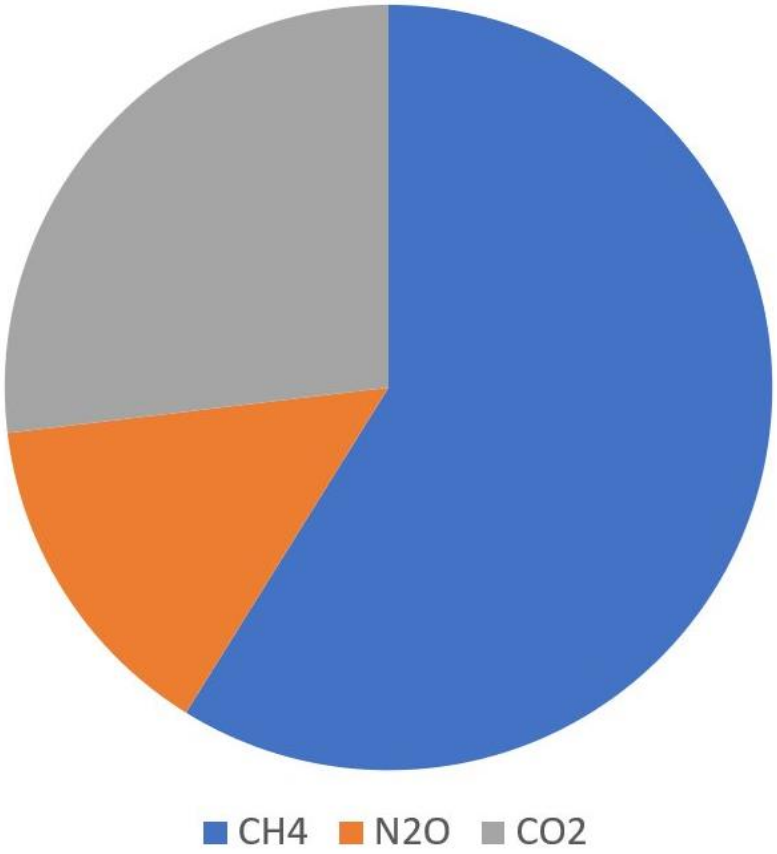
When considering the natural baseline emissions, the CF of transhumant lamb meat is reduced by almost 30%, reaching values quite below those reported for intensive lamb production systems in Spain.

Intensive*



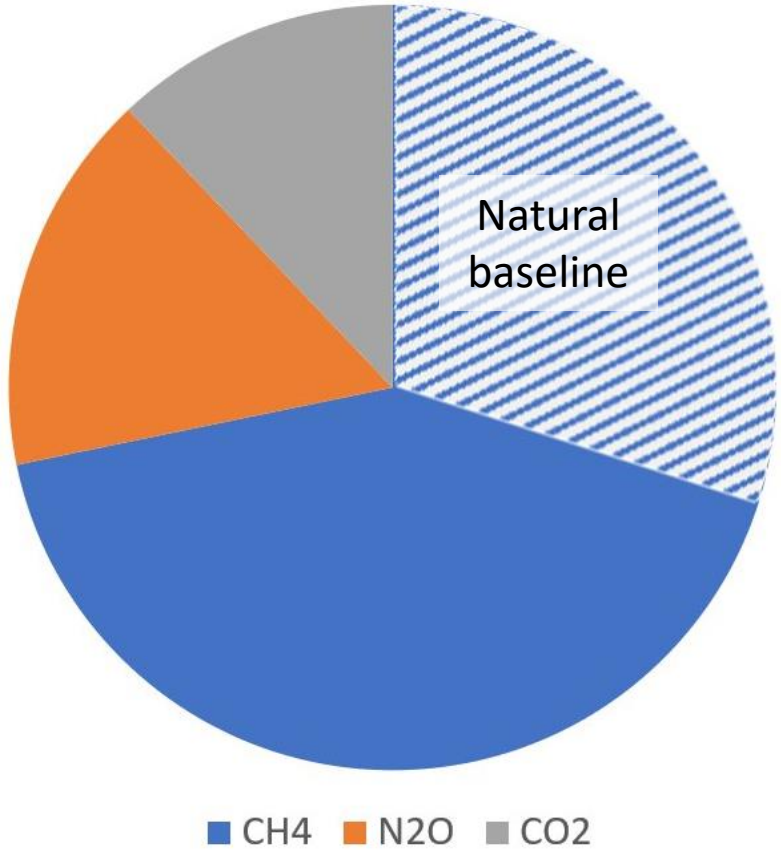
19.5 kg CO_2-eq / kg

Sedentary



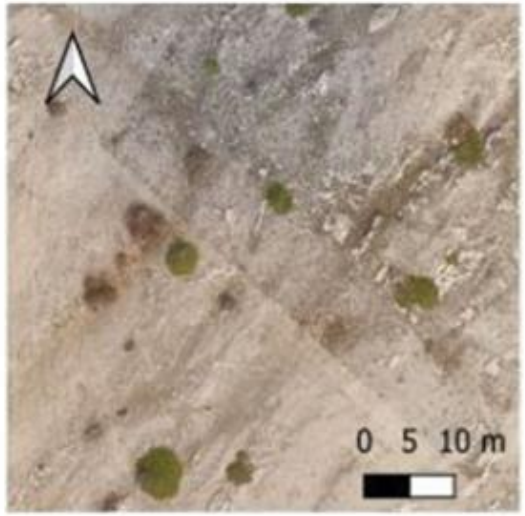
25.1 kg CO_2-eq / kg

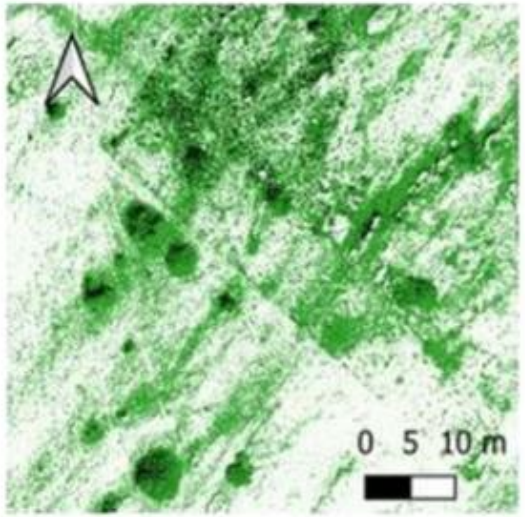
Trashumant



18.2 kg CO_2-eq / kg

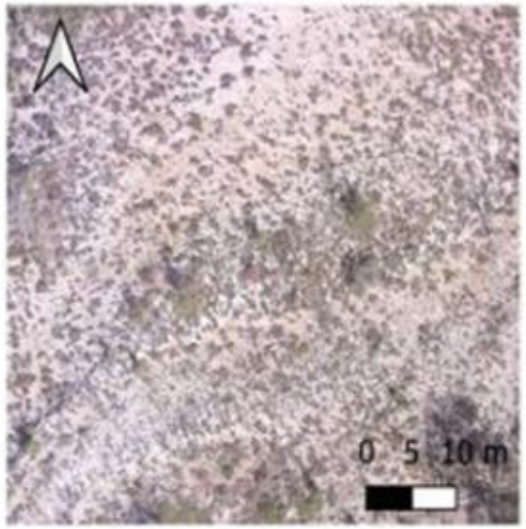
* Source: Ripoll-Bosch et al. 2013
Agr Syst 116: 60–68

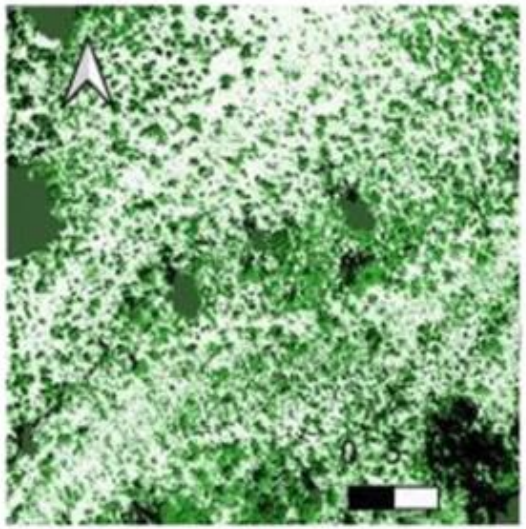




Velamazán et al 2023
https://doi.org/10.1007/s10980-023-01676-0

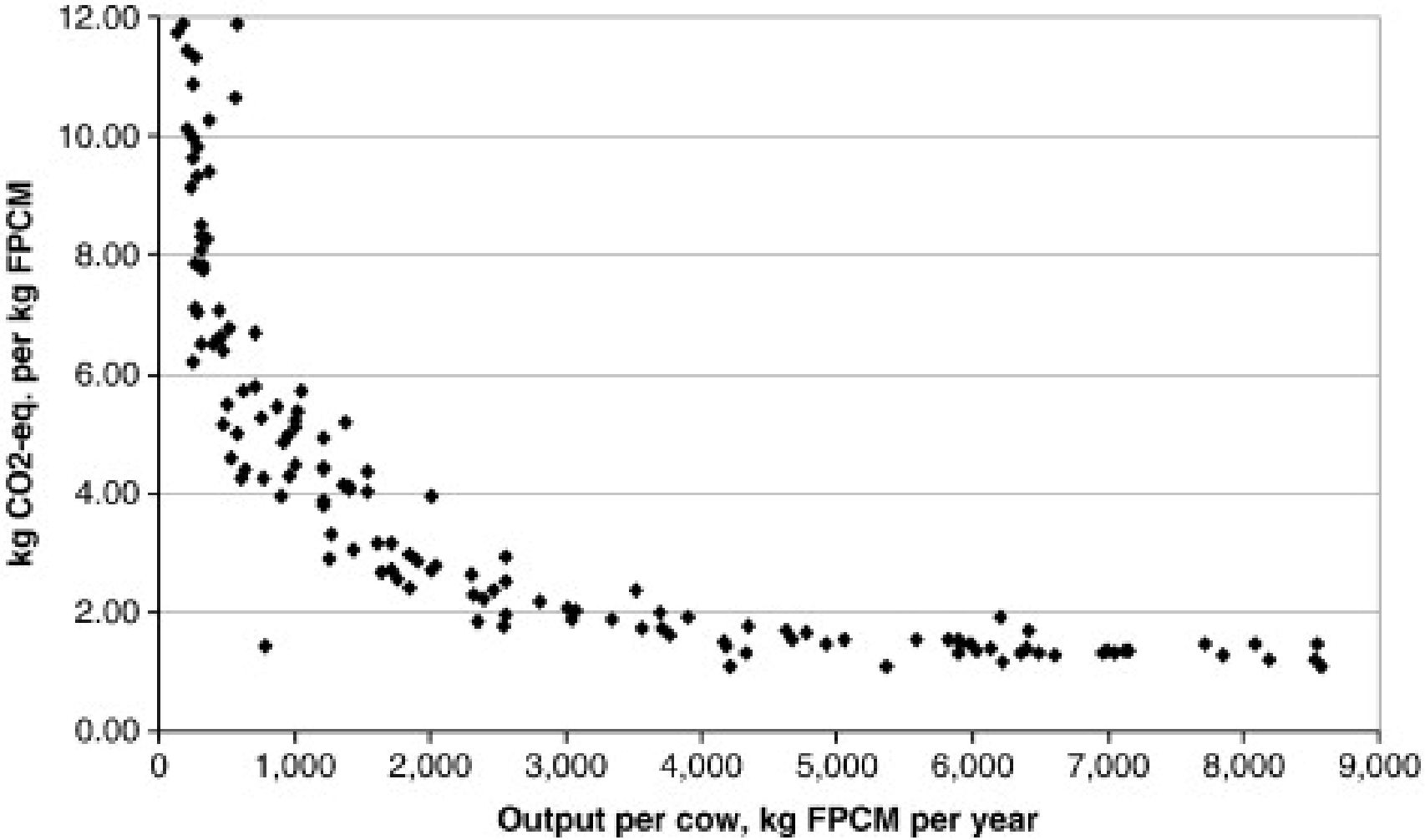
Transhumant Livestock+wild ungulates



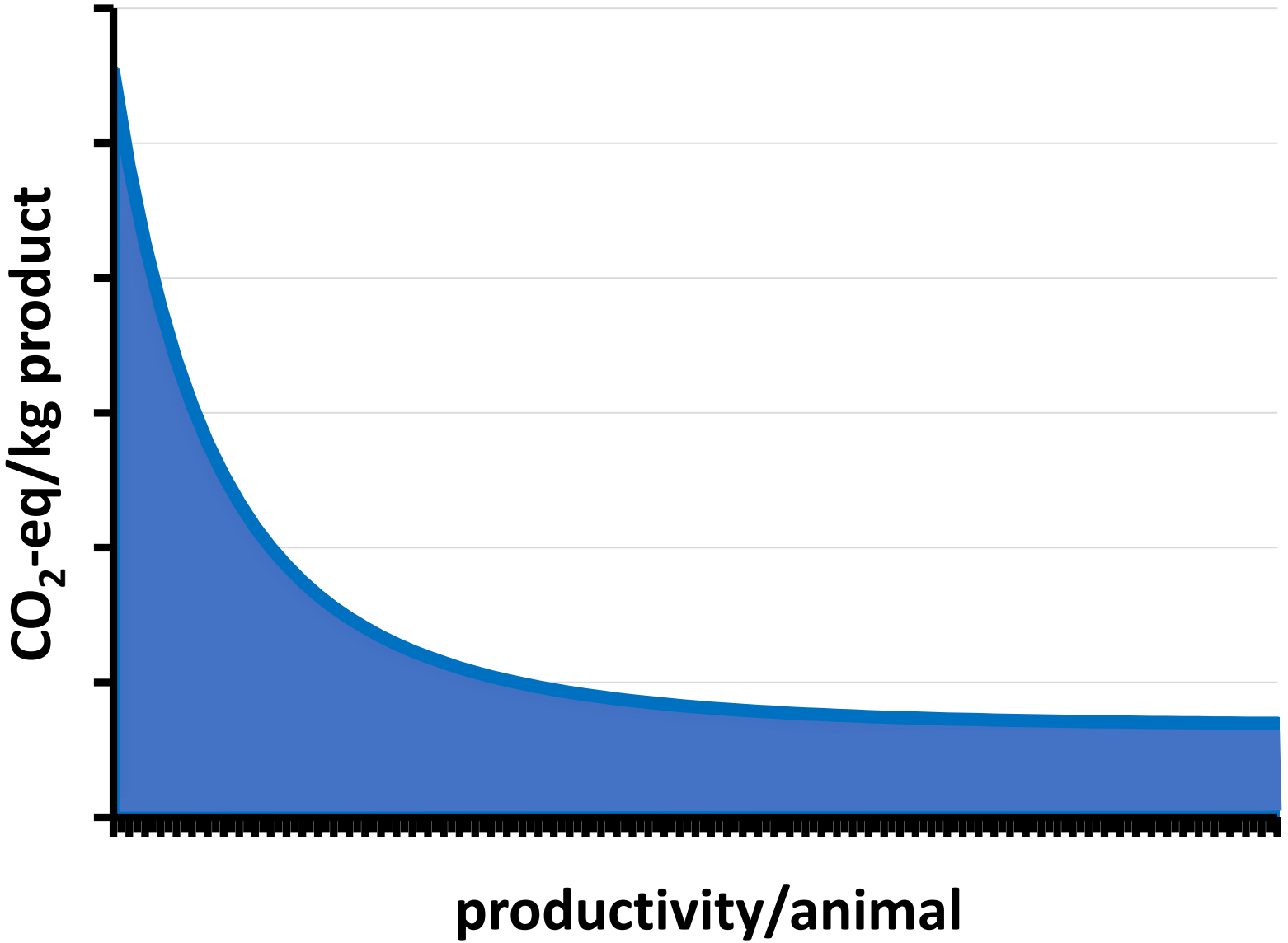


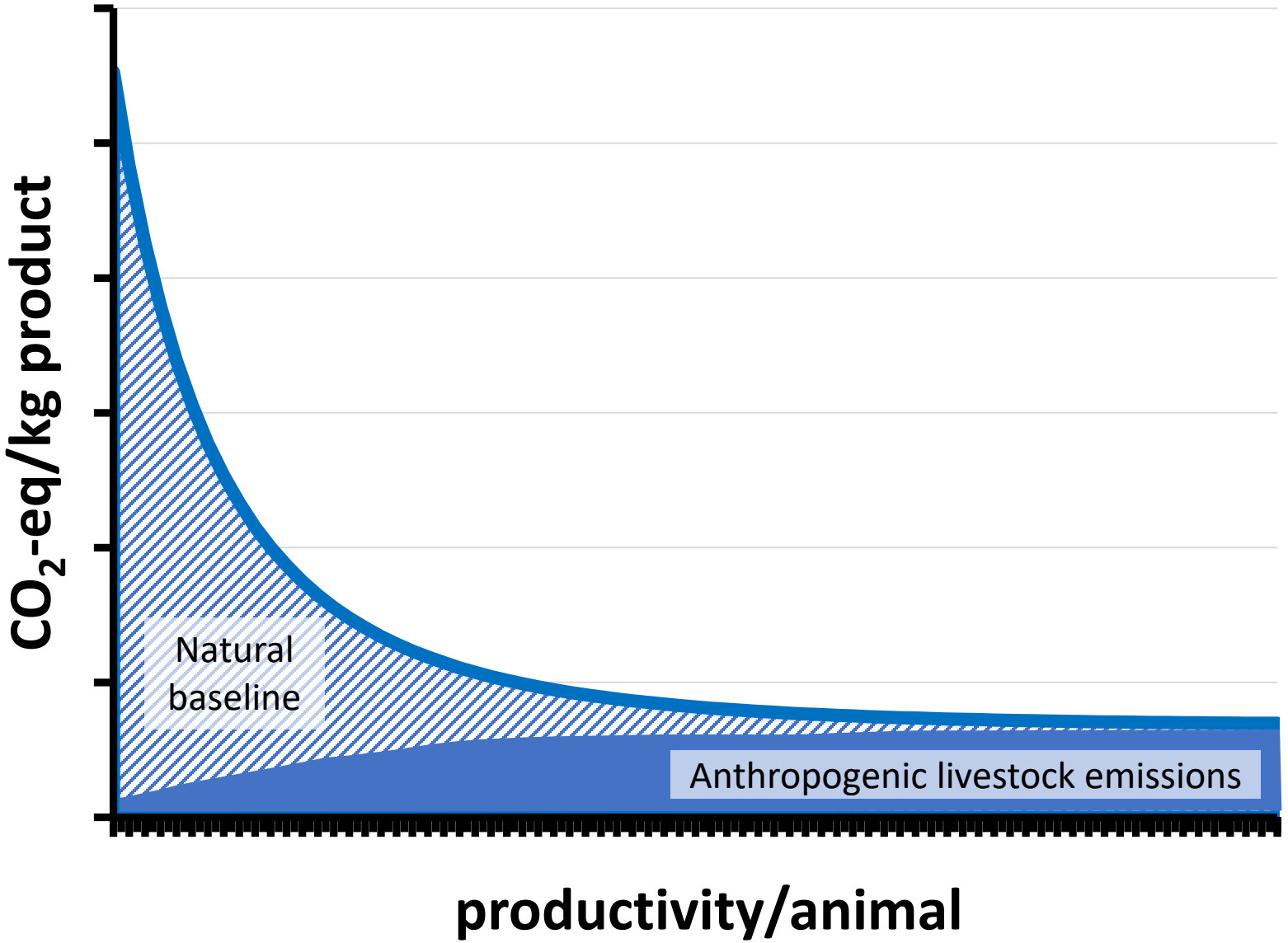
Wild ungulates

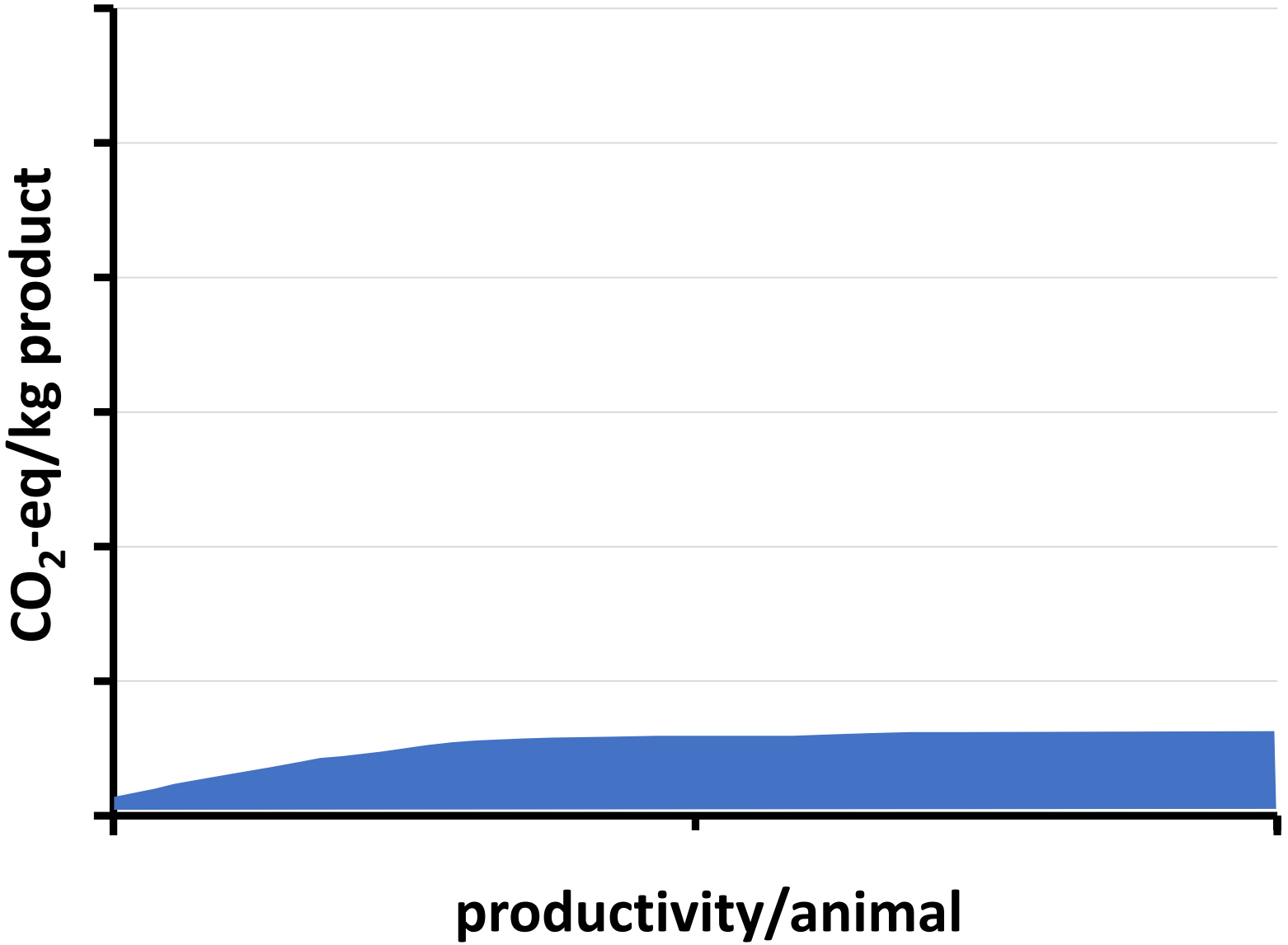
A widespread example of the relationship between productivity & emissions (dairy cattle, Gerber et al. 2011)



https://doi.org/10.1016/j.livsci.2011.03.012

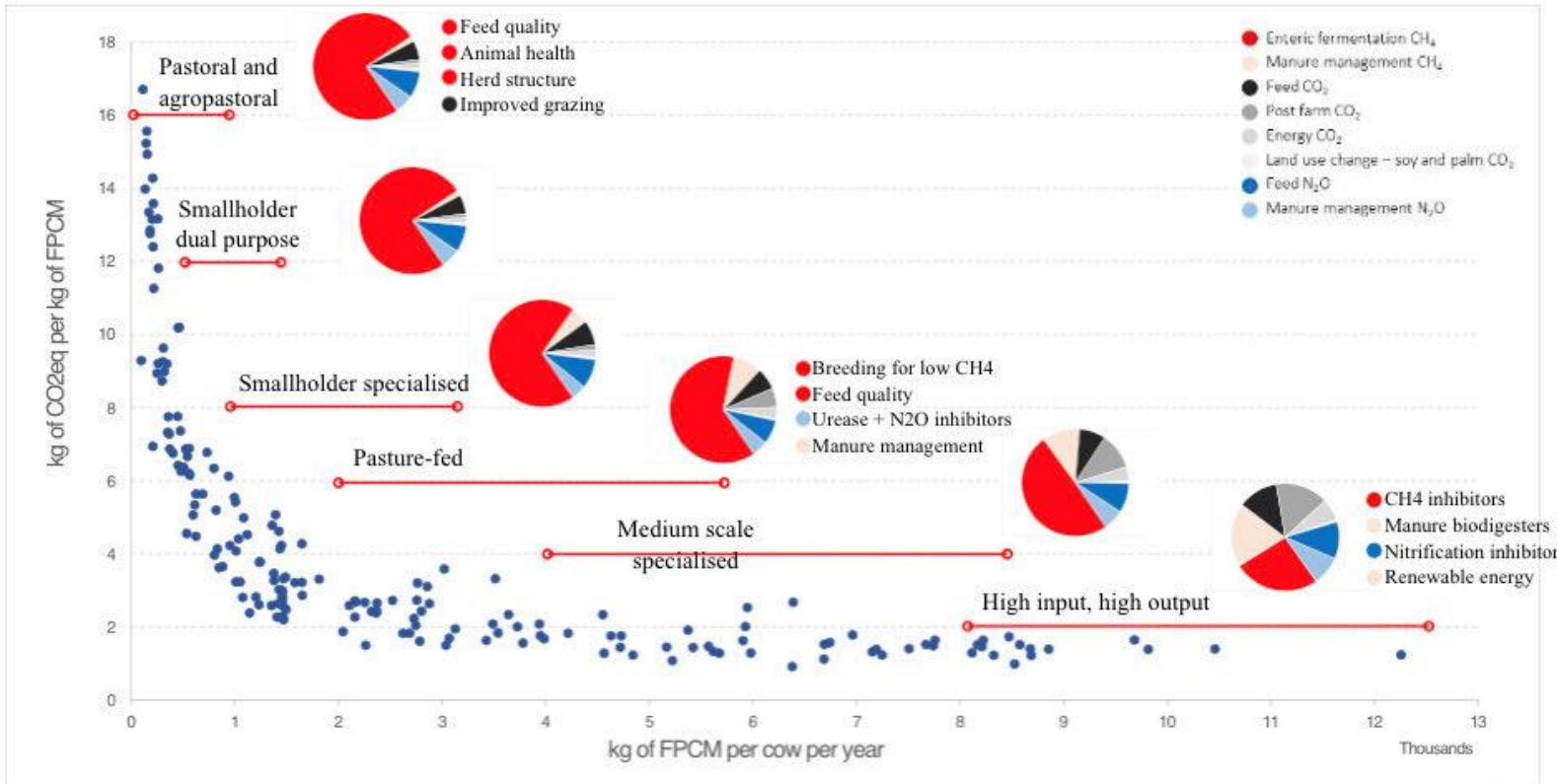

CO_2-eq/kg product
productivity/animal


CO_2-eq/kg product
Natural baseline
Anthropogenic livestock emissions
productivity/animal


CO_2-eq/kg product
productivity/animal

Latest research

PATHWAYS TO DAIRY NET ZERO.



Slide prepared by FAO and GRA
Source: FAO GLEAM 3, unpublished 2020 data

Thank you for your attention!

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With thanks to

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