

The importance of OneHealth to people and biodiversity

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What and why OneHealth

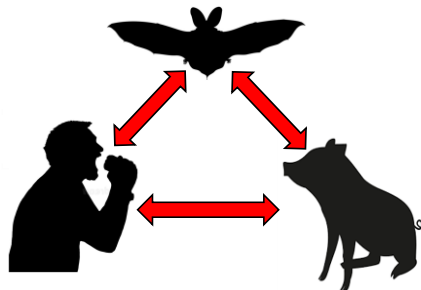
- OneHealth is a holistic approach to landscape and biodiversity management that promotes healthy ecosystems, and species as the basis of a healthy economy
- It requires an overarching and synergistic assessment of the interrelationships between elements of the system to inform management and safeguard all components

Zoonoses and risks

- 111 recent epidemic disease outbreaks have zoonotic origins (i.e. HIV-AIDS, Ebola, MERS and SARS)
- 60% of human emerging disease events are caused by zoonotic pathogens, with most (72%) originating in wildlife.
- Most human pathogens are zoonotic (80% of viruses)
- (50% of bacteria, 40% of fungi, 70% of protozoa and 95% of helminths)
- Seven coronaviruses (CoVs) are currently known to infect humans (Andersen et al 2020), four of which are regularly found in populations in which they cause only mild symptoms (Corman et al 2018)
- However, the betacoronaviruses, SARS-CoV-1, MERS and SARS-CoV-2 are more often fatal
- Over 200 novel coronaviruses have been identified in bats and approximately 35% of the bat virome sequenced is composed of coronaviruses (Banerjee et al. 2019)

Route of spillover

1. **Direct:** Bites, scratches, fluids (i.e. Rabies)
2. **Indirect:** Contamination (i.e. Marburg)
3. **Vector-borne:** Bites (i.e. Lyme, Plague)
4. **Foodborne/Waterborne:** Contamination (i.e. Hendra, Ebola)



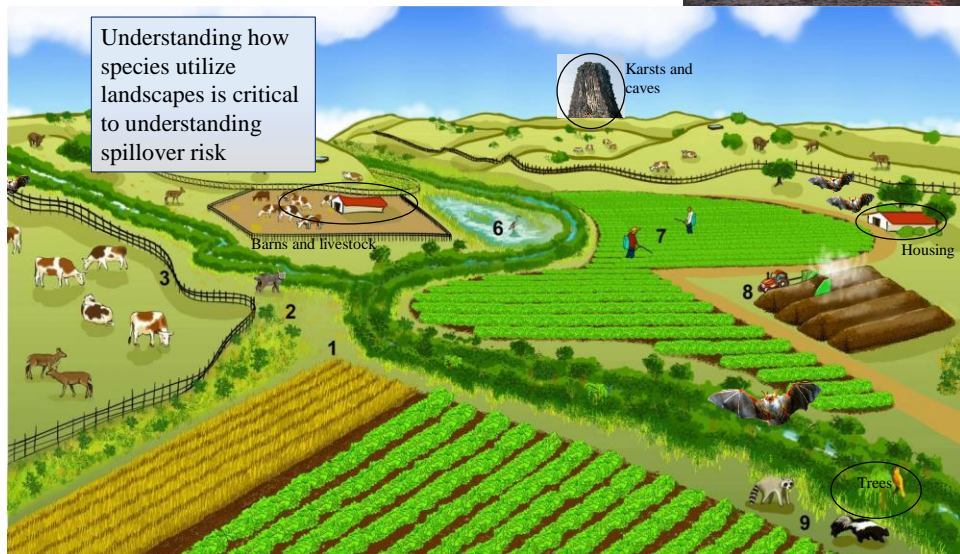
OneHealth-one world



- Unsustainable land management also increases disease risk by increasing vulnerability, transmission and spread-we will see more epidemics without better governance
- Health is a good example of how the importance of intact ecosystems and preventing unregulated consumption can be mainstreamed
- In addition to protecting key regions we can develop management approaches which minimise risk of spillover
- Following Covid-19 we will see a change in consumption patterns-but these lessons need to be expanded
- Mainstreaming of other ecosystem benefits also need to be better integrated into governance and management systems

Zhou, H., Chen, X., Hu, T., Li, J., Song, H., Liu, Y., ... & Hughes, A. C. (2020). A novel bat coronavirus closely related to SARS-CoV-2 contains natural insertions at the S1/S2 cleavage site of the spike protein. *Current Biology*.

Wildlife & Humans



Badgers and TB



- TB became a renewed issue in cattle in the 1960s around when maize (high sugar, low nutrients) started to be widely grown
- Habitats in England are fragmented, and combined with easy food badgers encounter cattle
- Government funded scientists showed that culls were not only ineffective of preventing badgers spreading TB to cattle but actually exacerbated it due to the perturbation effect
- Disrupting populations makes badgers stressed, and makes them move-spreading TB, increasing upto 130% in cull zones
- The government funded culls have increased cattle TB in areas with culls
- This shows that species ecology is important, and policy that ignores it will exacerbate issues
- Quoted in 2012 as calling the proposed pilot strategy ‘mindless’, Lord Krebs reiterated that: “The scientific case is as clear as it can be: this cull is not the answer to TB in cattle. The government is cherry-picking bits of data to support its case.”

Nip it in the bud!

DON'T LET HENDRA TAKE HOLD

Be alert with sick horses

- Protect yourself from body fluids
- Wash your hands and equipment
- Call your vet quickly

Put feed and water under cover

Be aware around flying foxes

- Move horses from paddocks or fence off trees with flying foxes
- Don't leave out food like fruit or vegetables

Native tree

Fruit tree

Hedge

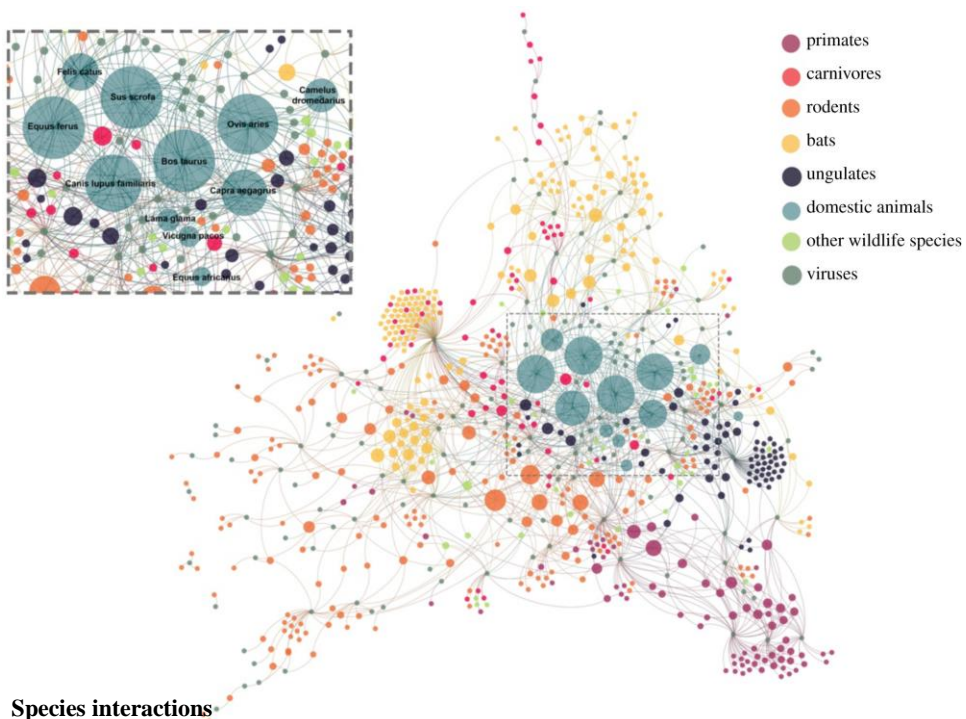
Fence off danger zones under trees attractive to flying foxes

The Australian Veterinary Association Ltd ABN 63 008 522 852 www.ava.com.au August 2011

OneHealth and risk

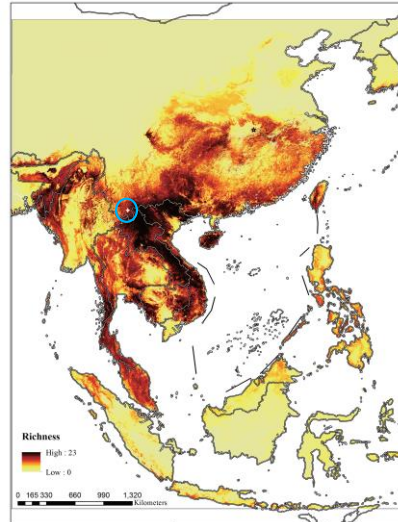


- Fragmentation associated with changes in diet, and changes in microbiome
- We need a clearer understanding of the impacts of habitat modification on species to understand what the risks are and where they fall to enable proactive management
- Changing the landscape has a domino effect on other elements of the ecosystem, and this changing interface combined with the effects of stress may drastically increase spillover risk
- So understanding links between species, and species and environment are essential



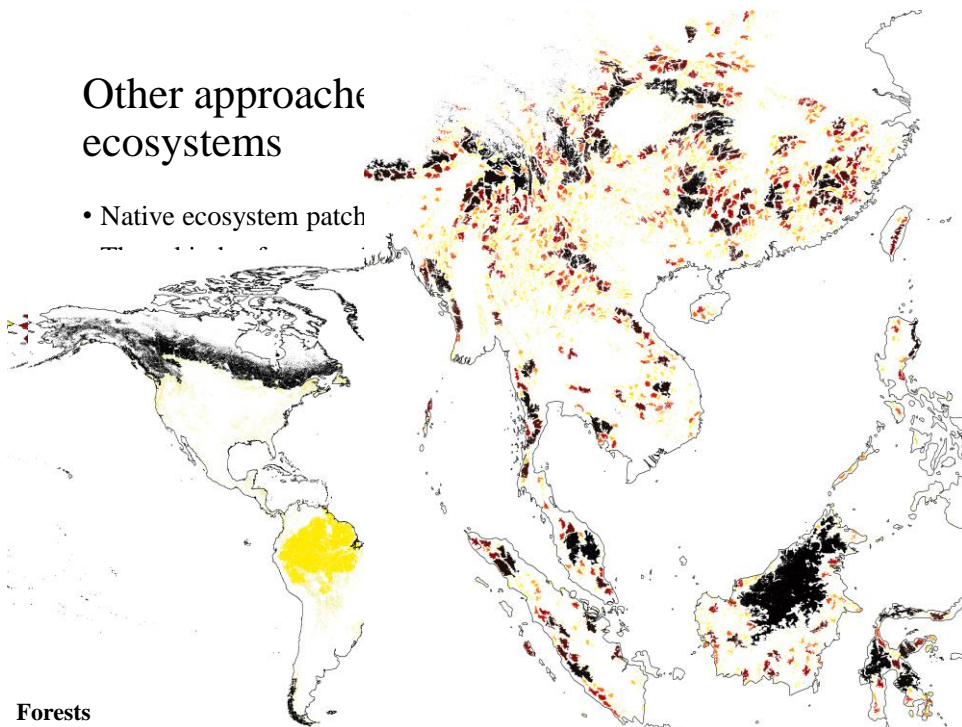
Bats and CoVs

- In a sample of 441 bats we found 24 CoVs
- This included some of the most similar to SARS-COV2 (94.5%)
- Including four novel SARS-CoV-2 related and three SARS-CoV related genomes
- Bat CoVs are not rare!
- However-spillover is still rare
- High diversity with at least 24 species projected to co-exist in some regions
- Understanding risks of when and why spillovers may occur is important

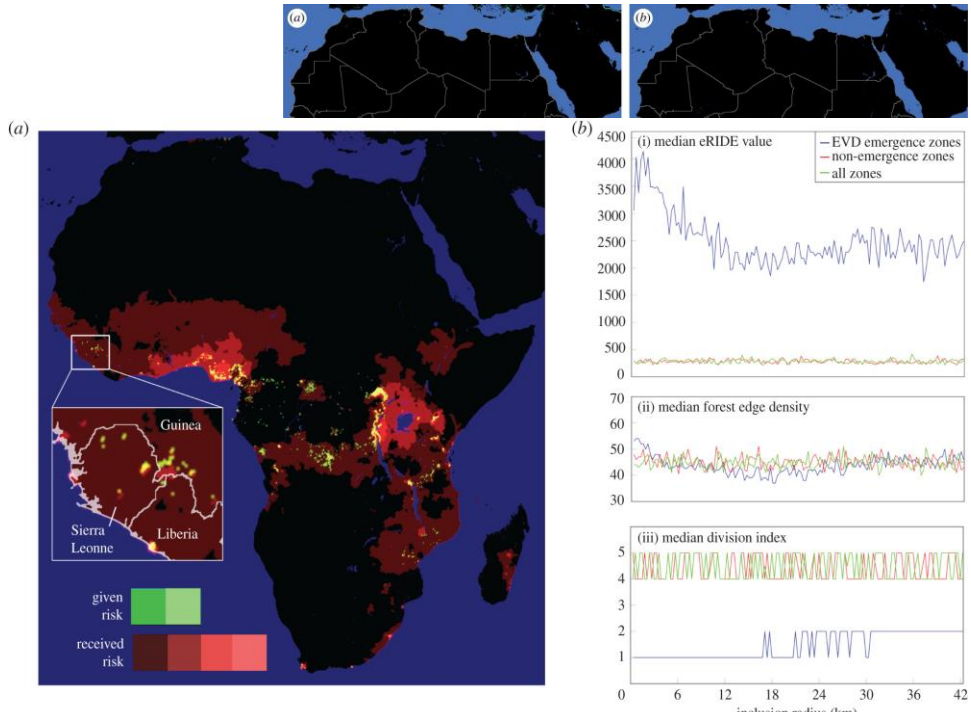


Other approaches ecosystems

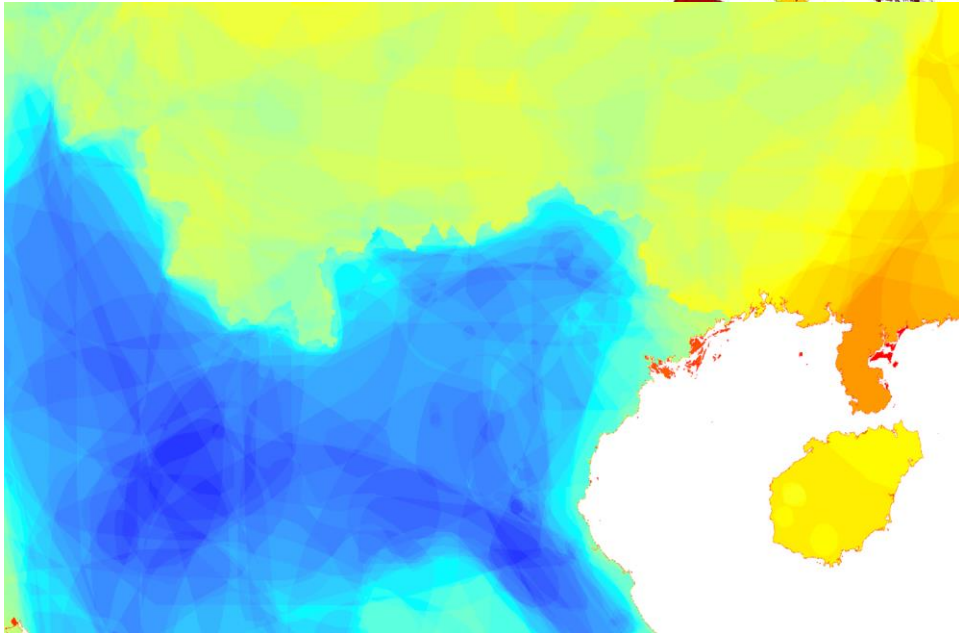
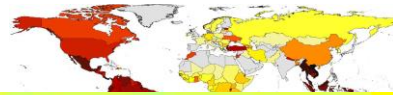
- Native ecosystem patch



Forests



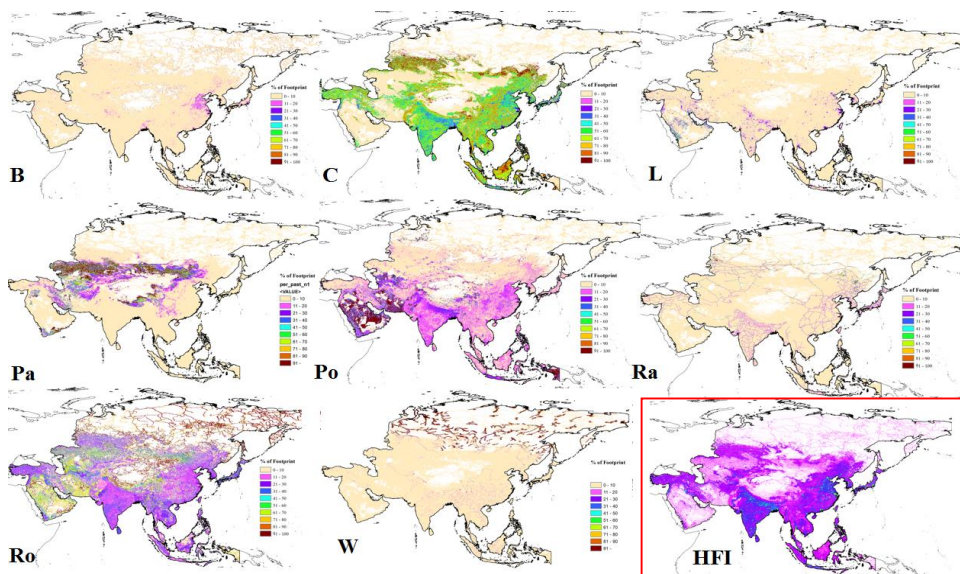
Understanding data for

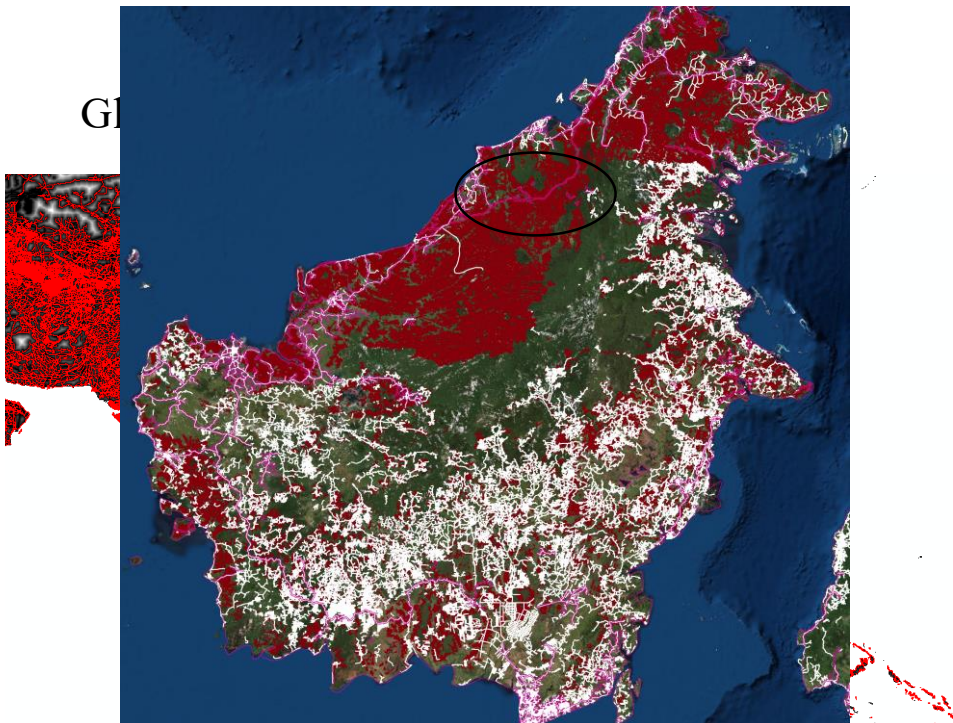
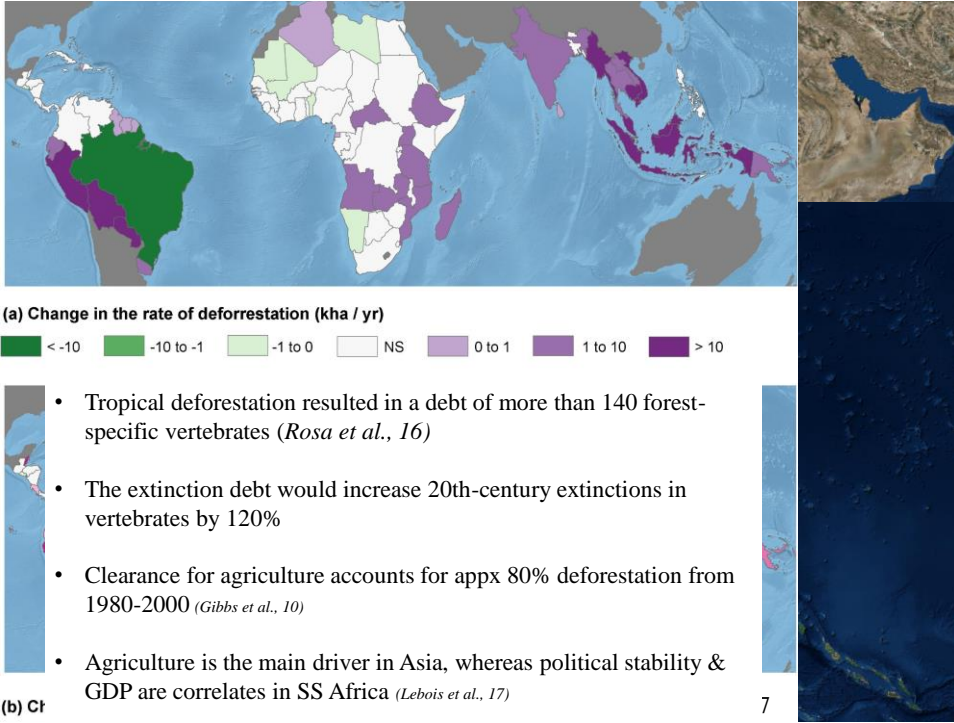


Is Asia at a higher risk?

- Asia has well over half the worlds population
- With increasing population, industrialization and consumption of meat it is putting natural resources under increasing pressure
- The interface between livestock and wildlife is also considerable providing risks of spillover via direct contact, parasites or fluids
- Asia Pacific Accounts For 69% Of The Dimension Stone Mining Market; Granite Accounts For The Largest Segment
- However rate of change within Asia is also a major risk

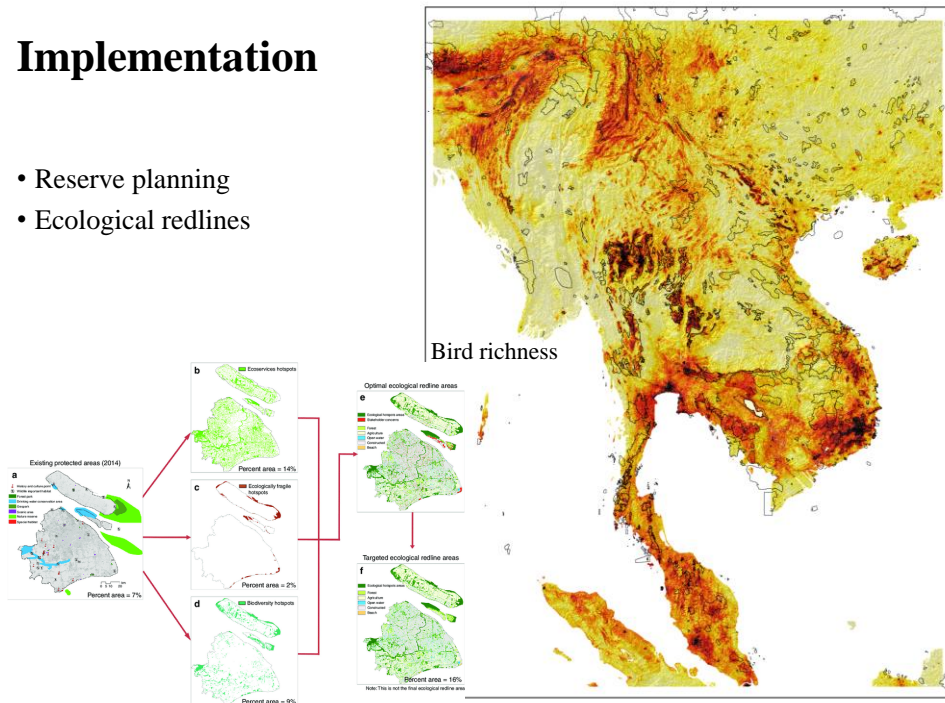
Is Asia at a higher risk?





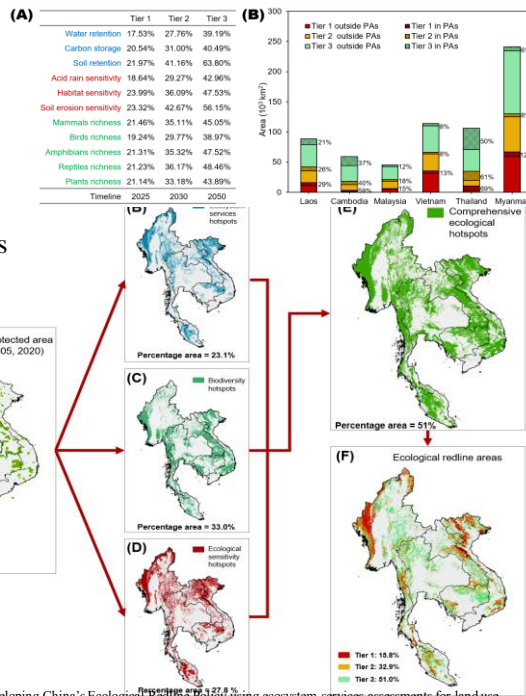
Implementation

- Reserve planning
- Ecological redlines



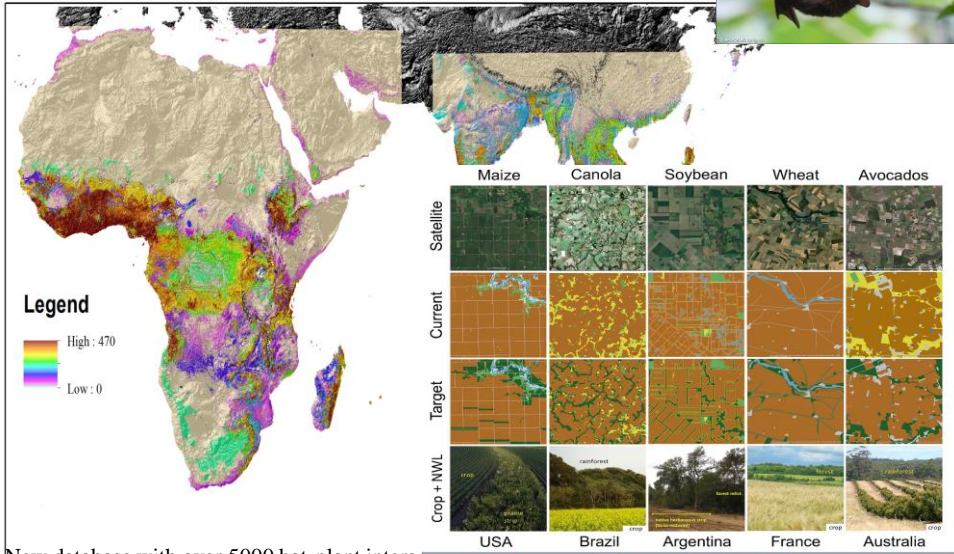
Navigating better targets

- Managing landscapes to maintain ecosystem service provision means balancing different needs and understanding the trade-offs which allow direct mechanisms for payments for ecosystem services
- These can be set to be implemented in concert with global targets



Bai, Y., C. P. Wong, B. Jiang, A. C. Hughes, M. Wang, Q. Wang. (2018) Developing China's Ecological Redline Policy using ecosystem services assessments for land use planning.

Services and value



New database with over 5000 bat-plant interactions
 Garibaldi, L. A., Oddi, F. J., Miguez, F. E., Bartomeus, I., Orr, M. C., Jobbágy, E. G., Hughes, A.C. ... & Abramson, G. (2020). Working landscapes need at least 20% native habitat. *Conservation Letters*, e12773.

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Where Bats Are Still on the Menu, if No Longer the Best Seller

Indonesia's wildlife markets are "like a cafeteria for animal pathogens," but they have resisted efforts to close even as China has shut its own markets over coronavirus fears.



A vendor arranging bat meat in Tomohon market in northern Sulawesi, Indonesia, in 2017. "Before the virus, bats were the most popular" meat, one butcher said. Bay Ismoyo/Agence France-Presse — Getty Images

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Interface with wildlife



Threats



- Bat hunting for consumption as bushmeat and medicine affects at least 167 species of bats (13 % global bat species)
- Half (92/183) extant Pteropodidae species are hunted
- Pteropodids that are hunted are six times more likely to be Red Listed as threatened: 66 % species (CR, EN, VU, NT), compared to 11 % of species in the 'Least Concern' (LC) category
- Bats are frequently a scapegoat for issues with disease and fruit predation
- Mauritius culled over 20,000 *P. niger* (20% global population)
- Culls have also been used to combat crop damage elsewhere (*i.e. Australia*)
- Culling programs have failed to reduce rabies prevalence in vampire bats (Streicker et al. 2012); and failed attempt to cull *Rousettus aegyptiacus* in Uganda resulted in a rise in the prevalence of Marburg virus (Amman et al. 2014). Yet these happen globally



Our future-our choices

- Covid is a consequence of unsustainable resource use
- The difference between Covid and the 100s of other Novel Zoonoses is that it spreads well, can be spread asymptotically-and we now move more
- The difference between now and the 2012 cases-connections
- This will not be the last pandemic unless we learn-maintain healthy habitats and populations, reduce interactions and spillover
- Sustainability and tracking systems to identify and stop spread, and reduce use of high risk species is key to reducing future pandemics

Synthesis



- Bats are keystone to many ecosystems, especially desert, savanna and island ecosystems
- Bat services are ecologically vital and economically important
- We still know very little about the majority of bat species, even basic information on distribution or taxonomy
- Better data is needed to identify and monitor species
- Regulations to protect species are also urgently needed as many species are threatened by habitat loss or direct persecution
- Education is also needed to enhance appreciation and understanding of a unique group of highly specialised mammals
- Understanding the inter-relationship between species-health and ecosystem health is challenging, but critically important

Synthesis

- Bats are a hugely diverse group with a suite of mechanisms that prolong longevity and give immunity to many viruses
- Naturally these species provide services and an index of ecosystem health
- Understanding how bats use landscapes, and how we can maintain healthy populations and conserve key sites is crucial
- However; extensive landscape change increases not only the risk of losing services, but spillover between bats, and between bats and other taxa
- For a safer future we need better information on how bats respond to stressors, and how we can protect them and thereby maintain a safer future

