



Food and Agriculture
Organization of the
United Nations

Assessing multifunctionality of livestock breeds and species at global level

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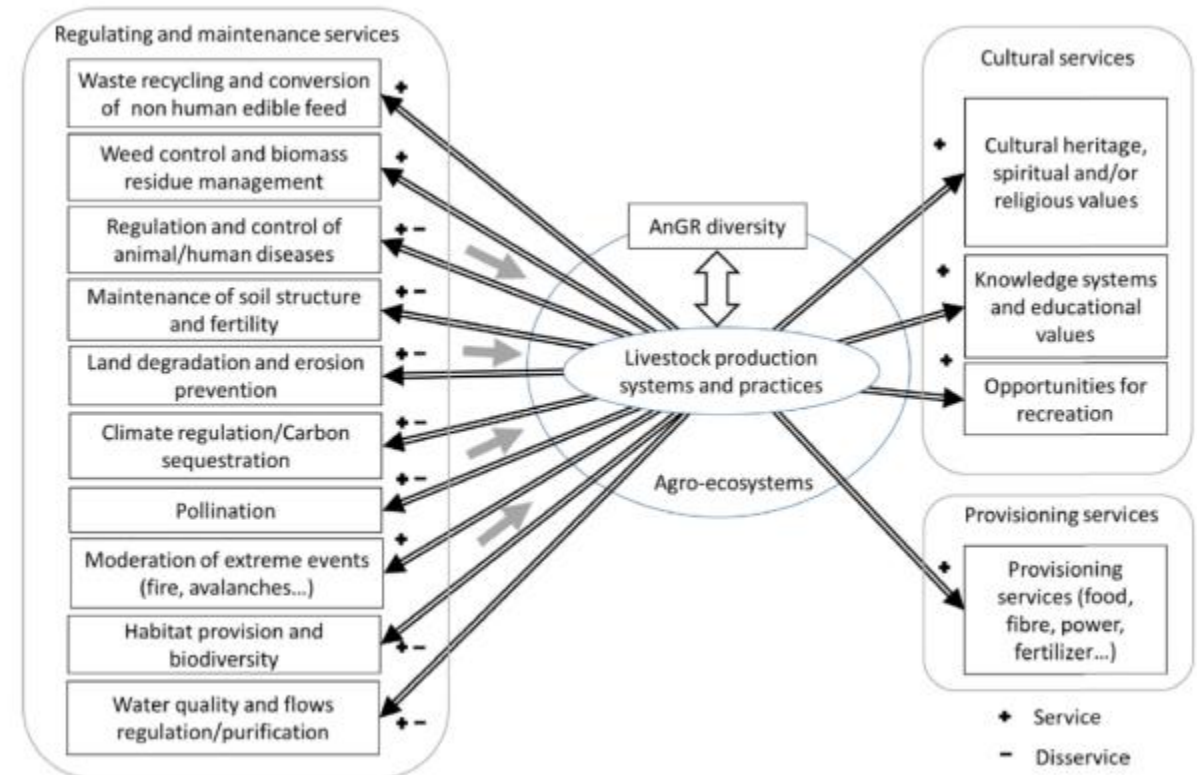
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Multifunctionality of livestock breeds

Livestock linked to variety of positive and negative externalities resulting from the **complex interactions** within production environments

Categories of Ecosystem Services (CICES 2017):

- **provisioning**
- **cultural**
- **regulating and maintenance**



Multifunctionality of livestock breeds

- Some services depend on the **species**.
- **Choice of breed** or species can regulate the provision of specific ES.
- Animal genetic resources sometimes considered as ES in themselves.



Main reason for preference (%)	Preferred breed		
	N'Dama (n=57)	Crossbred (n=48)	Fulani Zebu (n=55)
Market price	0	35	49
Disease resistance	30	18	0
Body size	0	15	16
Low raising cost	27	0	0
Milk yield	0	6	18
Tolerance to feed shortage	18	2	0
Other	25	24	17

Reported main reason for preferring a cattle breed group in Mali (Traore et al. 2017)

Material & Methods

Data

The Domestic Animal Diversity Information System **DAD-IS** developed by the Food and Agriculture Organization of the United Nations (FAO)

Information on more than 15,000 national breed populations of 37 livestock species

- Allows provision of data on ecosystem services (ES)
- Officially nominated National Coordinators provide data

41 countries provided information on to **3361 national populations of 27 species on 52 ES** (FAO 2022).



Data analyses

Proxy for Multifunctionality: **Number of** cultural, provisioning, regulating, maintenance **ES** and total number of ES reported **per national breed population**.

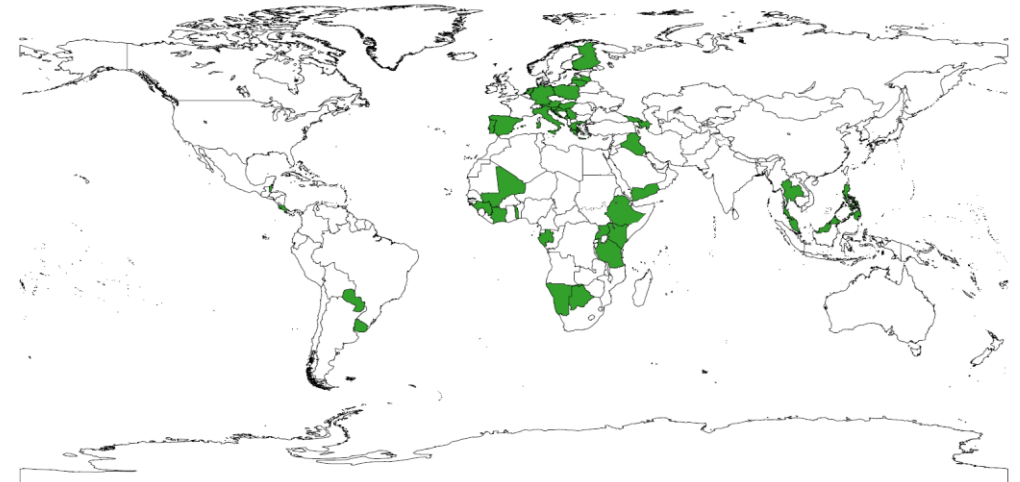
Generalized linear mixed effects model (R glmer function) with Poisson distribution.

Model 1: region, species, and breed adaptedness class fixed effects & country as random effect

Model 2: subset of 406 national breed with information on management systems, additional fixed effect: Back Yard/Farm Yard, Extensive, Semi intensive, Intensive, and Not for Production

Tetrachoric correlations (inferred Pearson correlations for binary variables) between ES (R tetrachoric function).

Multivariate factorial analysis was also undertaken (R function MFA).



		Cultural		Provisioning		Regulating and maintenance		Total	
Results		Avg	Est	Avg	Est	Avg	Est	Avg	Est
Model 1	Intercept		-1.22**		1.06***		-0.99 ^{NS}		1.39***
	Region								
	Africa	0.91	0 ^a	3.95	0 ^a	1.64	0 ^a	6.51	0 ^a
	Europe	0.71	-0.72 ^a	1.88	-0.56 ^b	1.36	-0.59 ^a	3.96	-0.48 ^a
	Other regions	0.68	-0.34 ^a	2.43	-0.11 ^{ab}	0.7	-1.23 ^a	3.82	-0.17 ^a
	Adaptedness								
	Native	0.92	0 ^a	3.03	0 ^a	2.02	0 ^a	5.97	0 ^a
	Locally adapted	0.62	-0.06 ^a	2.39	-0.13 ^b	1.1	-0.19 ^b	4.1	-0.14 ^b
	Exotic	0.69	-0.45 ^b	1.68	-0.41 ^c	0.54	-0.45 ^c	2.9	-0.44 ^c
	Unknown	0.38	-0.77 ^b	2.1	-0.42 ^c	1.45	-0.1 ^{ab}	3.93	-0.38 ^c
	Species								
	Cattle	0.44	0 ^{de}	3.35	0 ^a	1.65	0 ^a	5.43	0 ^b
	Goat	0.49	0 ^{de}	2.95	-0.17 ^b	2.24	0.11 ^a	5.68	-0.05 ^{bc}
	Sheep	0.4	-0.4 ^e	2.58	-0.15 ^b	1.96	0.11 ^a	4.93	-0.06 ^{bc}
	Pig	0.45	0.05 ^{de}	2.18	-0.2 ^b	0.72	-0.37 ^b	3.36	-0.24 ^d
	Horse	2.47	1.8 ^a	1.73	-0.44 ^c	1.09	-0.34 ^b	5.3	0.12 ^a
	Rabbit	0.87	0.98 ^b	1	-0.69 ^d	0.23	-1.58 ^d	2.1	-0.51 ^e
	Other mammals	1.23	0.82 ^b	3.29	-0.15 ^b	1.81	-0.49 ^b	6.34	-0.12 ^{cd}
	Chicken	0.72	0.48 ^c	1.84	-0.53 ^{cd}	0.65	-0.94 ^c	3.2	-0.5 ^e
	Other birds	0.45	-0.18 ^{cd}	1.66	-0.48 ^{cd}	0.77	-0.82 ^c	2.87	-0.47 ^e
74 th Annual M	Total	0.75		2.39		1.32		4.46	

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Results

Model 2

	Cultural		Provisioning		Regulating and maintenance		Total	
	Avg	Est	Avg	Est	Avg	Est	Avg	Est
Intercept		-0.63 ^{NS}		1.14 ^{***}		-0.63 ^{NS}		1.59 ^{***}
Management systems								
Back Yard / Farm Yard	0.78	0.72 ^{**}	1.53	0.03 ^{NS}	0.53	-0.03 ^{NS}	2.12	0.25 [*]
Extensive	1.03	0.1 ^{NS}	2.93	0 ^{NS}	1.76	0.24 ^{NS}	5.68	0.2 [*]
Semi-Intensive	0.96	-0.21 ^{NS}	2.37	-0.1 ^{NS}	1.16	0.2 ^{NS}	4.48	0.04 ^{NS}
Intensive	0.18	-1.32 ^{***}	2.22	-0.04 ^{NS}	0.74	0.06 ^{NS}	3.13	-0.08 ^{NS}
Not for production	0.51	-0.19 ^{NS}	1.28	0 ^{NS}	0.05	-2.1 ^{**}	1.52	-0.16 ^{NS}
Total	0.85		2.30		1.16		4.02	

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Conclusions

Use of DAD-IS data allowed for a holistic analysis of how ES related to livestock are recognized, putting each of these ES on an equal footing.

BUT:
Identifying and quantifying ES remains challenging

- some of these uses and ES are highly correlated
- recognition of ES is rather subjective
- structure of the dataset – only few transboundary breeds
- disentangling effects not always possible



Conclusions

Main findings

- number of reported ES follows a **gradient from exotic breeds to locally adapted and native breeds** and **from intensive to semi-intensive and extensive systems**
- results confirm the contrast between **specialized and intensive production systems** that raise highly productive **exotic breeds** and **extensive multipurpose systems** that use **native breeds**



Conclusions

Policies can influence farmers' decisions

- livestock policies (e.g. in the face of mitigation of CC and increased demand) aimed at supporting the adoption of highly productive breeds by producers may lead to a decrease in the multifunctionality of local livestock production systems and loss of certain breeds.

Therefore,

- actions must be carefully assessed taking into account the impact they may have on livelihoods and the environment.
- **assessment of ES** and how they are regulated by current practices should be a **prerequisite for any livestock development intervention.**
- Multidisciplinary participation/broad involvement of stakeholders with a role in related food systems needed.

We need more and better data to base decisions on facts!





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SUSTAINABLE
DEVELOPMENT
GOALS

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25-27 September 2023



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