These slides with links:
landscapemodelling.net/pres/RGS24

# Global mapping of human fire use and management from new databases and models

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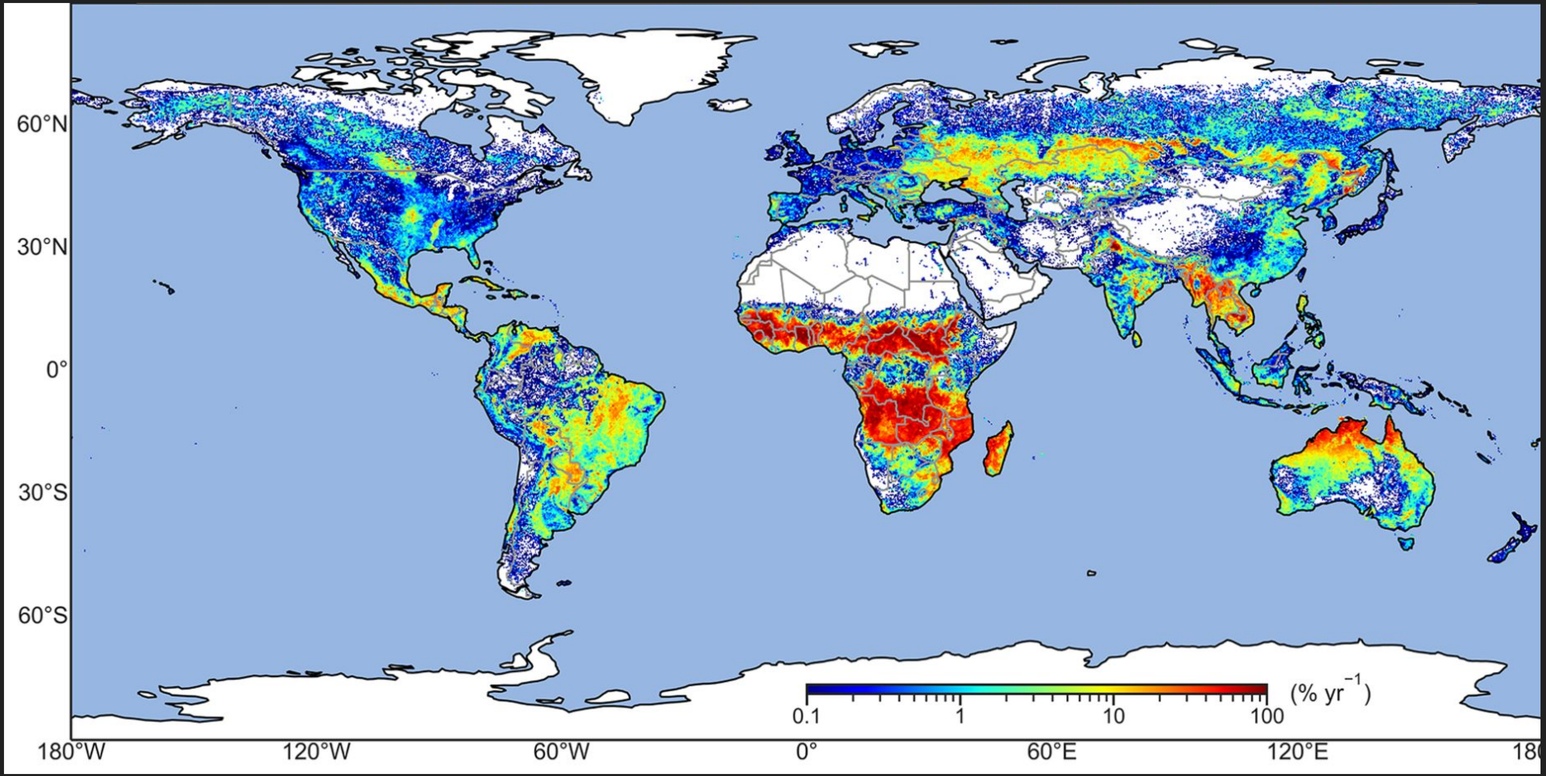
28 Aug 2024, Royal Geographical Society Annual Conference

KING'S College LONDON Geography
ROYAL HOLLOWAY UNIVERSITY OF LONDON
LEVERHULME Centre for Wildfires, Environment and Society

# Global Burned Area (from space)




GFED 0.25° (~25 km at equator)
Annual mean %/yr

Paper: Chen *et al.* 2024 | Data: *via* Zenodo

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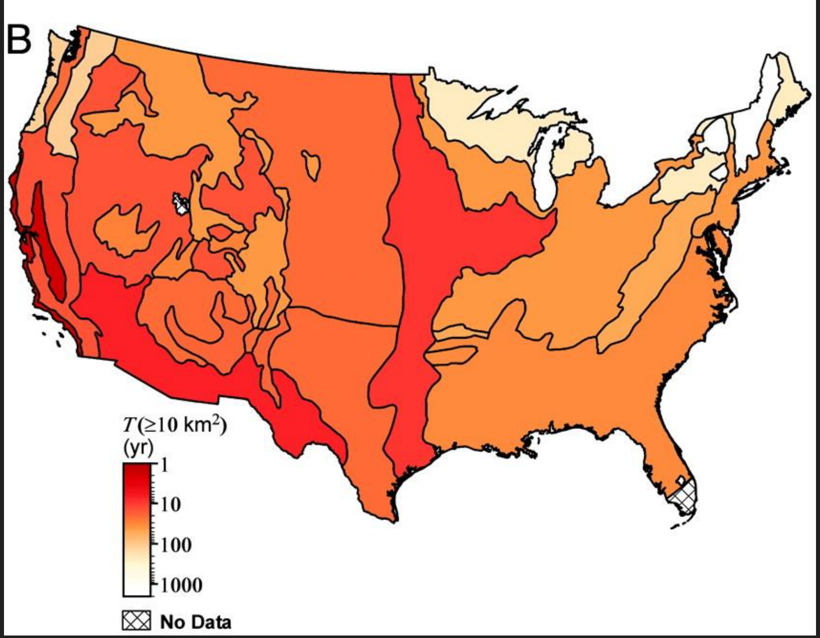
# Burned Area (from government data)

USFS and US DOI recorded 657,949 wildland fires (1970-2000)

Malamud *et al.* (2005) used 88,916 USFS fires >1 acre to map fire regimes by ecoregion

- 64% were classified as human caused: ‘campfire’, ‘arson’, ‘miscellaneous’ and ‘smoking’




Recurrence intervals for fires >10 km2 per 1,000 km2

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# Diverse Empirical Research

**Burning the Seasonal Mosaic: Preventative Burning Strategies in the Wooded Savanna of Southern Mali**

**Paul Laris**[1]

*Human Ecology, Vol. 30, No. 2, June 2002 (© 2002)*

*Data are presented indicating a seasonal mosaic pattern of burning in the savanna of southern Mali. A seasonal mosaic is a landscape that is annually*

Land Use Policy 47 (2015) 448–458

Contents lists available at ScienceDirect

Land Use Policy

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

ELSEVIER

**Why do farmers burn rice residue? Examining farmers' choices in Punjab, Pakistan**

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ABSTRACT

Burning agriculture residues has ...
carbon and contri...

ELSEVIER

Journal of Environmental Management 82 (2007) 481–494

Journal of Environmental Management

www.elsevier.com/locate/jenvman

**Cattle-rangeland management practices and perceptions of pastoralists towards rangeland degradation in the Borana zone of southern Ethiopia**

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*Department of Animal, Wildlife and Grassland Sciences, University of the Free State, P.O. Box 339, Bloemfontein 9300, Republic of South Africa*

Received 7 March 2004; received in revised form 12 January 2006; accepted 13 January 2006
Available online 17 April 2006

**Abstract**

A survey was conducted in the Borana pastoral areas of southern Ethiopia to assess current ... management practices and the perceptions of the pastoralists ... future pastoral development ...

**Wildlife Biology 2017: wlb.00318**
doi: 10.2981/wlb.00318

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Subject Editor: Erlend Nilsen. Editor-in-Chief: Ilse Storch. Accepted 25 September 2017

Communications

**Managing grassland for wildlife: the effects of rotational burning on tick presence and abundance in African savannah habitat**

**Anne E. Goodenough, Alison N. Harrell, Rachel L. Keating, Richard N. Rolfe, Hannah Stubbs, Lynne MacTavish and Adam G. Hart**

*A. E. Goodenough (aegoodenough@glos.ac.uk), A. N. Harrell, R. L. Keating, R. N. Rolfe, H. Stubbs and A. G. Hart, Natural and Social Scie... Univ. of Gloucestershire, Francis Close Hall, Cheltenham, GL50 4AZ, UK. – L. MacTavish, Mankwe Wildlife Reserve, Northwest Prov... South Africa.*

...mals through blood loss and vectoring dis-
...h where ticks are

# New Databases and Models

## DAFI
Database of Anthropogenic Fire
Millington *et al.* (2022)

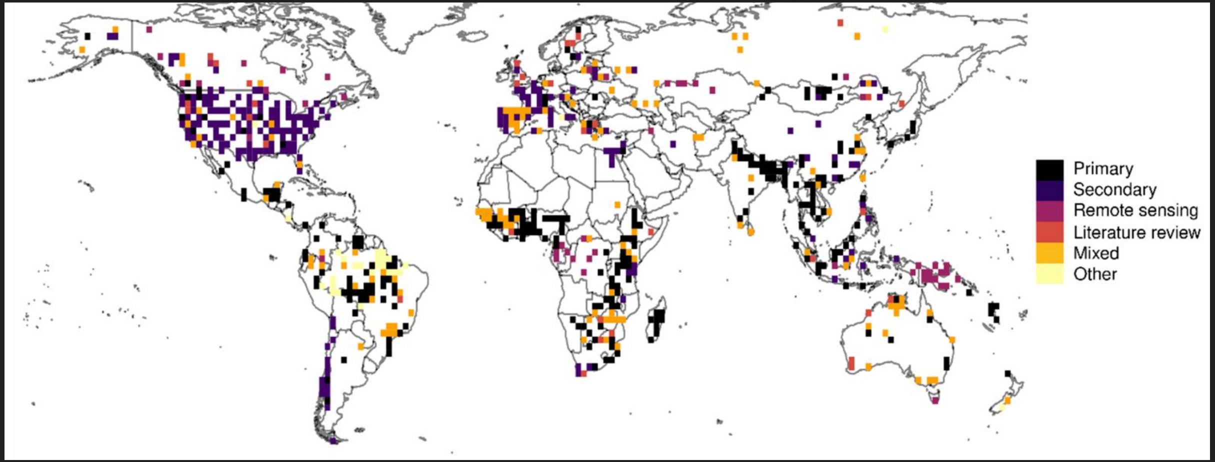
## LIFE
Livelihood Fire Database
Smith *et al.* (2022)

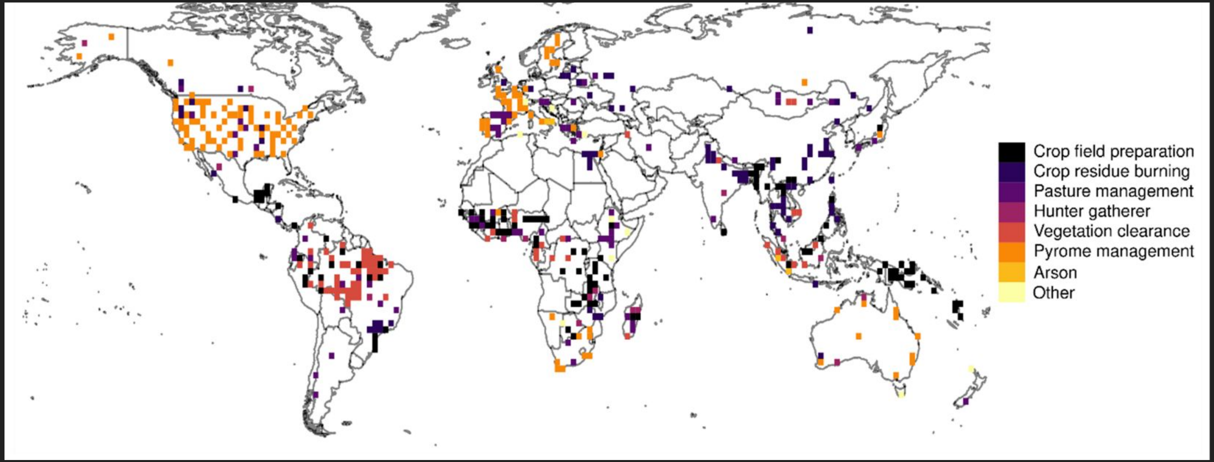
## GFUS
Global Fire Use Survey
Smith *et al.* (in review) [data online]

## WHAM!
Wildfire Human Agency Model
Perkins *et al.* (2024)

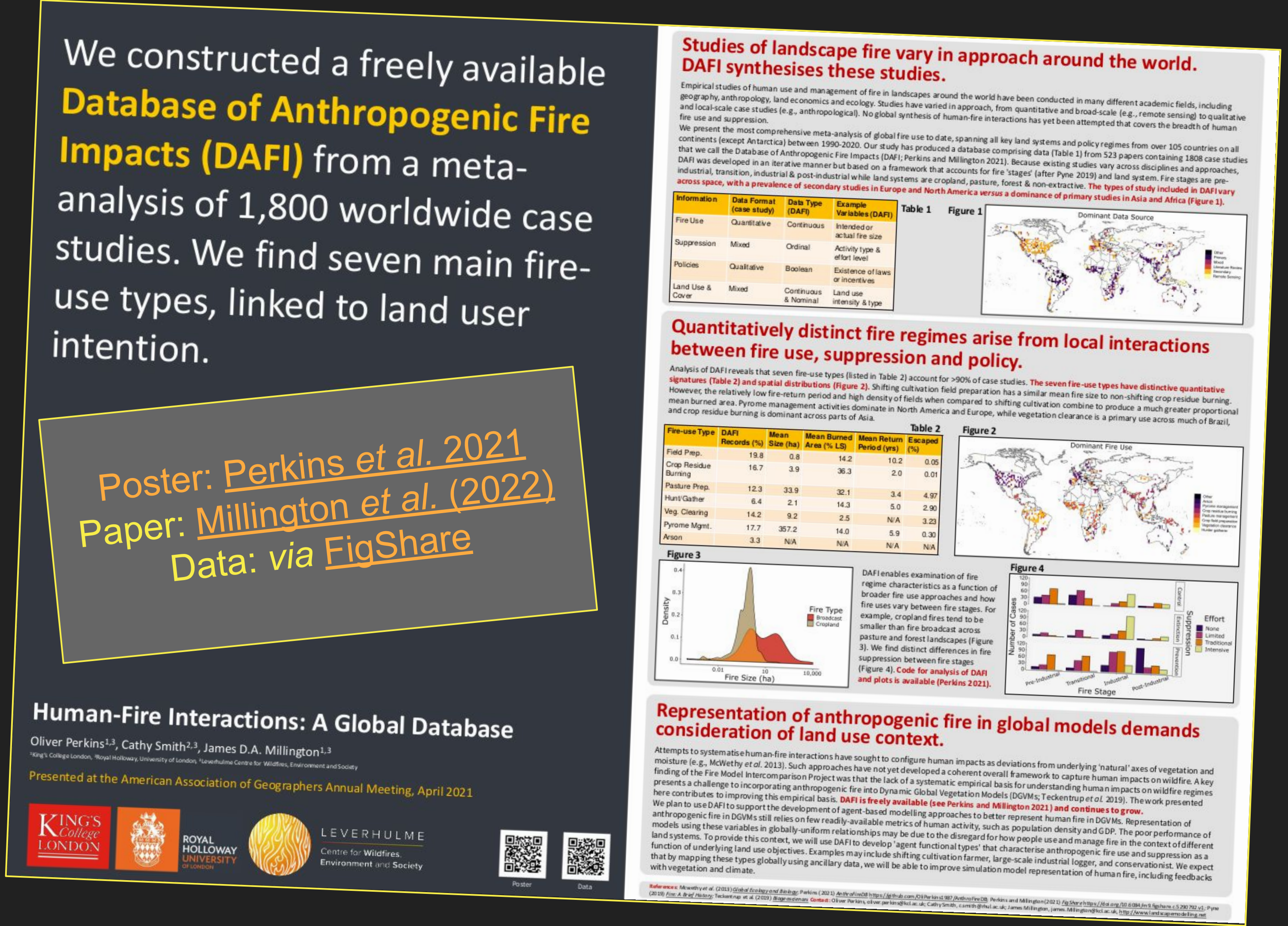
| | DAFI | LIFE | GFUS |
|---|---|---|---|
| Data Points | 1809 cases<br>504 sources | 1708 practices<br>592 sources | 174 regions<br>311 responses |
| Data Source | Literature:<br>Primary, Secondary, Remote Sensing, Reviews | Literature:<br>Primary | Primary:<br>Expert elicitation |
| Time Span | 1990-2020 | 1990-2020 | 2018-2022 |
| Fire Uses | *7 primary* [>20 total]<br>Crop prep., Crop resid., Pasture, Hunt-Gather, Veg. clearing, Fuel mgmt, Arson | *8 primary* [29 total]<br>Crops, Pasture, Hunt-Fish, Gather, Charcoal, Movement, Health, Social Signals | *25 total*<br>Main type by user:<br>Livelihood - agri/pasture<br>State/NGO - fuel mgmt.<br>Commercial - agri/pasture |
| Policy and Governance | *Intervention:*<br>Incentivise, Restrict, Ban<br>*Rationale:*<br>Environ., Econ., Health | *Intervention:*<br>Regulations, Incentives, Voluntary<br>*Intention:*<br>Reduce, Retain, Grow, Introduce<br>*Actor:* state, NGO, community | *Intervention:*<br>Reg., Incentives, Voluntary<br>*Effectiveness:*<br>Very, Somewhat, Not<br>*Level:* High, Med, Low |

# DAFI
## Spatial Distribution of Sources




# DAFI
## Spatial Distribution of Fire Uses




Poster: Perkins *et al.* 2021
Paper: Millington *et al.* (2022)
Data: *via* FigShare

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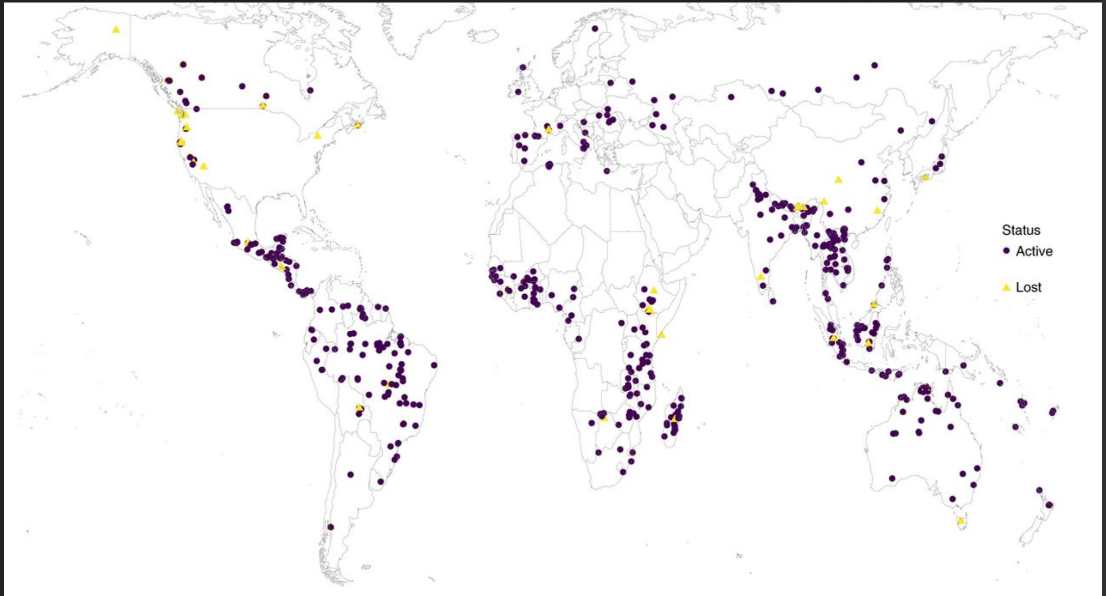
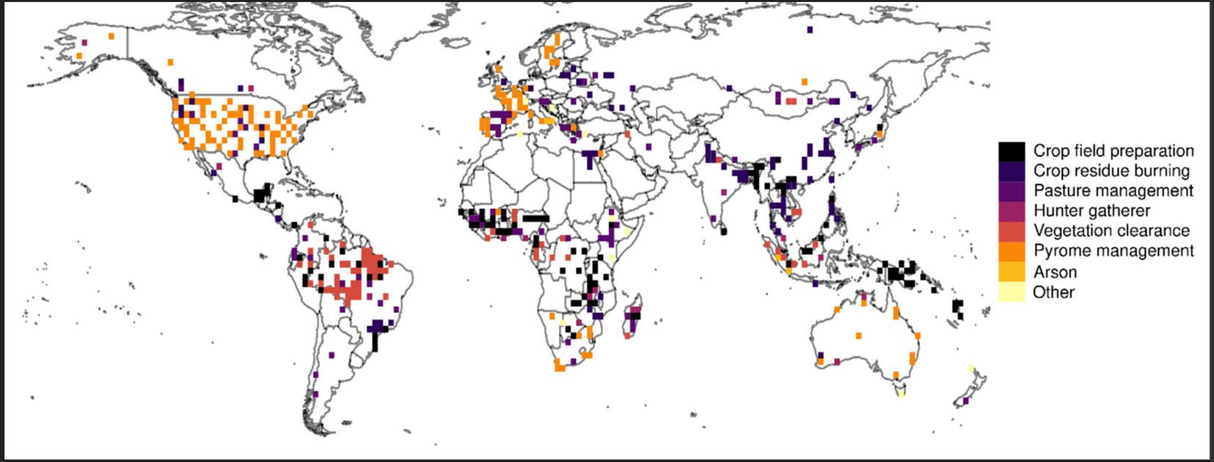
# LIFE
## Spatial Distribution of Case Studies
(point location)




# DAFI
## Spatial Distribution of Fire Uses
(gridded mode)

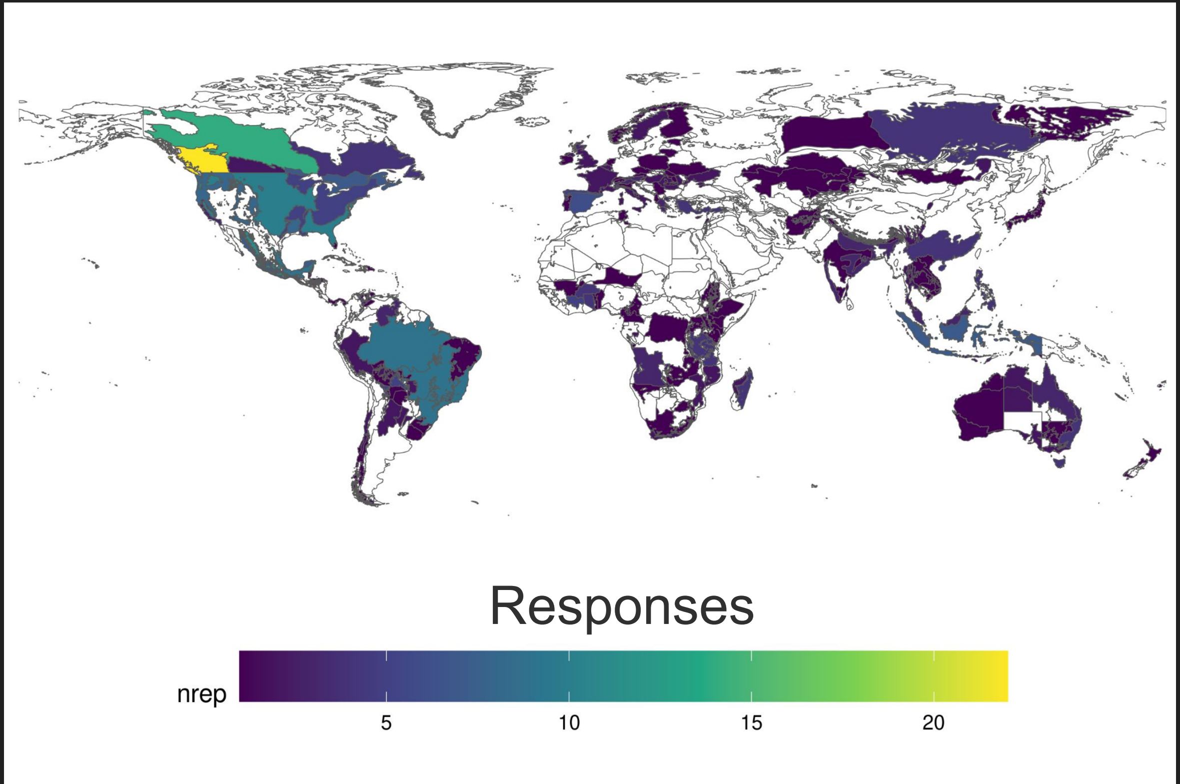


GFUS

# Spatial Distribution of Responses

Data for Russia and Kazakhstan

Over-representation in Americas?

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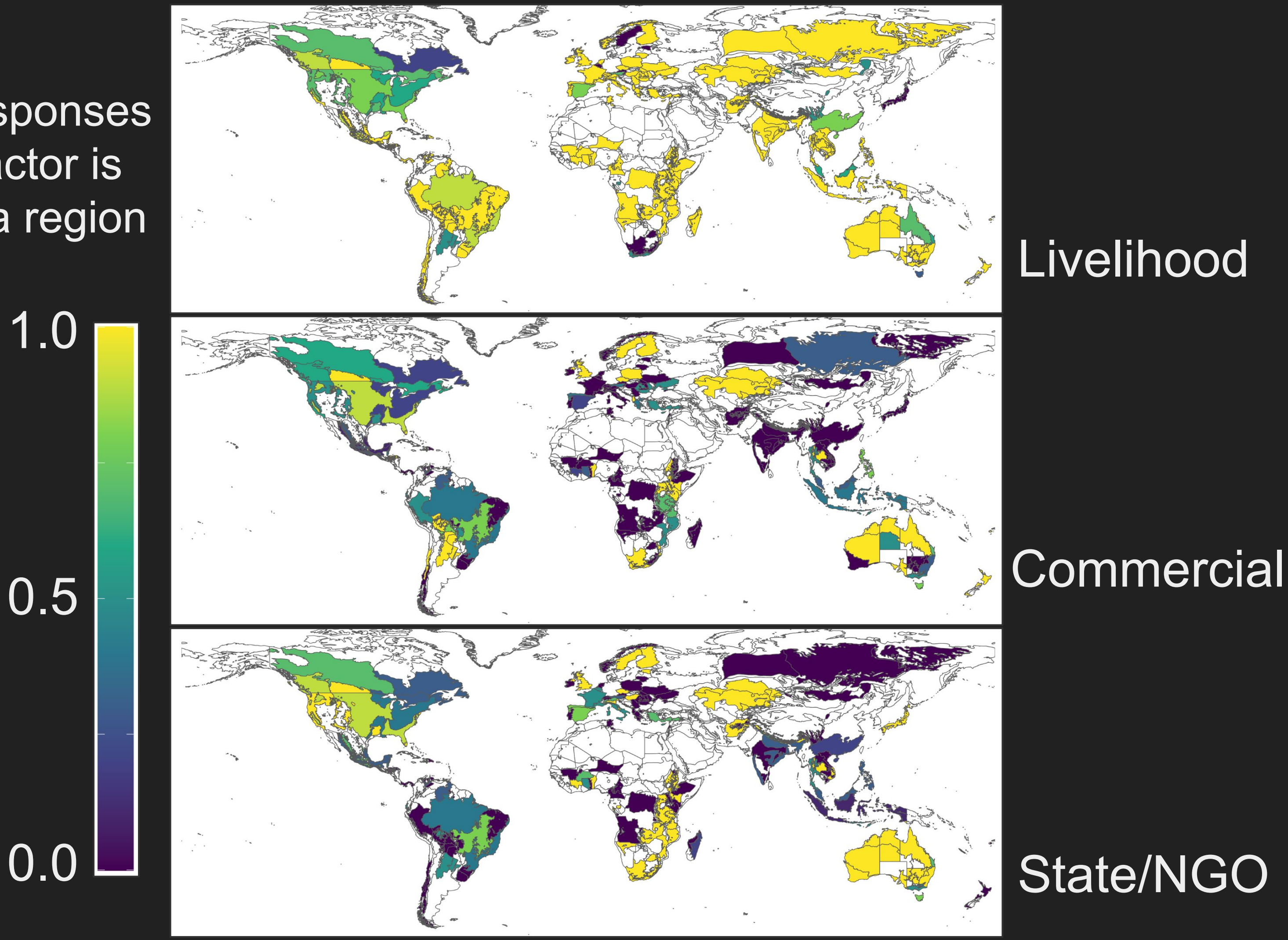
# GFUS

Prop. of responses indicating actor is present in a region

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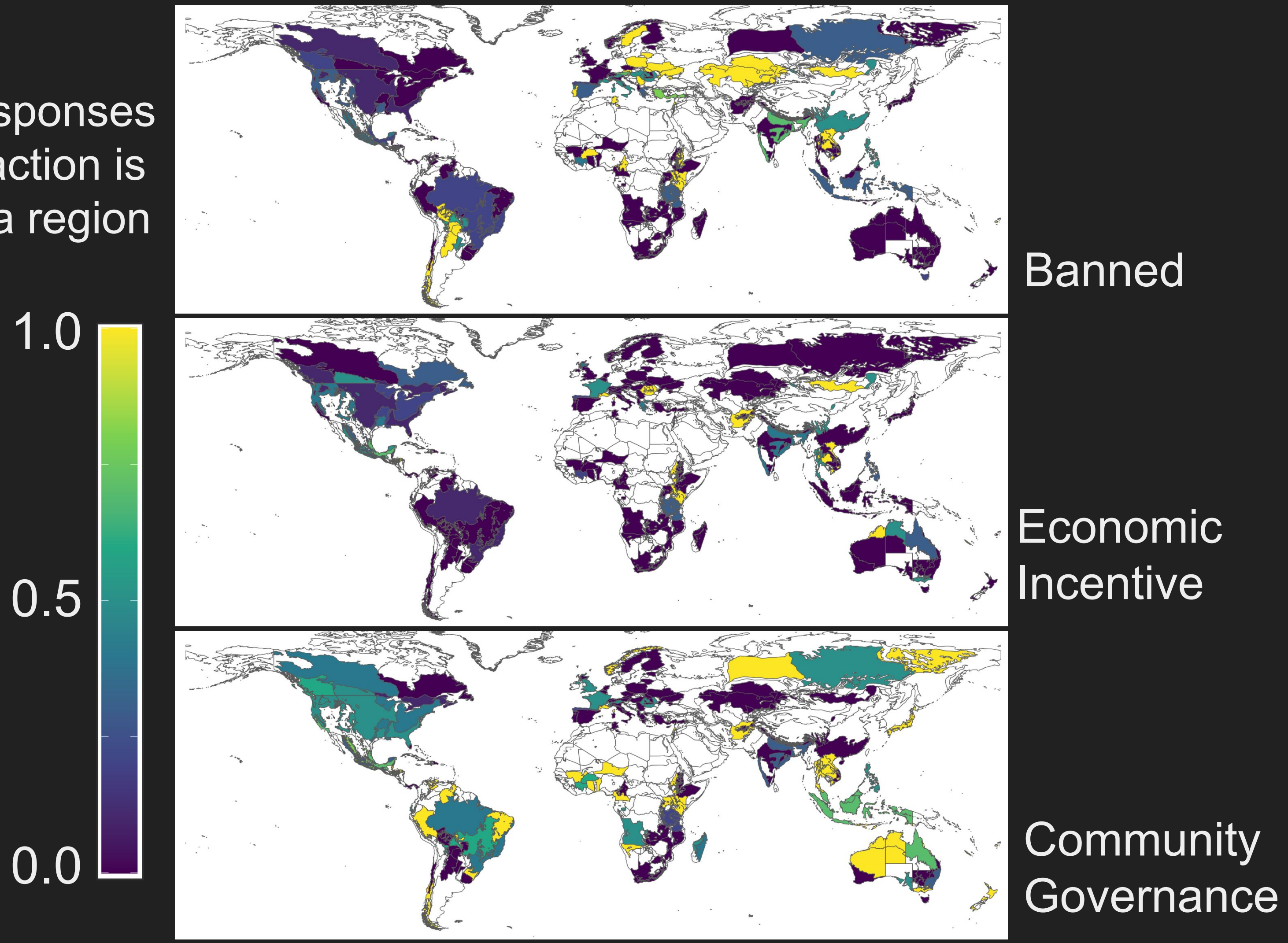
# GFUS

Prop. of responses indicating action is present in a region

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# 1. Anthropogenic Fire Regimes

- ~~First Fire pre-human~~
- Second Fire pre-industrial
- 2.5th Fire transition
- Third Fire industrial
- Pyrocene post-industrial

After Pyne's Fire 'stages', AFRs reflect available resources and management perspectives


[TED 15 min summary]

# 2. Land Use Systems

Non-Extractive

Forest

Pasture

Cropland

Combine land use intensity and land management practices

See Václavík *et al.* 2013 [GEC], Dou *et al.* 2021 [Lsp Ecol]

# Land-Fire Systems ['AGENT TYPES']

More here: Perkins *et al.* (2024)

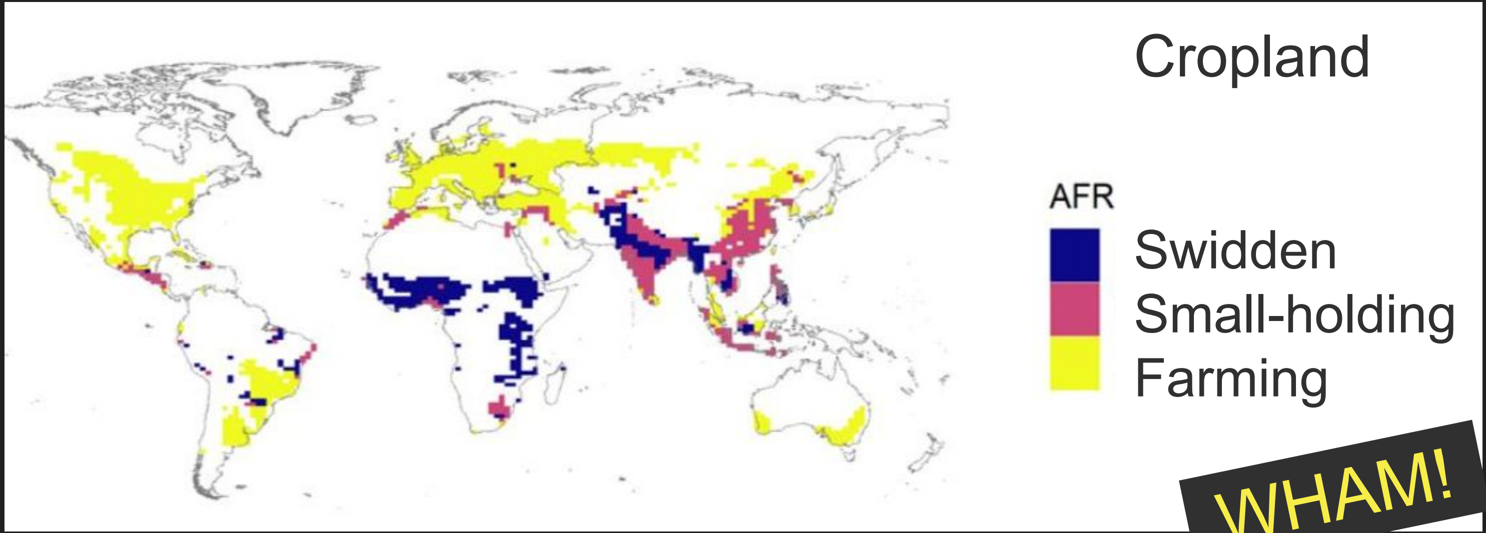
## From combination of Anthro. Fire Regimes and Land Use Systems

WHAM!

| Anthro. Fire Regime \ Land Use System | *Non-Extractive* | *Livestock* | *Crops* | *Forestry* |
|---|---|---|---|---|
| *Pre-Industrial* | Unoccupied | Pastoralism (S) | Swidden (S) | Hunt & Gather (S) |
| *Transition* | Unmanaged | Ranching (Extensive, S\|M) | Small-holding (S\|M) | Logging (M) (Primary Forest) |
| *Industrial* | Pyro-exclusion (State Manager) | Ranching (Intensive, M) | Farming (Intensive, M) | Managed (M) (Plantation or Second Forest) |
| *Post-Industrial* | Pyro-diverse (Fuel Load Management) | Grazing (Subsidised, Fuel Mgmnt) | Abandoned | Abandoned |

Non-Extractive = e.g. parks   S = subsistence   M = market

# Modelled Spatial Distribution of LFS




WHAM!

Combine density of *LFS* with *data from DAFI* to estimate *human Burned Area*

Paper: Perkins *et al.* (2022)

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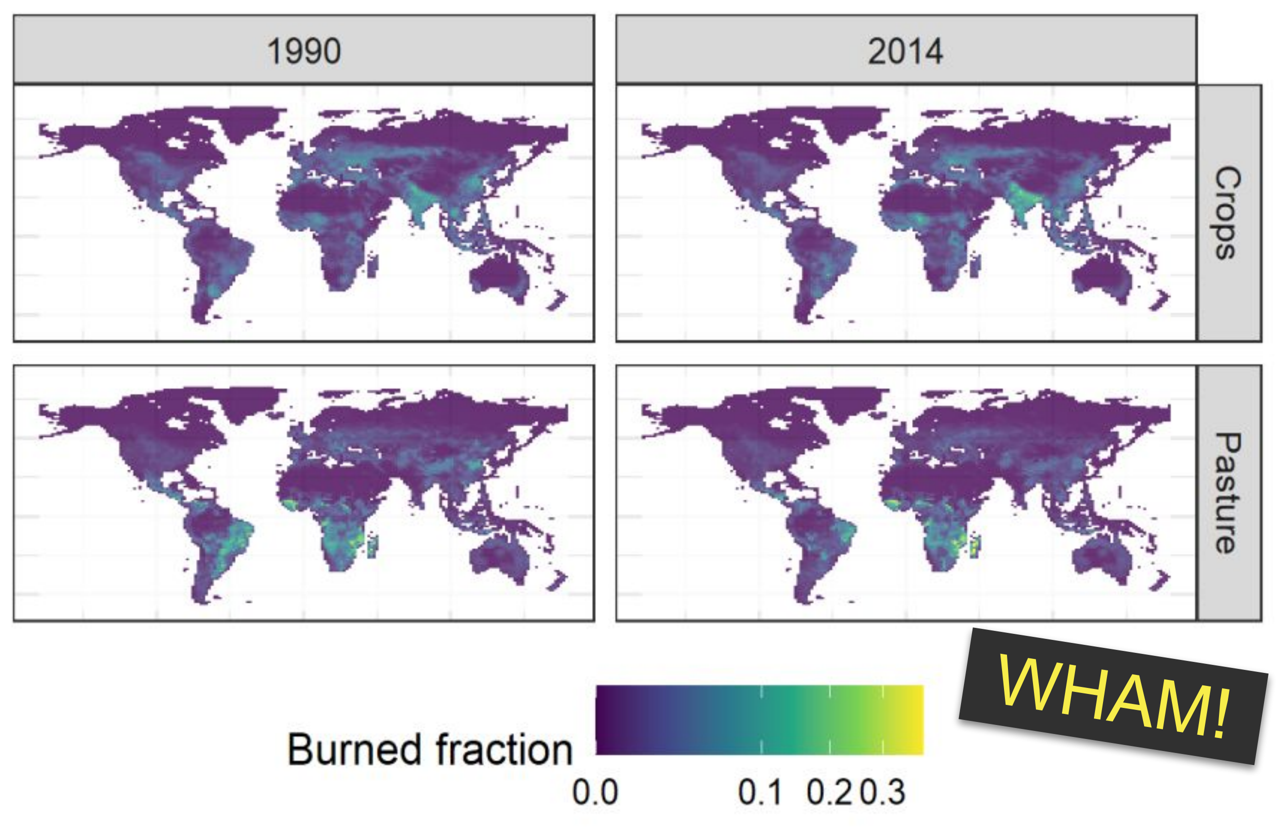
# Modelled Agriculture Burned Area




Paper:
Perkins *et al.* (2024)

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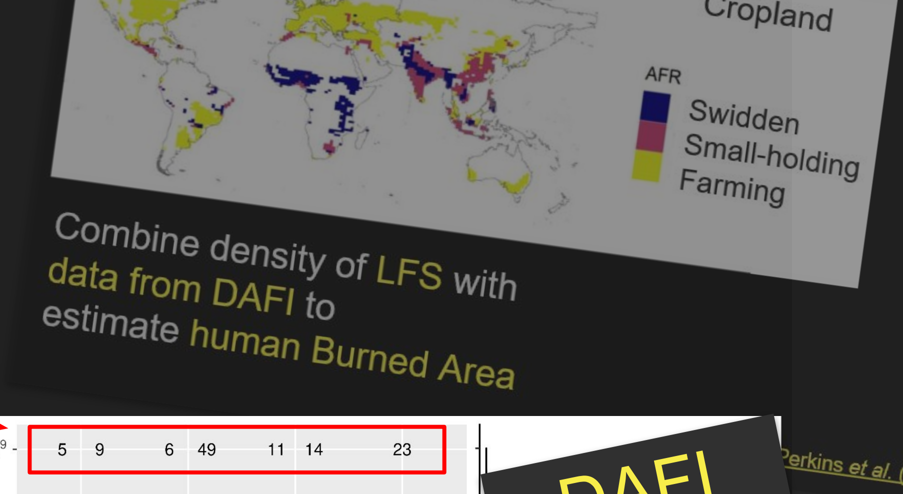
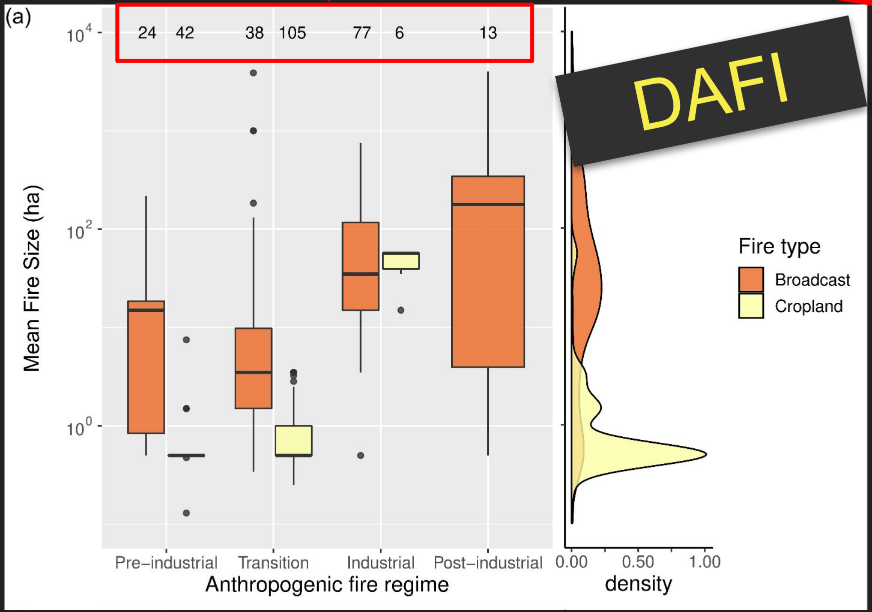
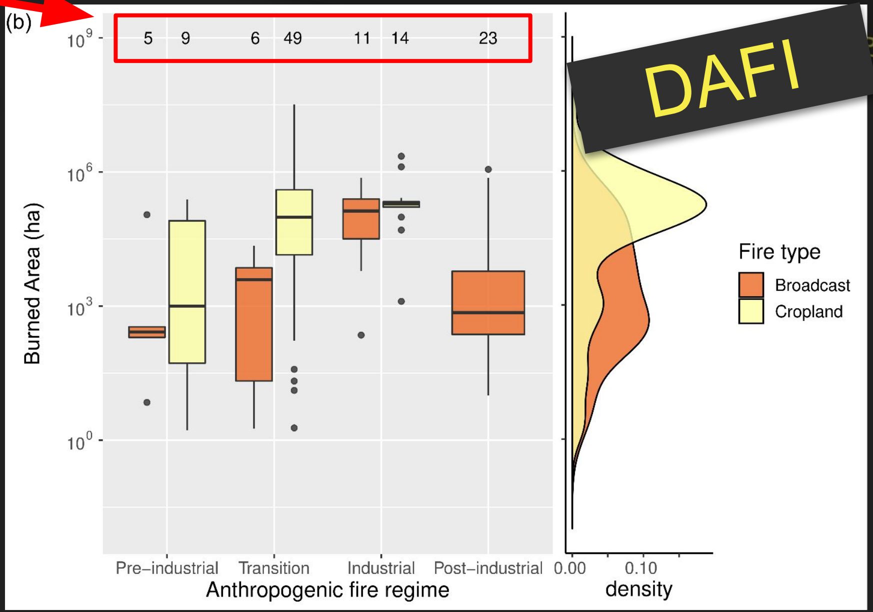
# Quantitative Estimates




Global BA by agent type based on relatively *low sample sizes*

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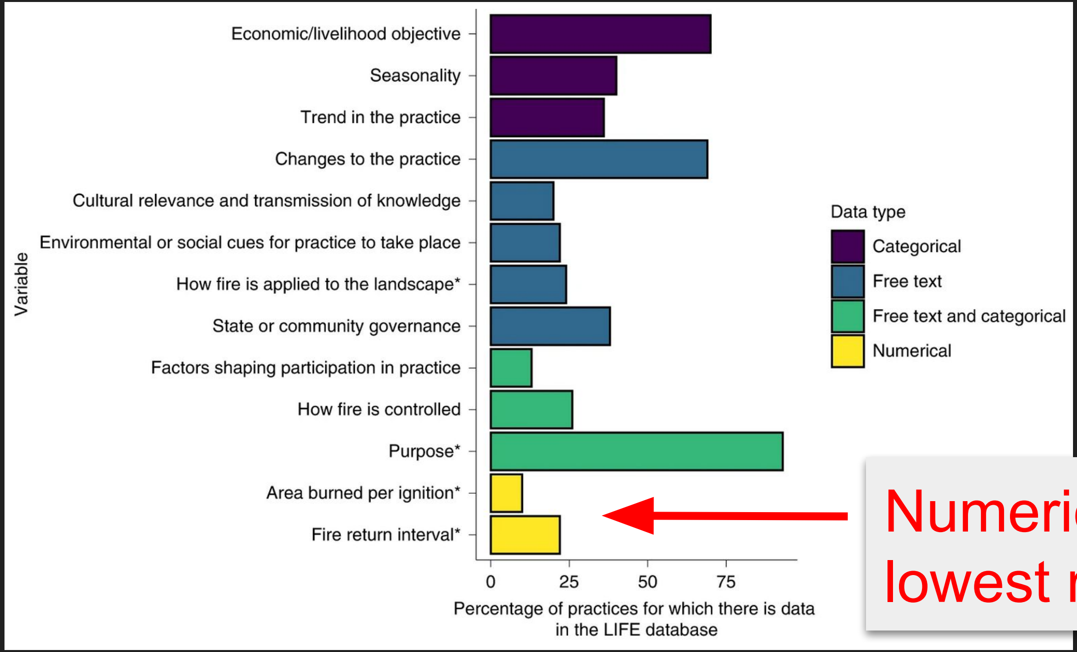
# LIFE Variable data completeness




# DAFI

Only half of studies on Hunt-Gathering provided quantitative metrics

Numerical variables have lowest representation in LIFE

*Not all fire users use formal quantification …*

*but statistical and many simulation models do*

# Other Challenges

## Clandestine Activity

- Difficult to study and therefore an area of uncertainty
- No studies (3.5% of all) had quantitative metrics for arson
- Several GFUS responses highlight importance of illegal activities

## Studies of Fire Absence

- LIFE highlights the loss of traditional fire practices
- Studies of (wild)fire mitigation and suppression are limite
- More studies needed on where fire is not used where it could be
- Longer-term understanding of absence (e.g. land abandonment)

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# Summary

*Good progress collating/analysing data globally, but challenges and gaps in data and understanding remain*

- Spatial Coverage: language, areas of change
- Fire Use in DGVMs: model fires, not ignitions - but better data needed! [see Kasoar *et al.* (2024)]

- Clandestine Activity: need more studies on effects of state bans, arson
- Mitigation and Suppression: far fewer studies than of fire use
- Long-term change: understanding pre-1990s fire use
- Qualitative Emphasis: mixed methods studies? e.g. with RS