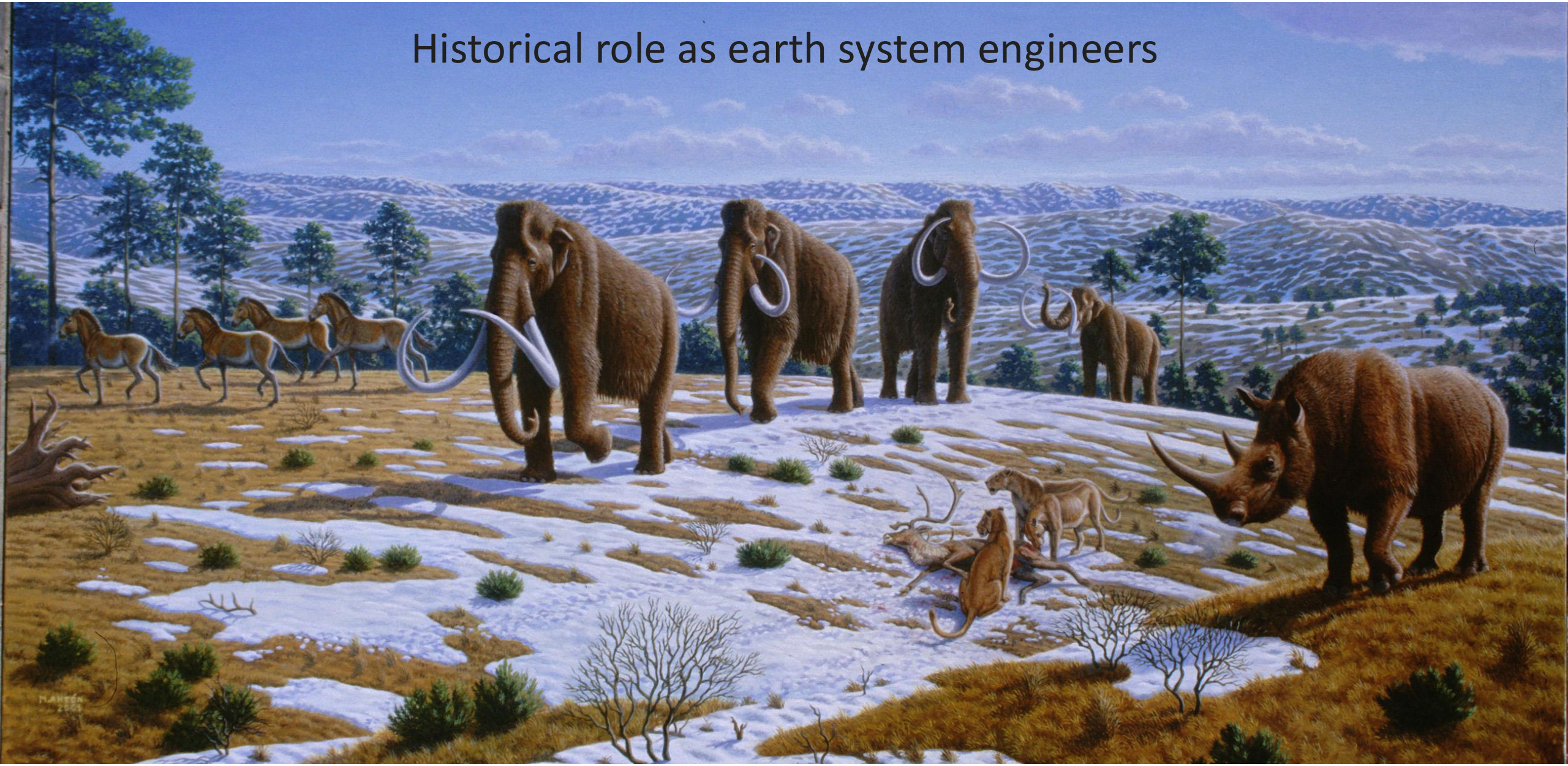
Megaherbivores as nature-based solution for resisting invasion dominance

Ninad Avinash Mungi, Yadvendradev Jhala,
Qamar Qureshi, Elizabeth le Roux,
Jens-Christian Svenning

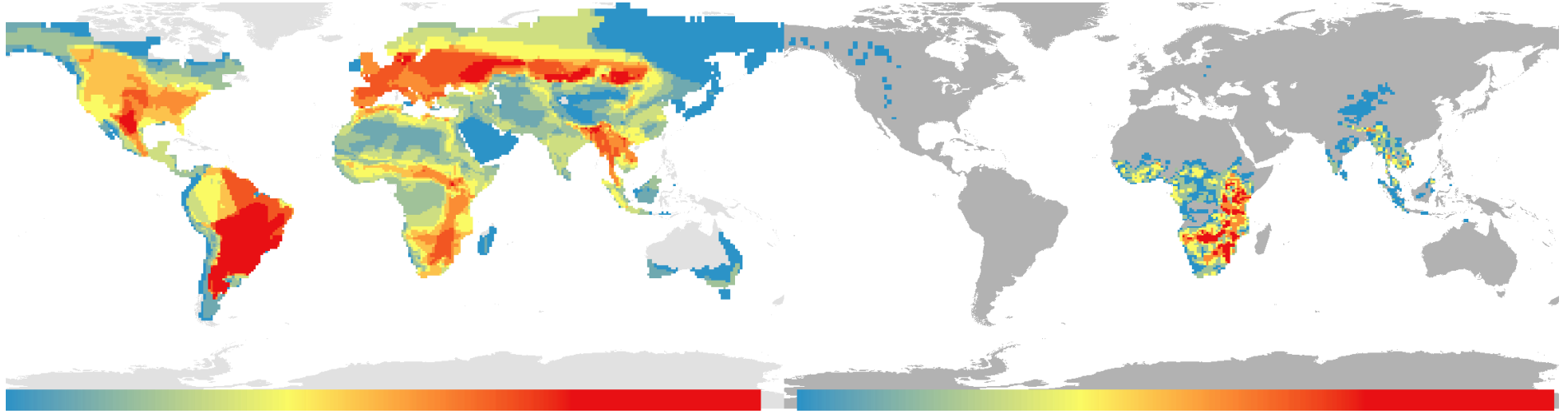
Historical role as earth system engineers

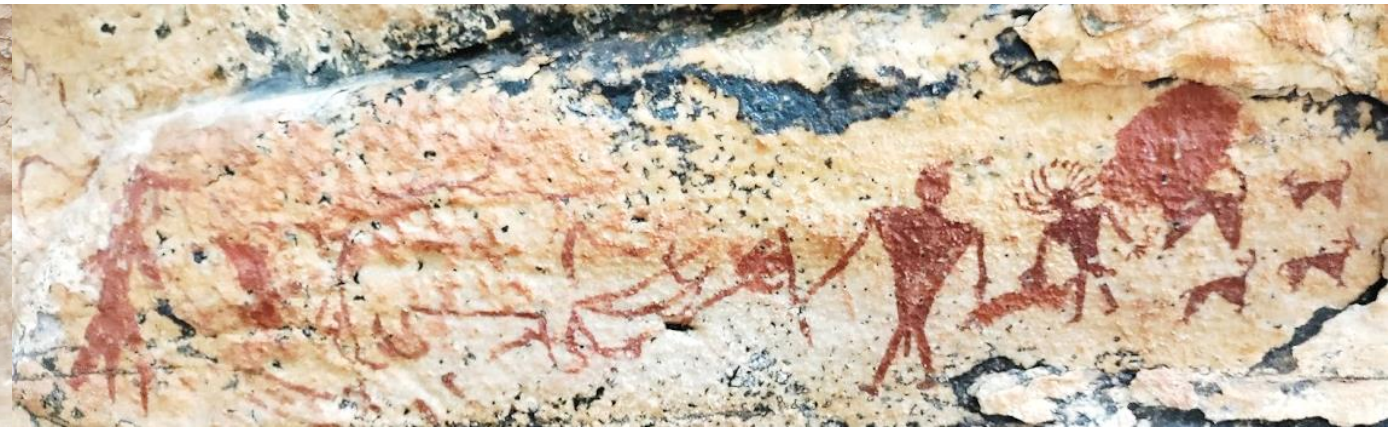


Large-scale persecution of megaherbivores

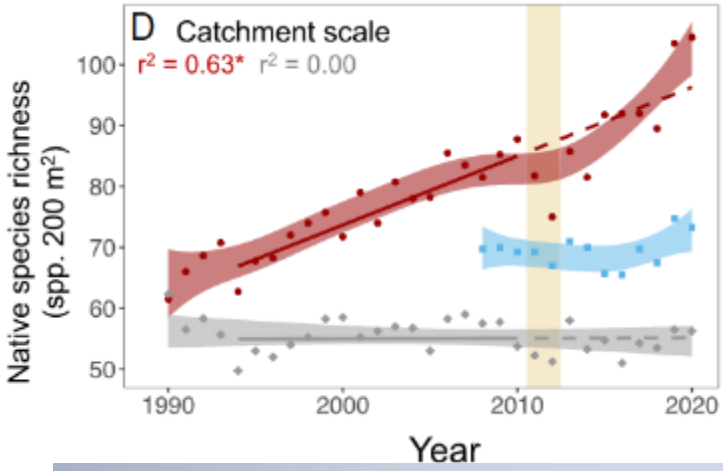
Historical range

Present range



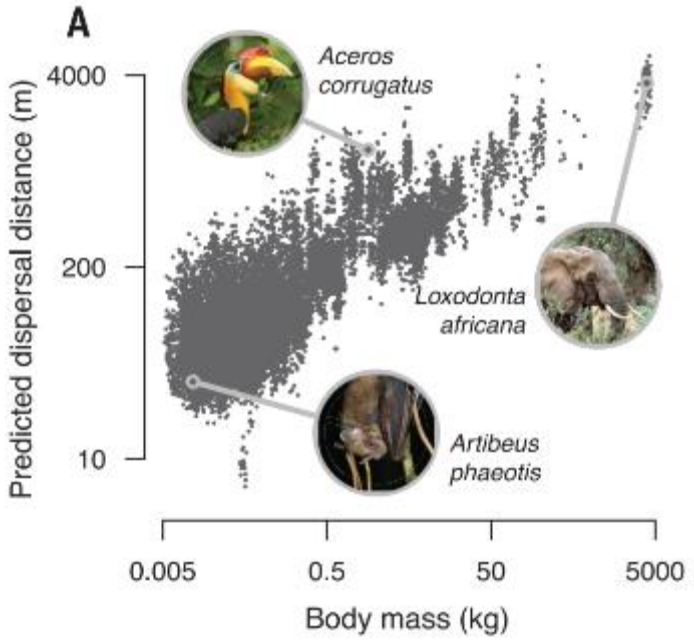


Plant diversity



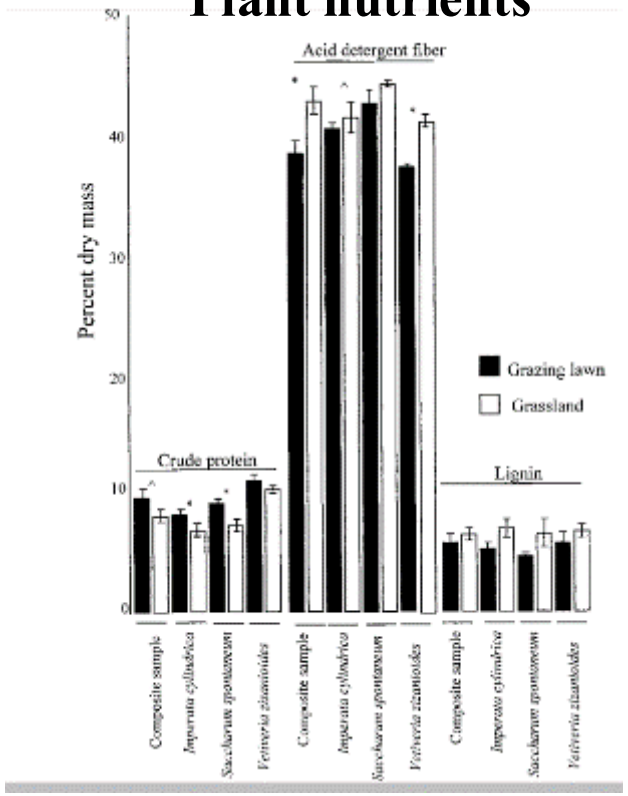
Ratajczak et al. 2022, PNAS

Plant dispersal



Fricke et al. 2022, Science

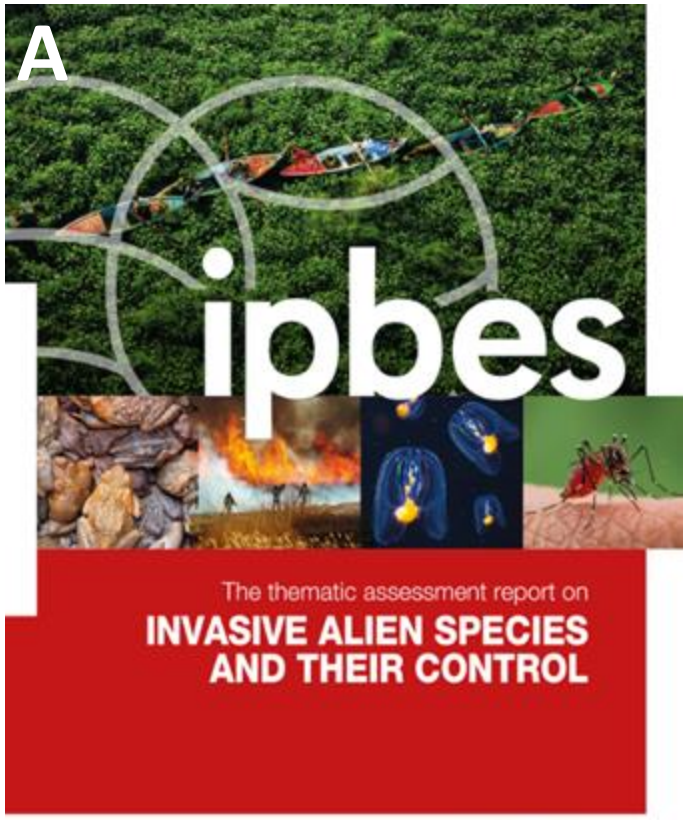
Plant nutrients



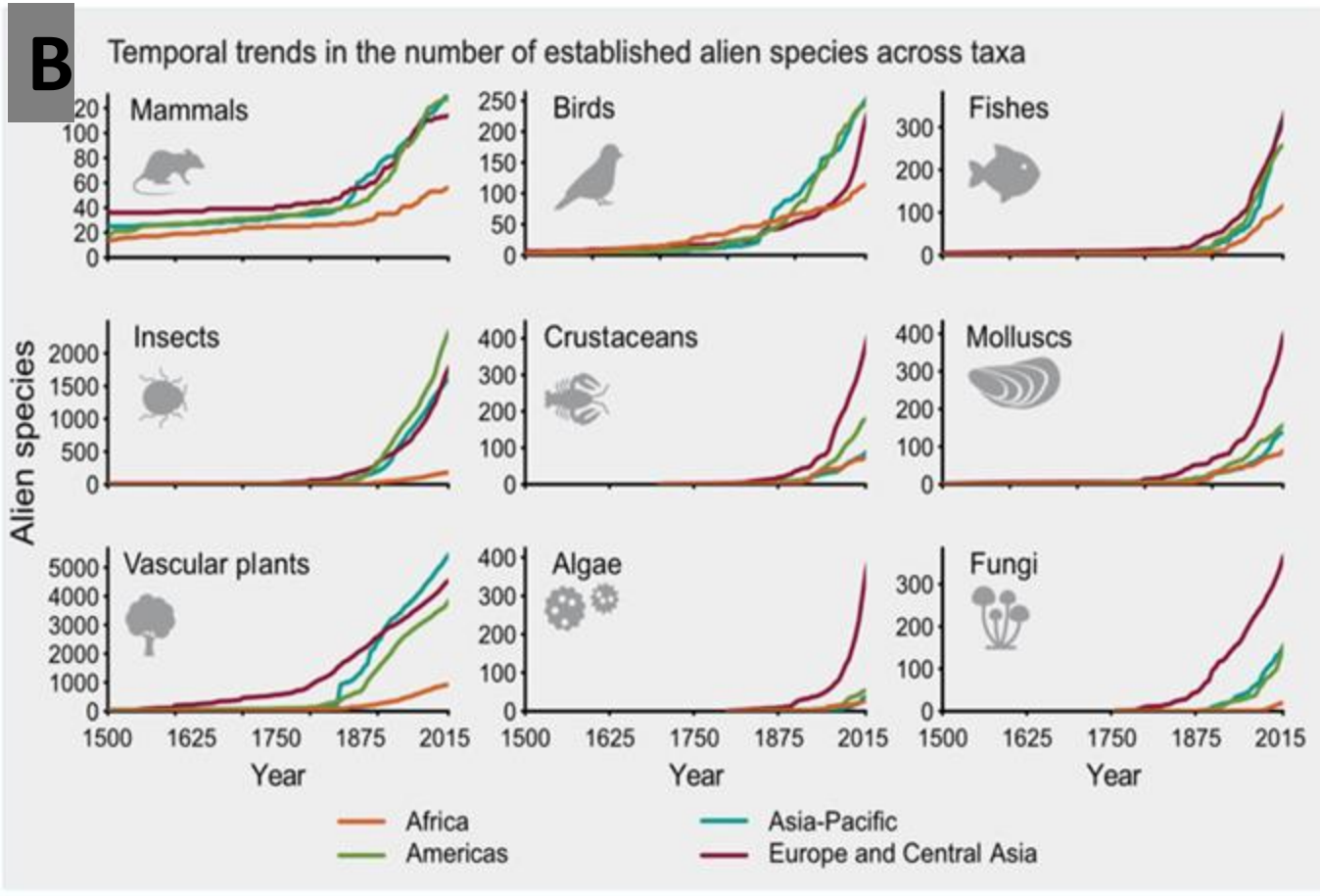
Kerki et al. 2000, Biotropica

Global increase in species introductions and invasions

A



B



Roy et al. including Mungi NA (2024) *Nature ecology and Evolution*

IPBES (2023) *Global invasion assessment*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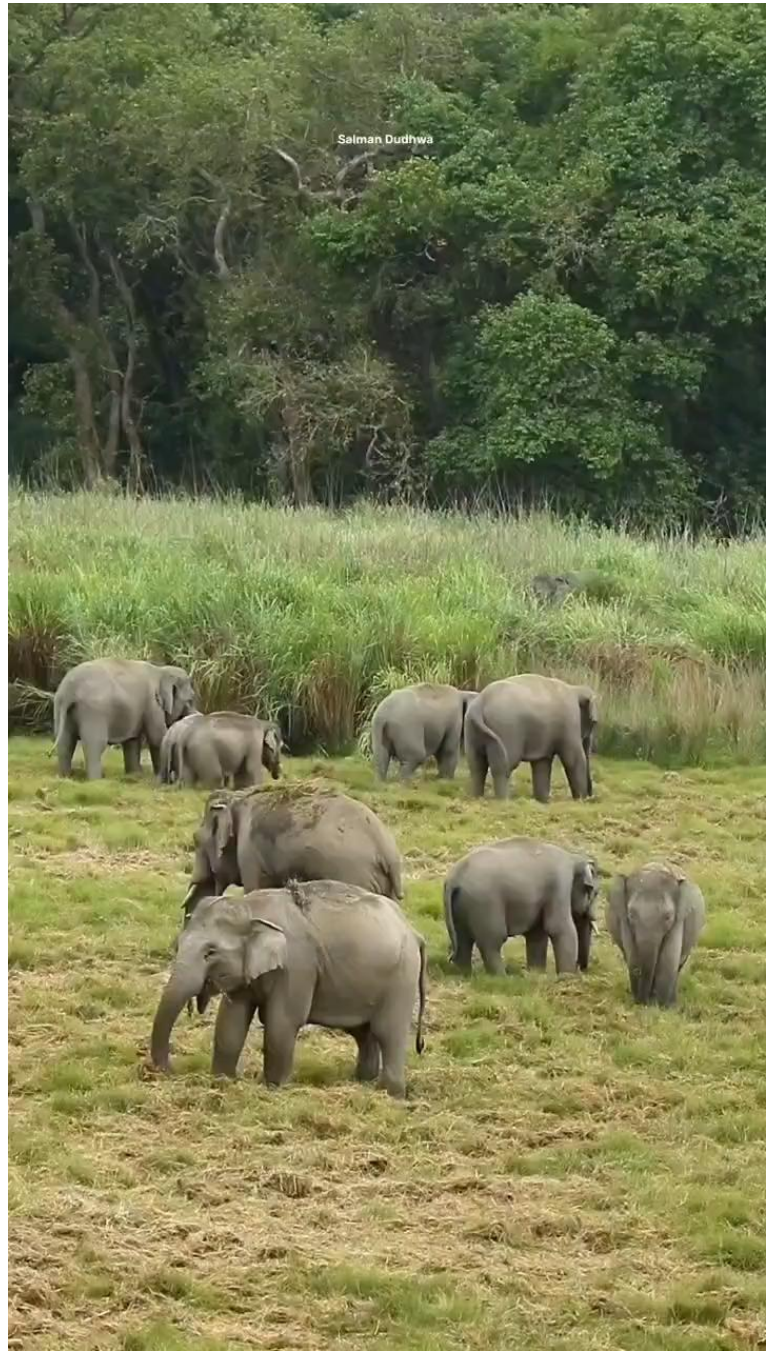
Is there a general pattern in the relationship between megaherbivores and alien plants?


Salman Dudhwa

Megaherbivores ~ plant invasions

- Heterogeneity
- Fragmentation
- Dispersal
- Nutrient pools

- Alien plant traits
- Native plant traits
- Ecosystem traits
- Trophic complexity

nature ecology & evolution

Article

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Megaherbivores provide biotic resistance against alien plant dominance

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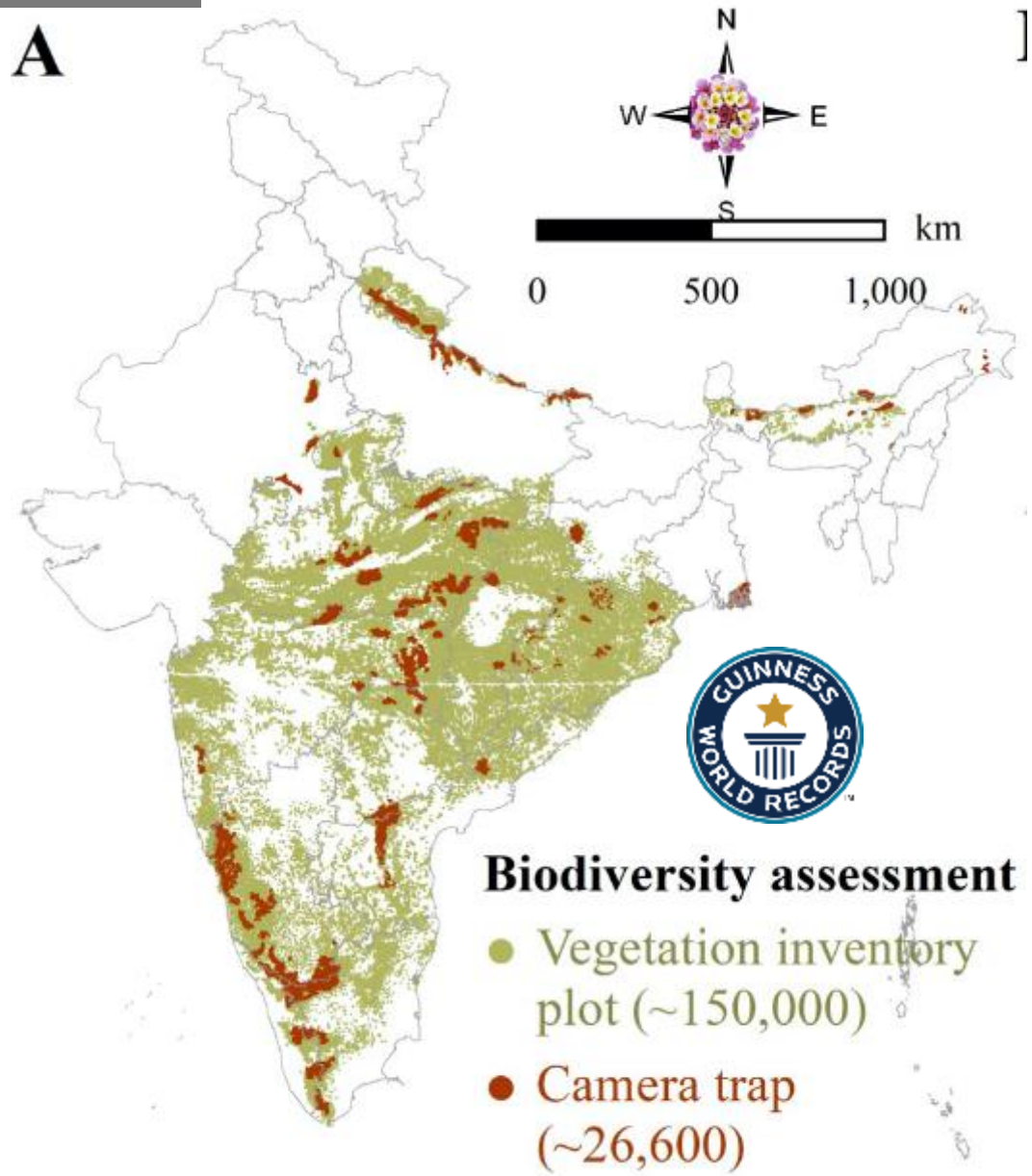
While human-driven biological invasions are rapidly spreading, finding

Largest known monitoring of invasive plants

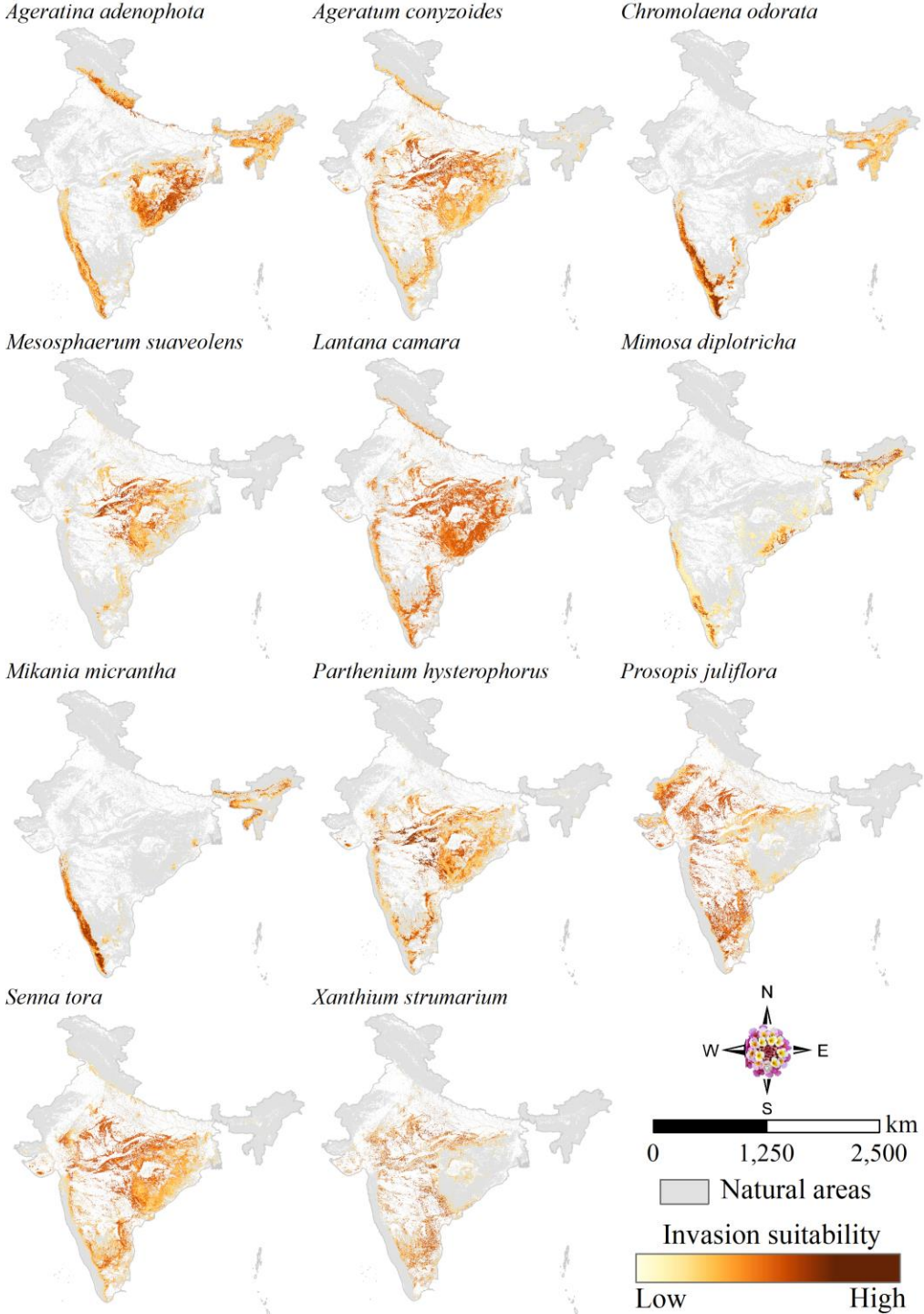
- ‘All India Tiger monitoring’ (2006, 2010, 2014 & 2018)
- Forested area sampled at scale of 25 km^2. Each cell had a transect of 2 km, circular plot (10 m diameter) at every 400 m for recording invasive plants and human disturbance

121,337 km^2
Camera trapping

200,000
Plant Inventory plots

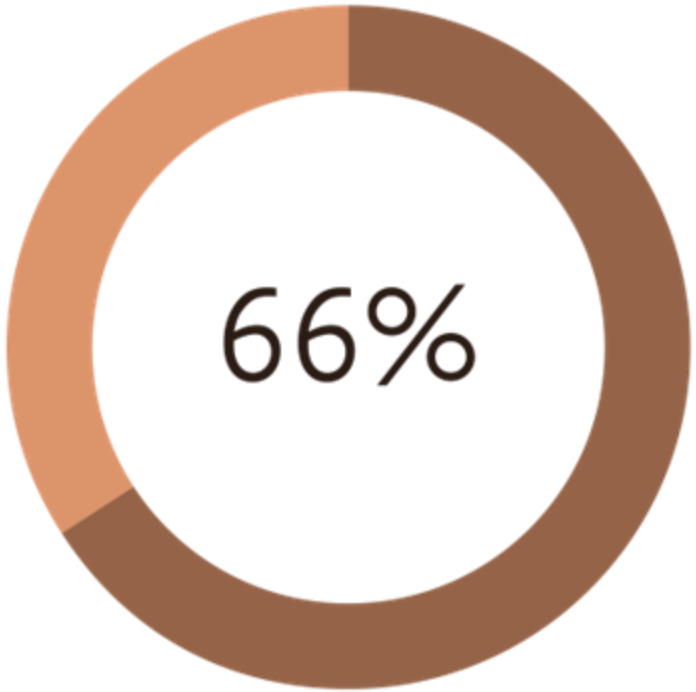


In the name of the Tiger.....

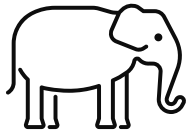


Two-third of India's

natural areas are invaded by invasive plants



Mungi NA, Qureshi Q, Jhala YV (2023) Journal of Applied Ecology

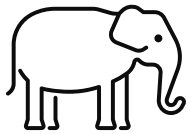


Invasive cover

Native cover

Native richness

Invasive richness

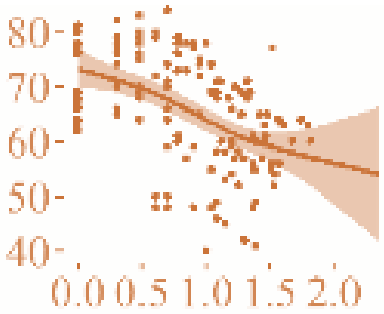


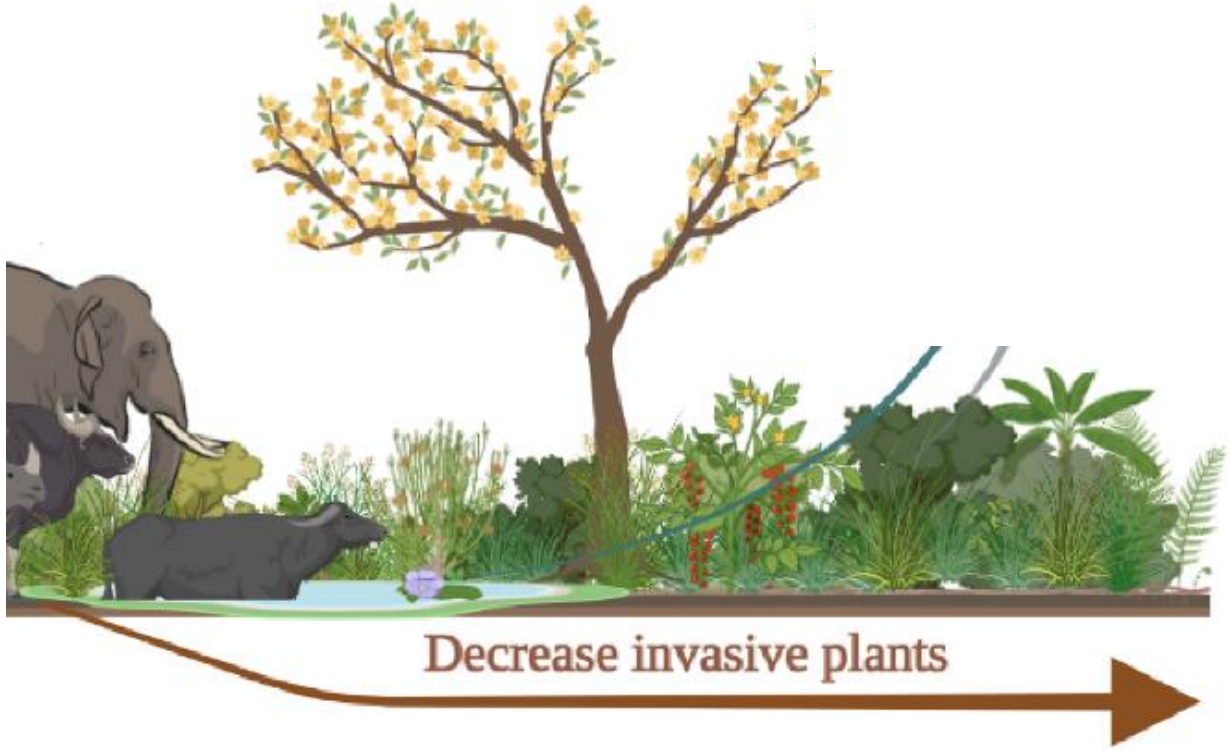
Native cover

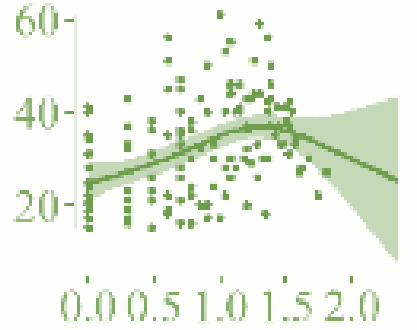
Native richness

Invasive richness

Invasive cover

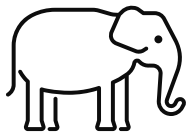






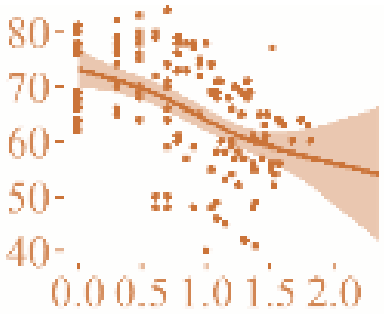
Native cover

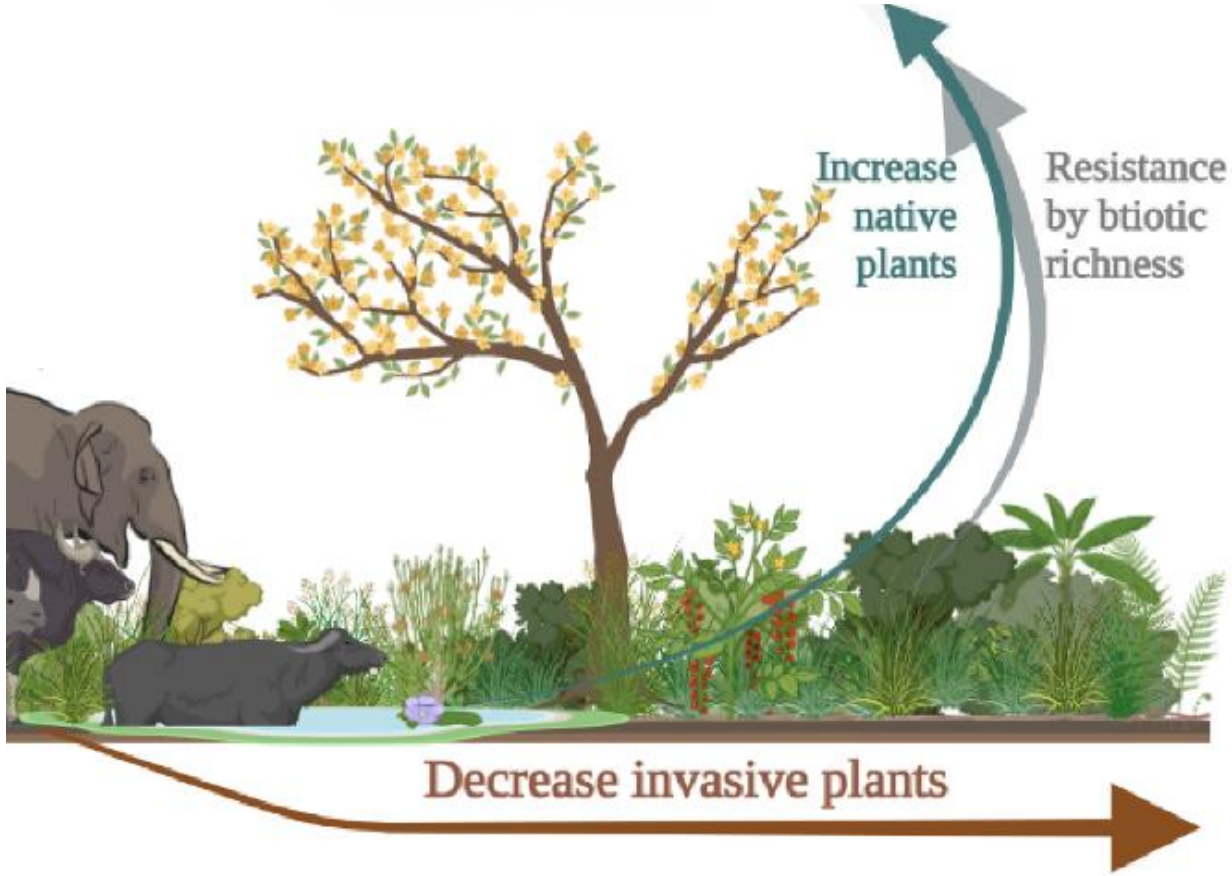
Native richness

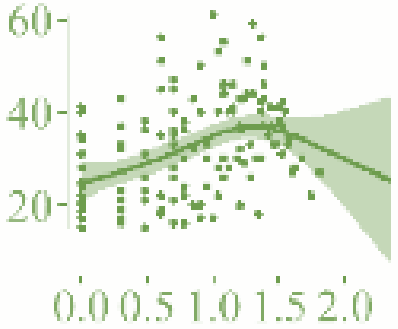


Invasive richness

Invasive cover

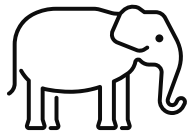




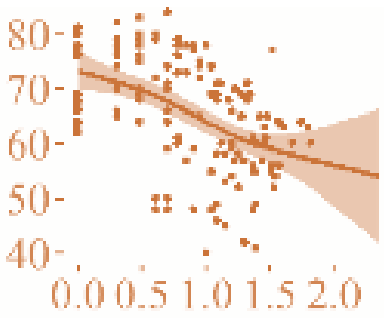


Native cover

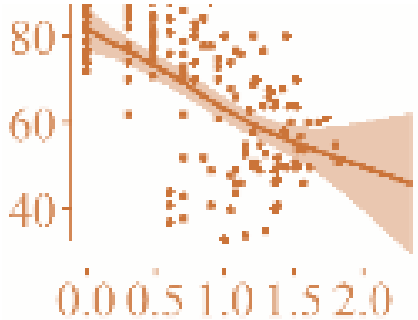
Native richness

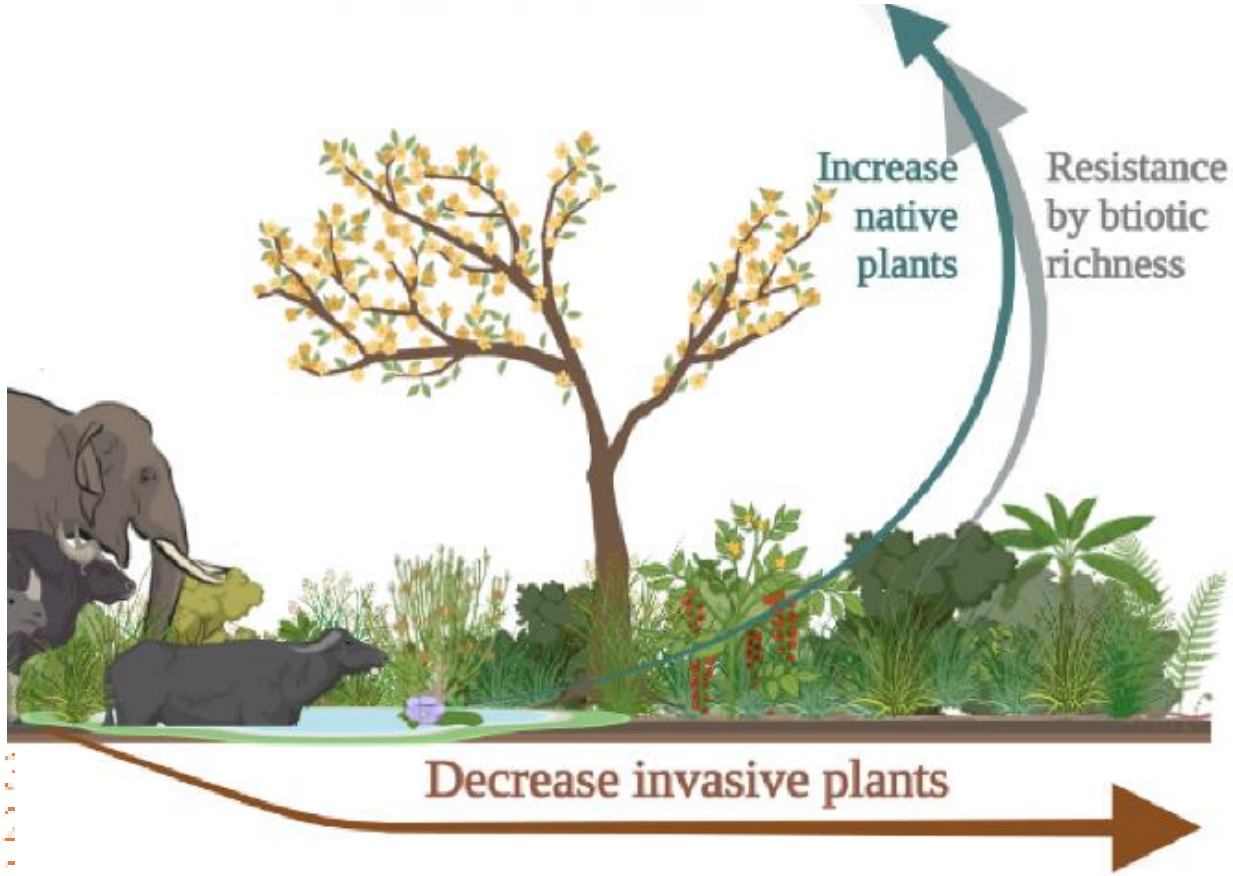


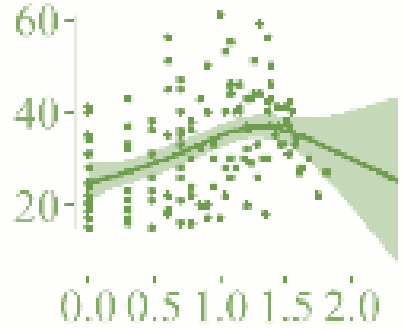
Invasive cover



Invasive richness

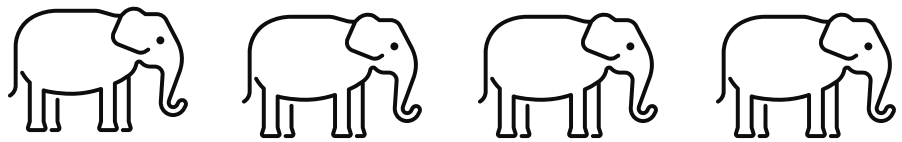




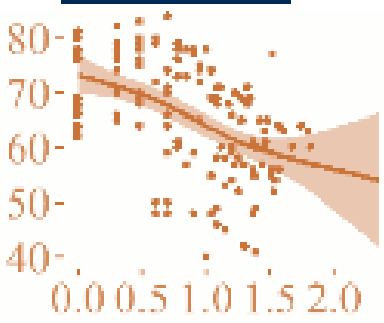


Native cover

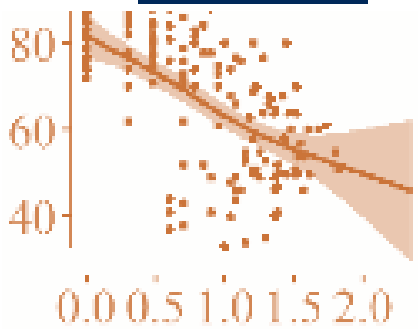
Native richness

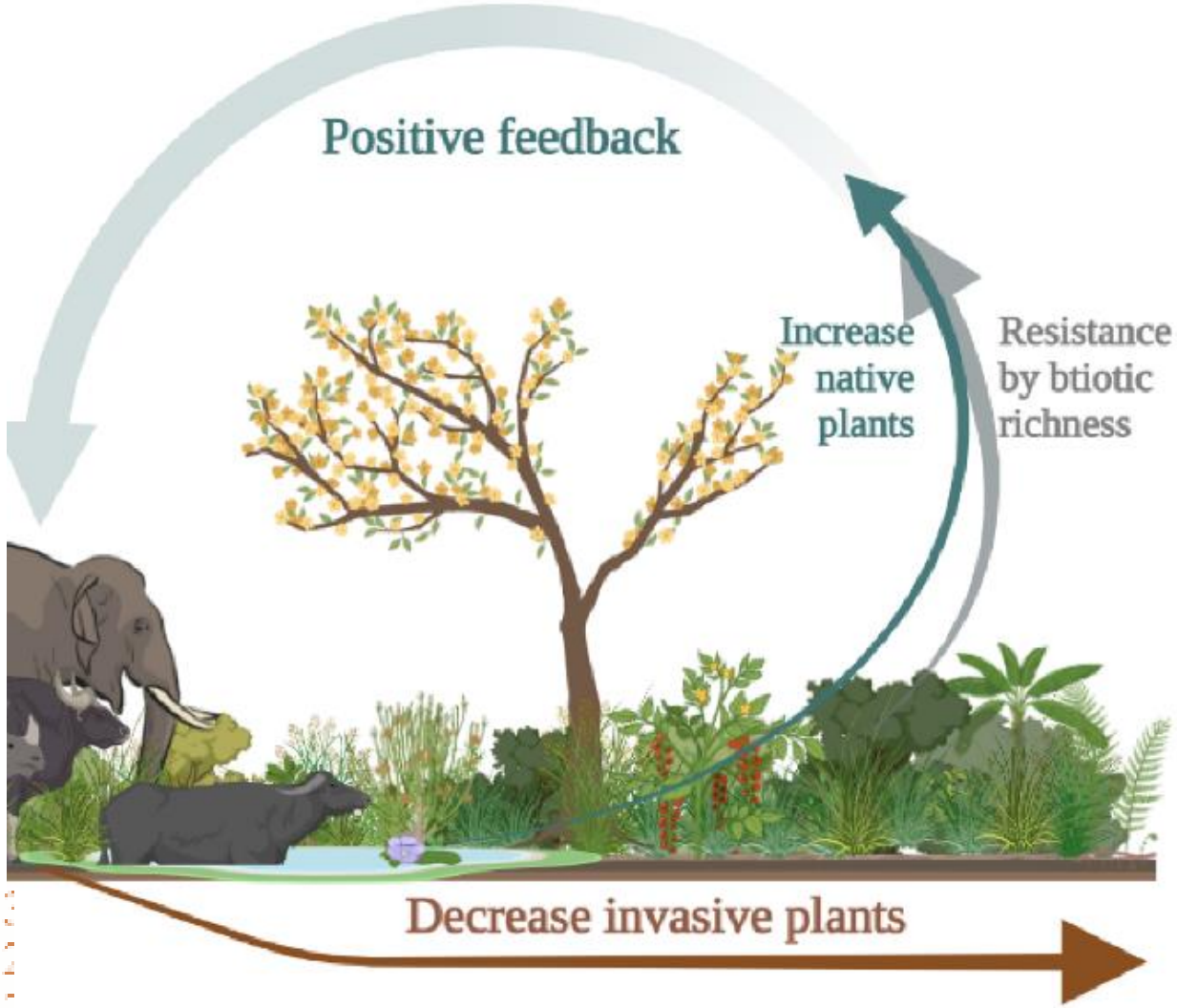


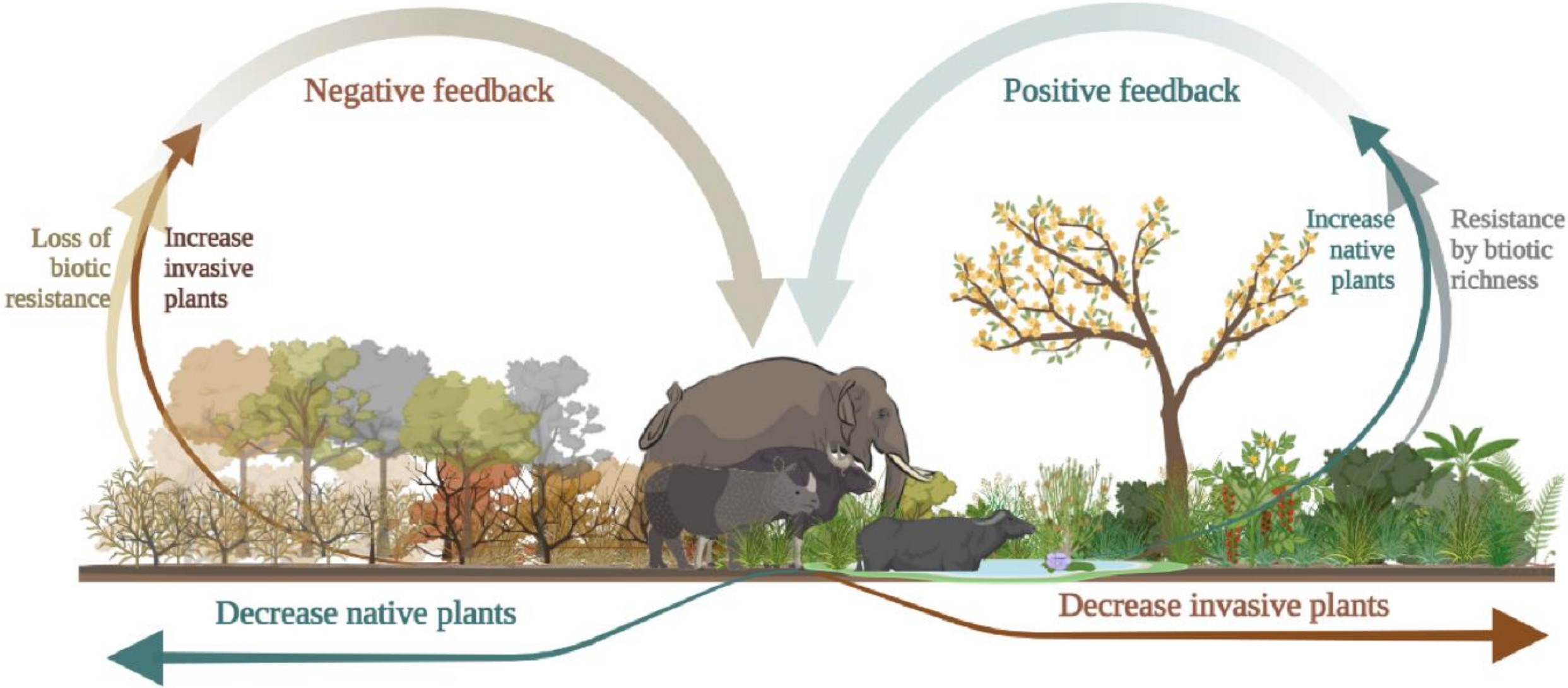
Invasive cover

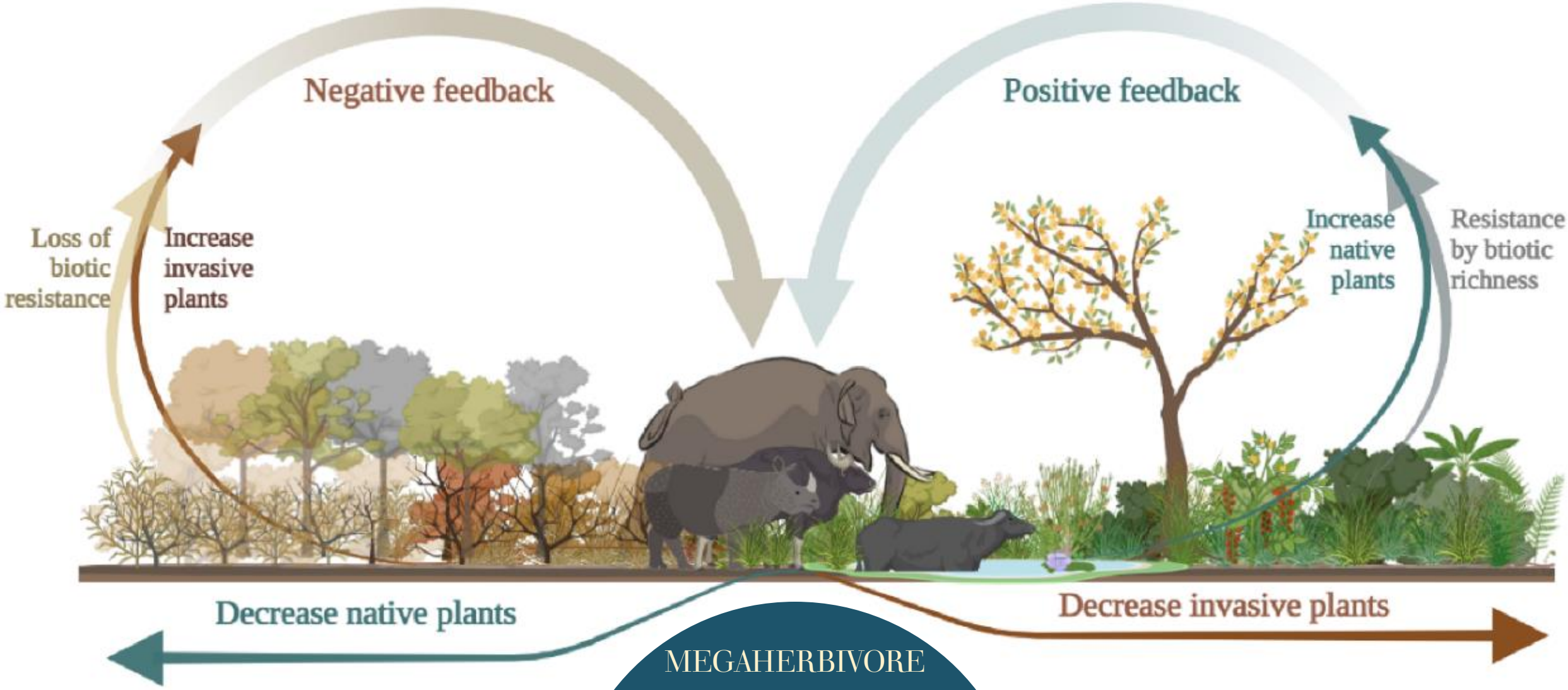


Invasive richness



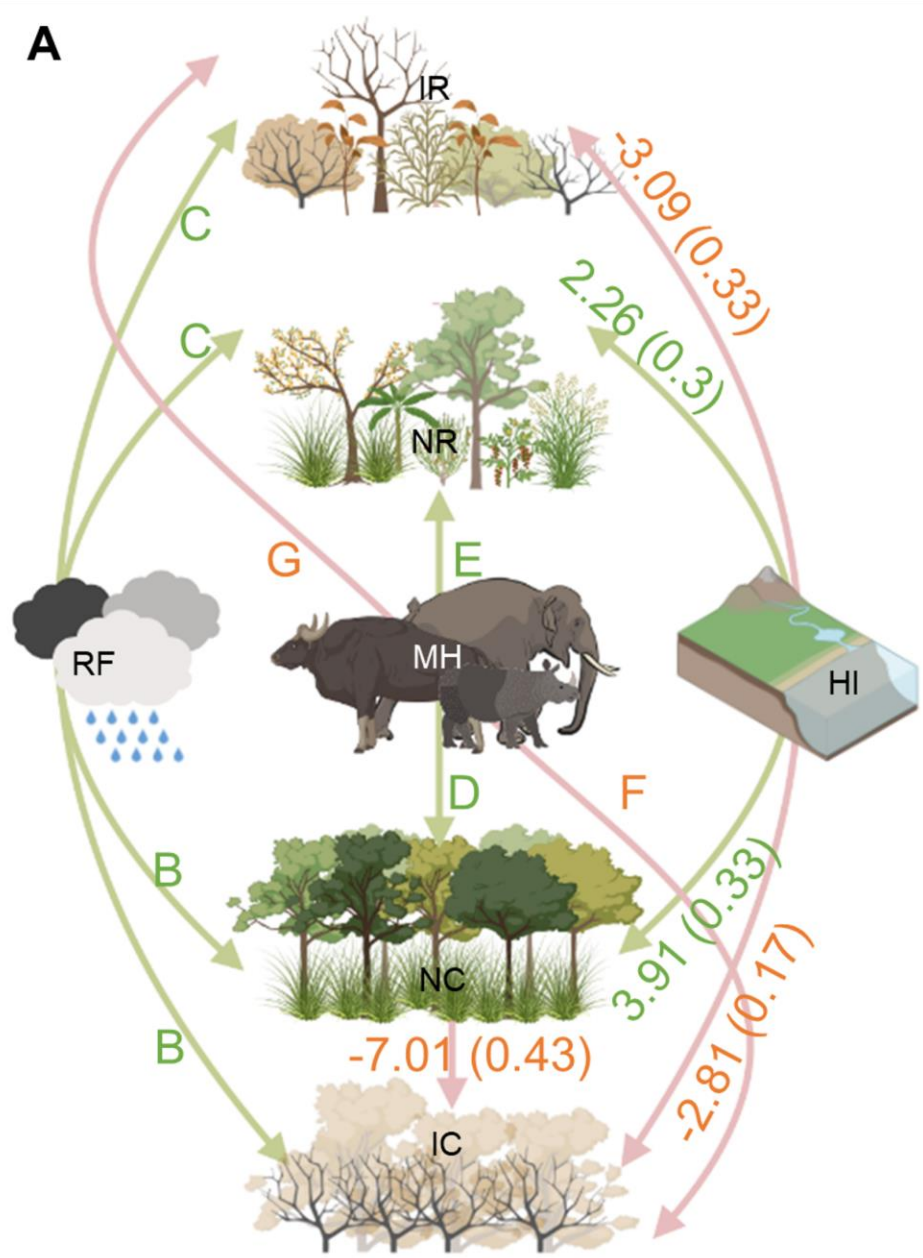



Negative feedback
Positive feedback
Loss of biotic resistance
Increase invasive plants
Increase native plants
Resistance by btiotic richness
Decrease native plants
Decrease invasive plants



MEGAHERBIVORE ENGINEERING POTENTIAL

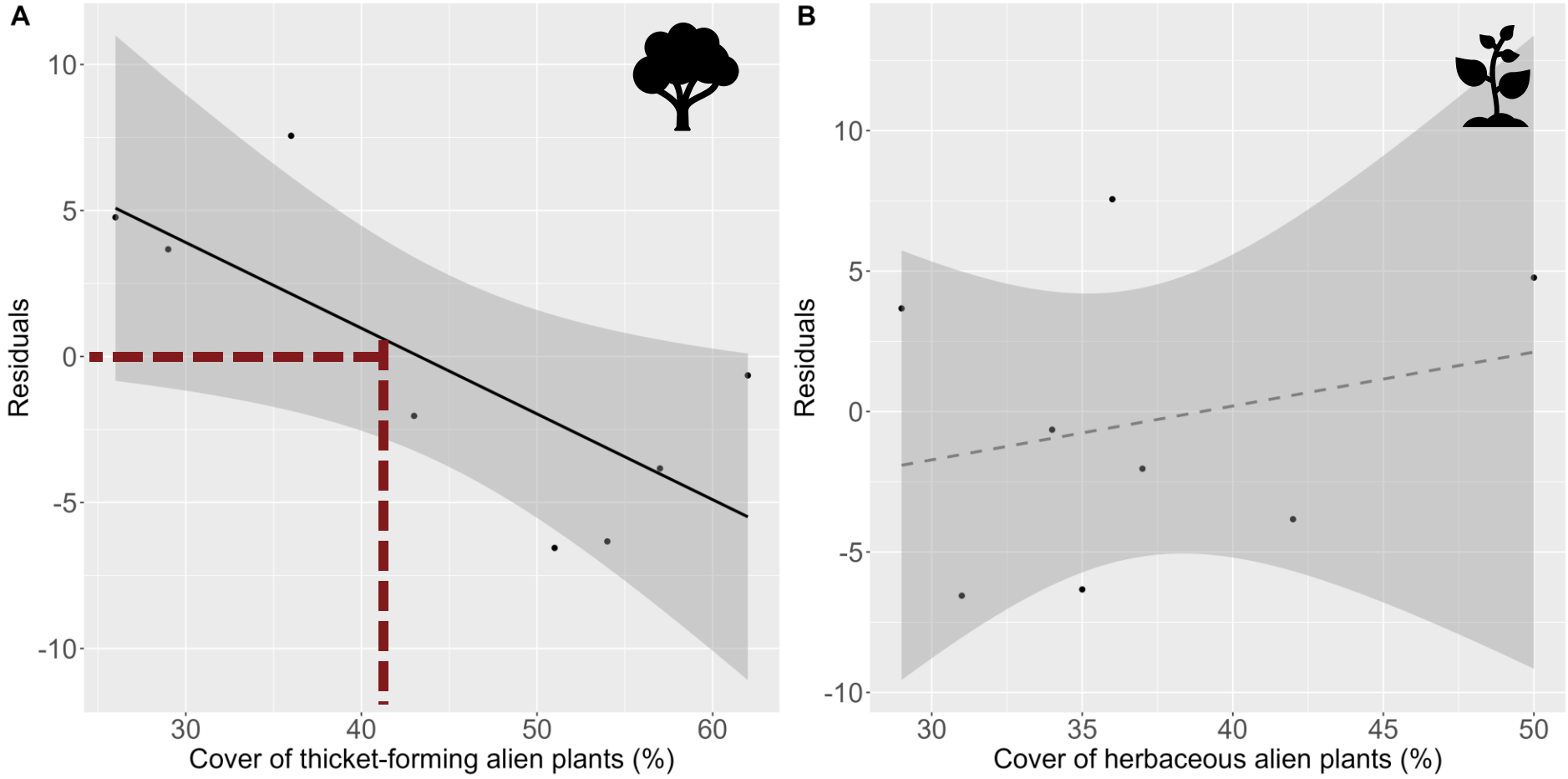

A
B
C
D



Fixed effects on vegetation parameters

1

Effects of plant traits and abundance

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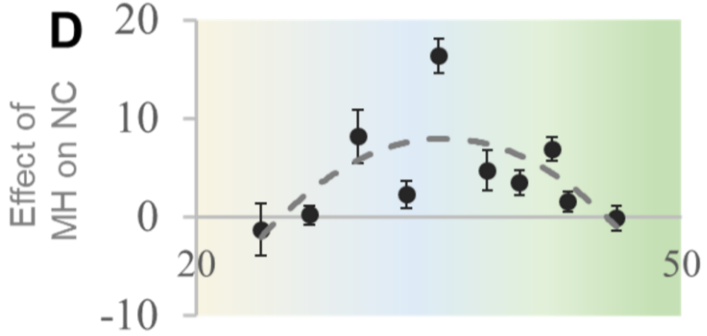
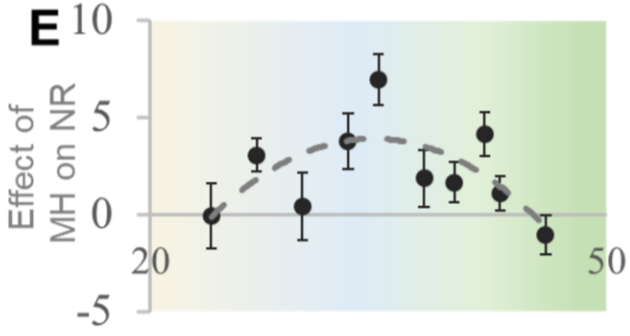
2

Effects of ecosystem traits

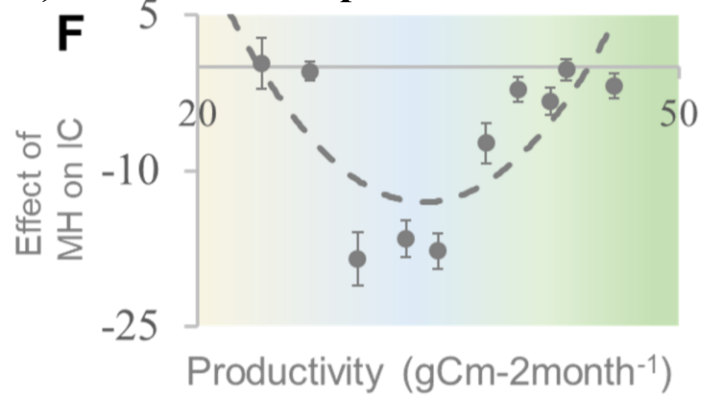
1) Effect on native plant cover



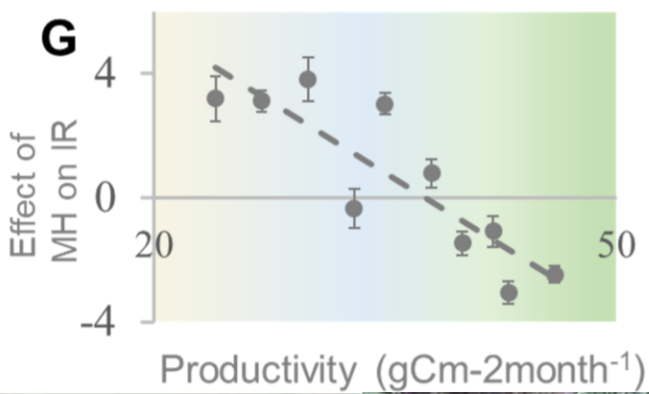
2) Effect on native plant richness



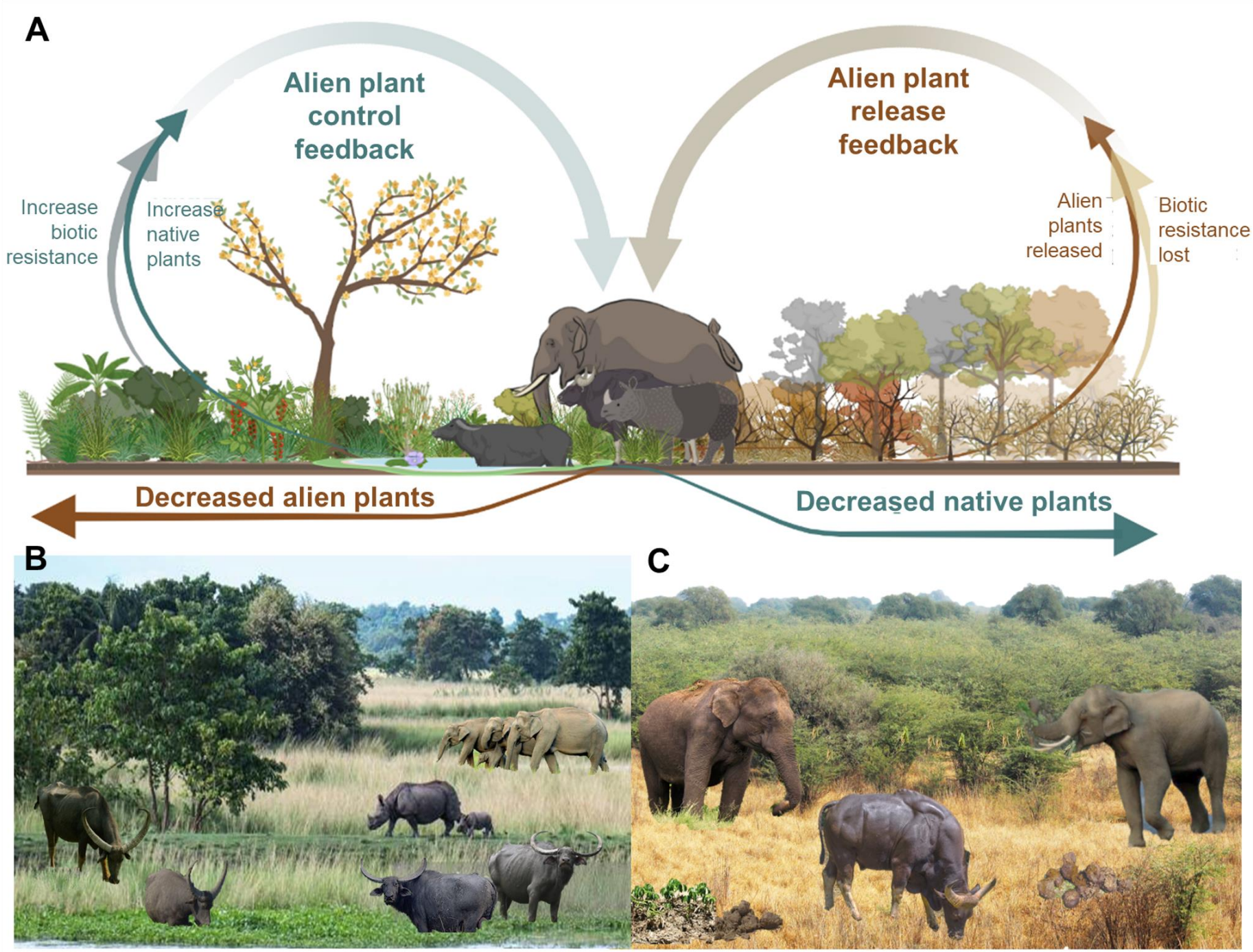
3) Effect on alien plant cover



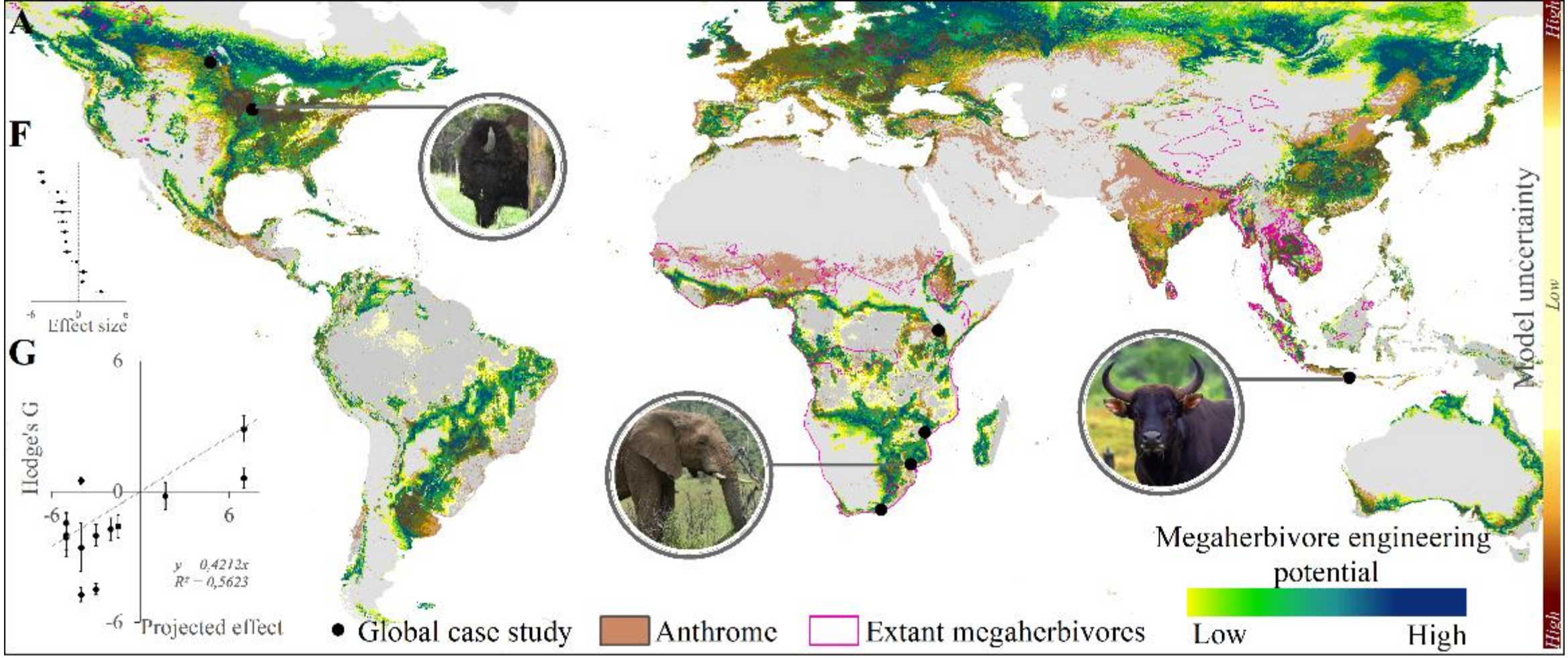
4) Effect on alien plant richness



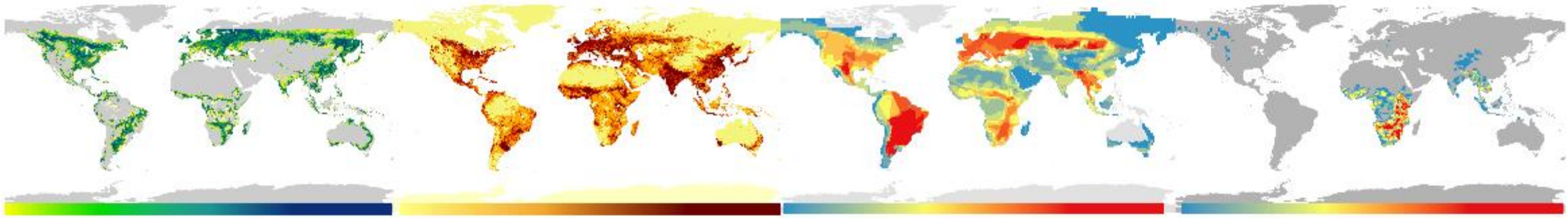
Low **PRODUCTIVITY** High

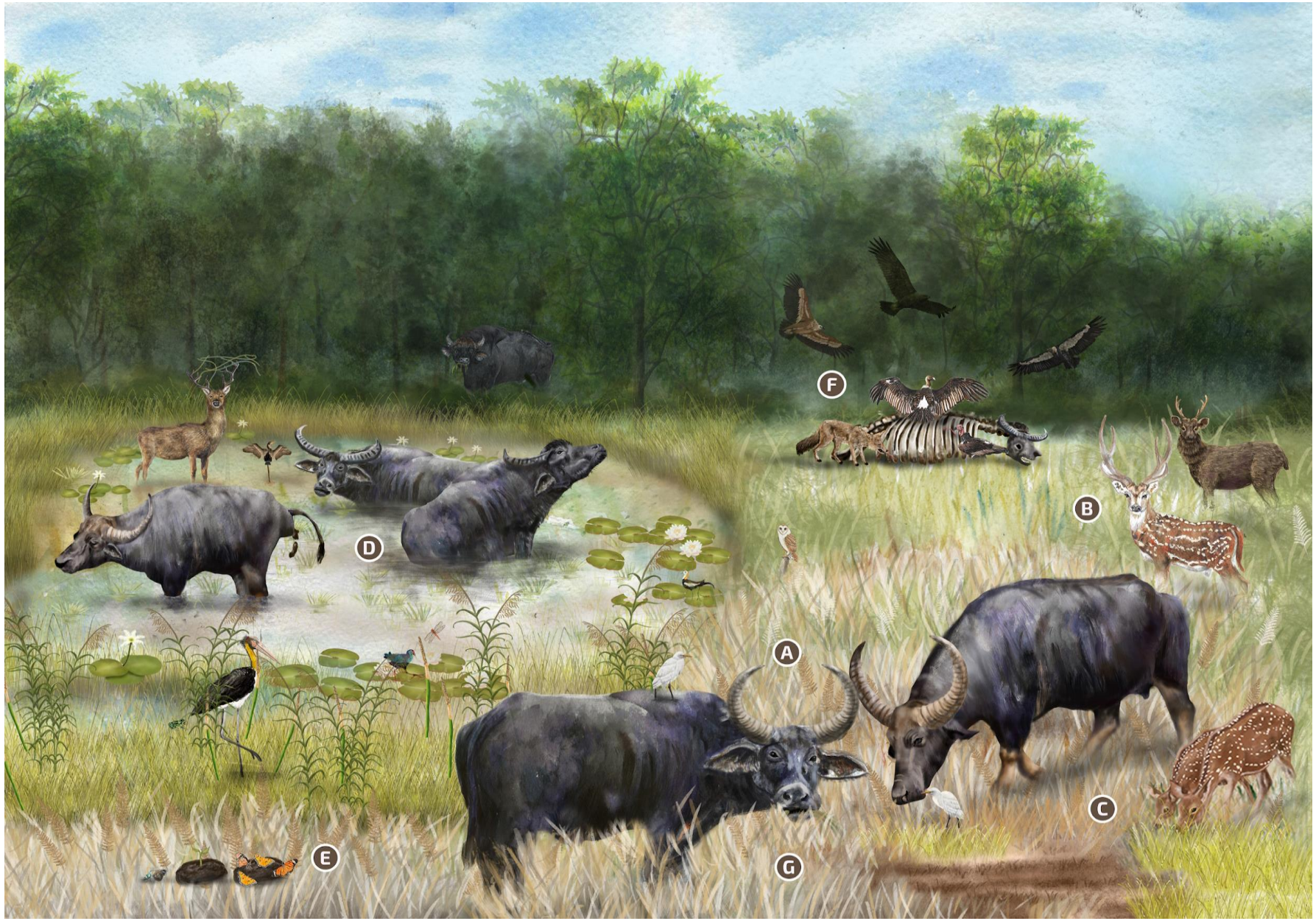

A
Alien plant control feedback
Alien plant release feedback
Increase biotic resistance
Increase native plants
Alien plants released
Biotic resistance lost
Decreased alien plants
Decreased native plants
B
C

Is there a general pattern in the relationship between megaherbivores and alien plants?



B Potential herbivory effect **C** Anthropogenic modification **D** Historical megaherbivores **E** Extant megaherbivores



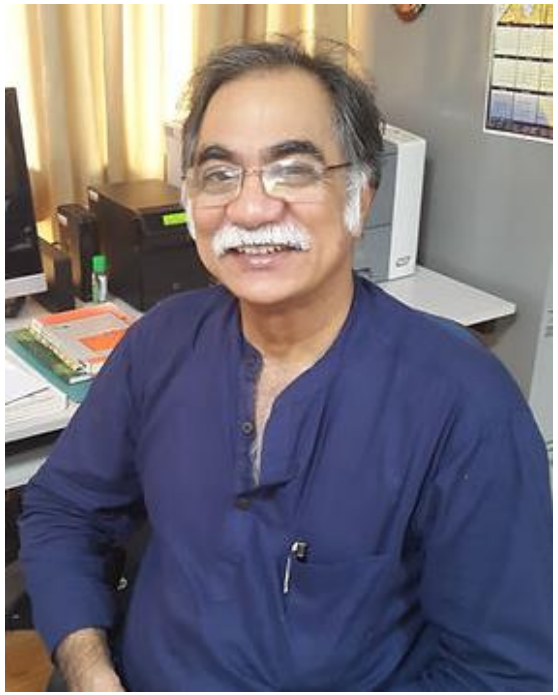
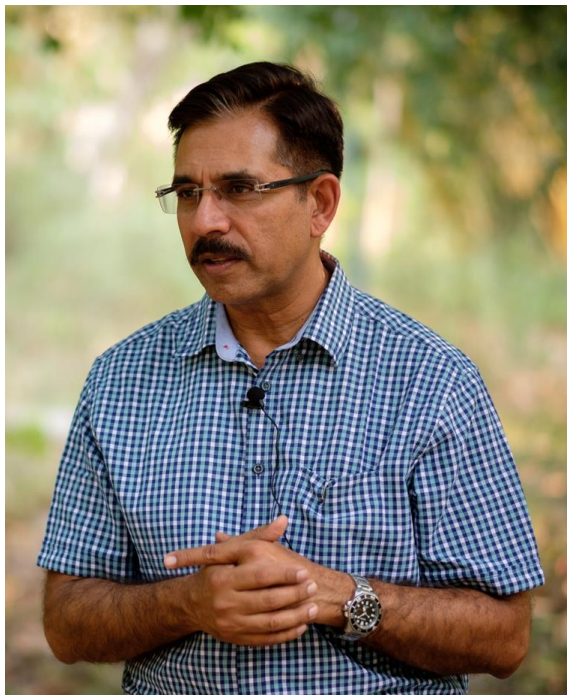


Bora JK, et. al. including Mungi NA (2024) Restoration Ecology

In summary:

1. Novel interactions between megaherbivores and alien species across biomes
2. Megaherbivores can limit plant invasions in mid-productive systems
3. Pervasive invasions (>40%) diminished the influence of megaherbivores
4. Megaherbivores can serve as nature-based solutions for invasions
5. Possibility of global recovery of megaherbivores



National Tiger Conservation Authority
राष्ट्रीय व्याघ्र संरक्षण प्राधिकरण

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Wildlife Institute of India


Thank you