Ecological effectiveness of nature reserve system in China

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Outlines

- Background
- Method
- Results
- Discussion

Background

- With rapid increase in human population, industrialization and urbanization over the last century, threats to Earth's life-support systems have been increasing
- One of the central approaches to curb such threats is establishing protected areas (e.g. nature reserves, national parks)
- Recently, there has been a tendency in shifting from the traditional view of securing biodiversity to the new conservation science of protecting ecosystems to sustain its service provision for human well-being
- What is the provision of ecosystem services from existing PAs?

Background

- Establishing PAs (e.g. nature reserves, the major category of PAs in China occupying over 80% of PAs area) is a common strategy for natural conservation in China to mitigate human threats. By the end of 2014, 2,729 nature reserves had been established, covering approximately 14.8% of its entire land surface.
- Previous nationwide assessments of the effectiveness of China's nature reserves have focused on ecological diversity.
- No comprehensive analyses have been done to assess ecosystem services in China's nature reserves
- We conducted the first nation-wide analysis of representation of both biodiversity and ecosystem services in China's nature reserves.

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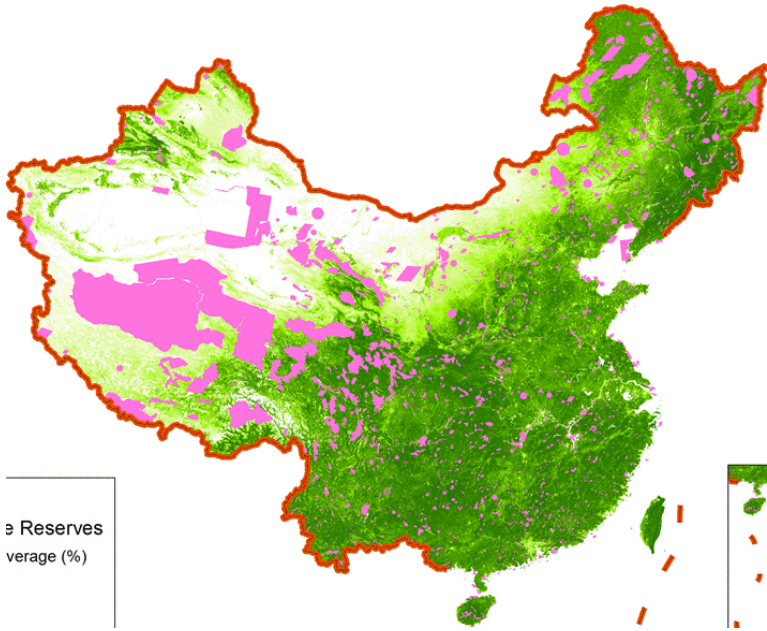
Method

Nature Reserves data

- A total of 2,412 terrestrial nature reserves collected
- From the Nanjing Institute of Environmental Sciences, and other provincial environmental sciences institutes (75% of reserves area)
- UNEP’s worldwide dataset on PAs



Method

Biodiversity mapping

- We selected threatened species in IUCN redlist or China's redlist as the indicator species, including categories of critically endangered (Cr), endangered (En), and vulnerable (Vu)
- The final selected list contains a total number of 1240 species, including 955 plants, 68 mammals, 80 birds, 91 amphibians, and 46 reptiles
- Distribution information for plants is from Scientific Database of China Plant Species
- Range maps for mammals, amphibians, and reptiles are from IUCN
- Range maps for birds are from BirdLife International

Method

Biodiversity mapping

- We refined the potential habitat for each species based on specific distribution area, elevational range, and vegetation
- Important areas for species conservation are identified by summing up weighted potential habitats for each taxon.
- To distinct the relative importance of different categories, we gave weights of 3, 2, 1 to categories Cr, En, and Vu, respectively.
- For each taxon group, we normalized the summed values separately to the range of 0–100

Method

Ecosystems service mapping

- We considered four key regulating ecosystem services: water retention, soil retention, sandstorm prevention, and carbon sequestration
- Those data are from the national ecosystem assessment project for years 2000-2010
- We normalized the biophysical supply value into importance index value range 0–100 using the minimum–maximum normalization method

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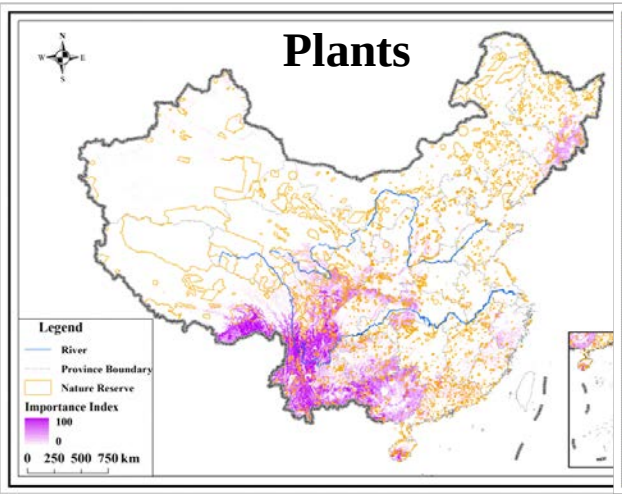
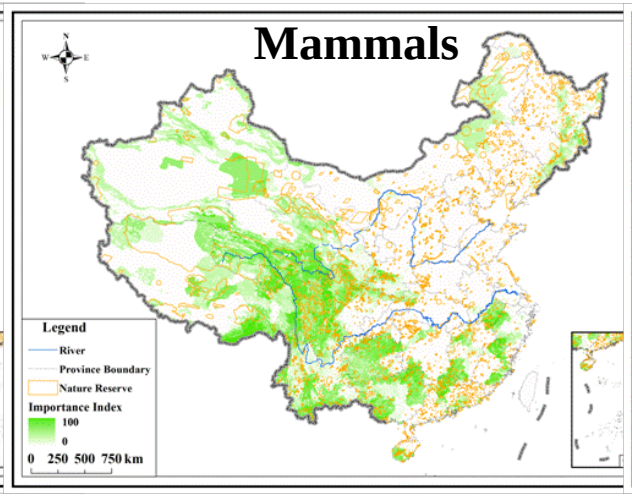
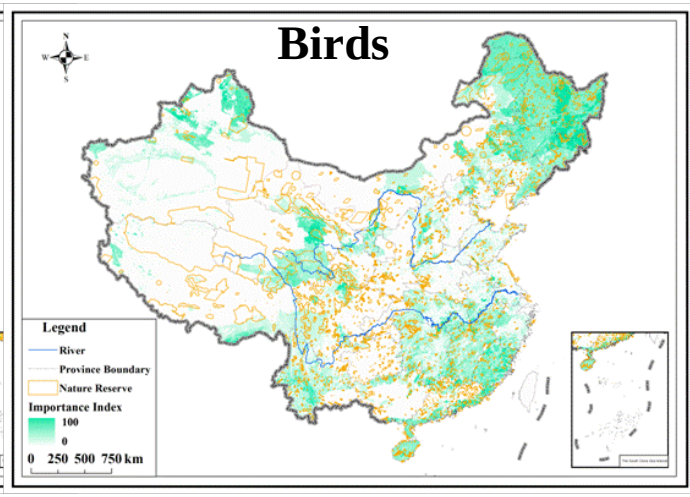
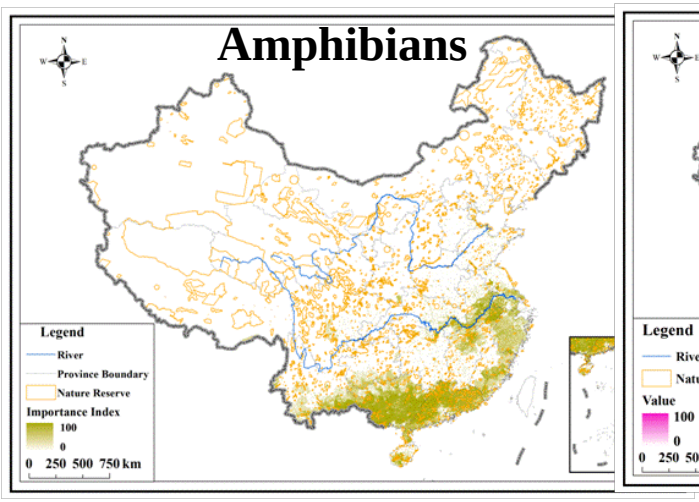
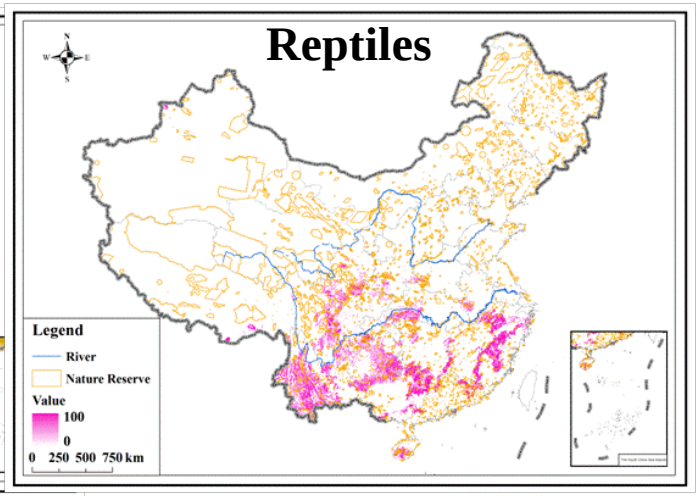
Habitat distribution of threatened species

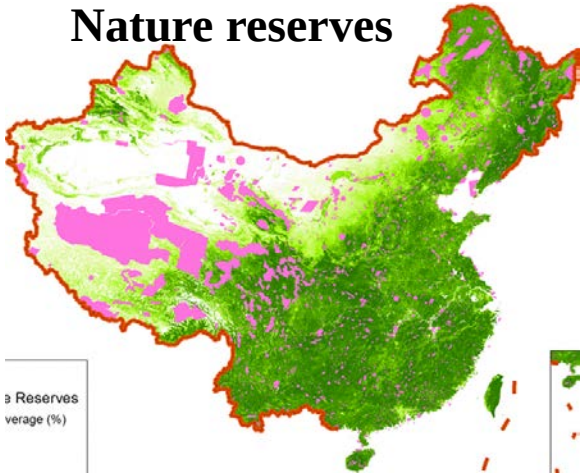






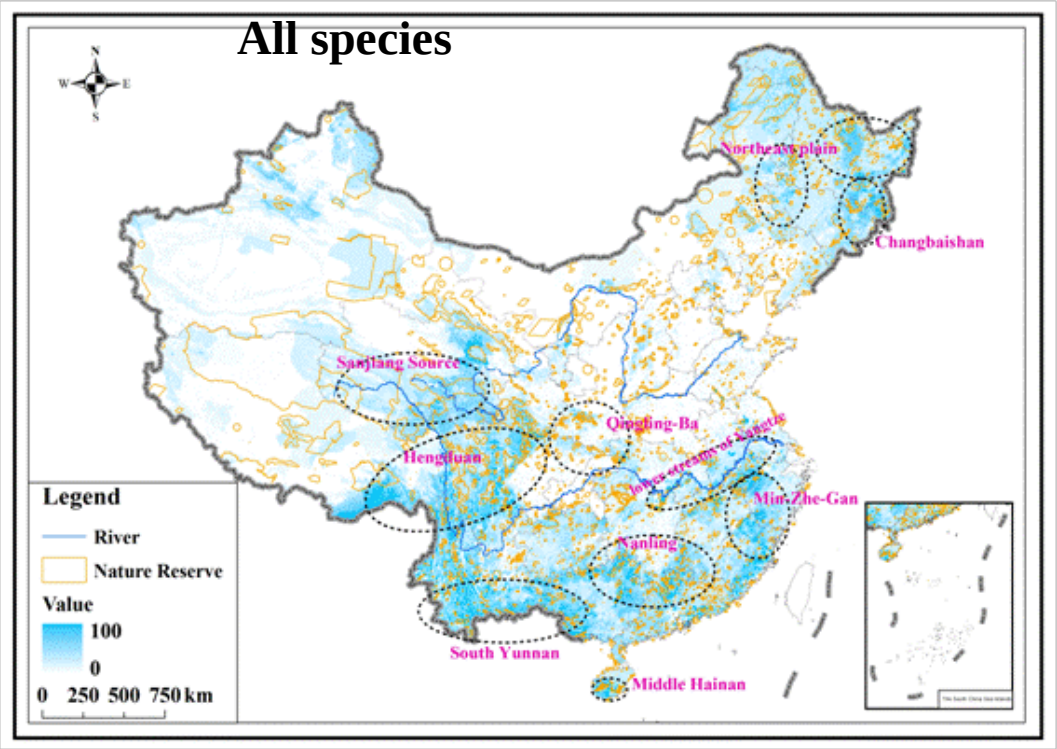


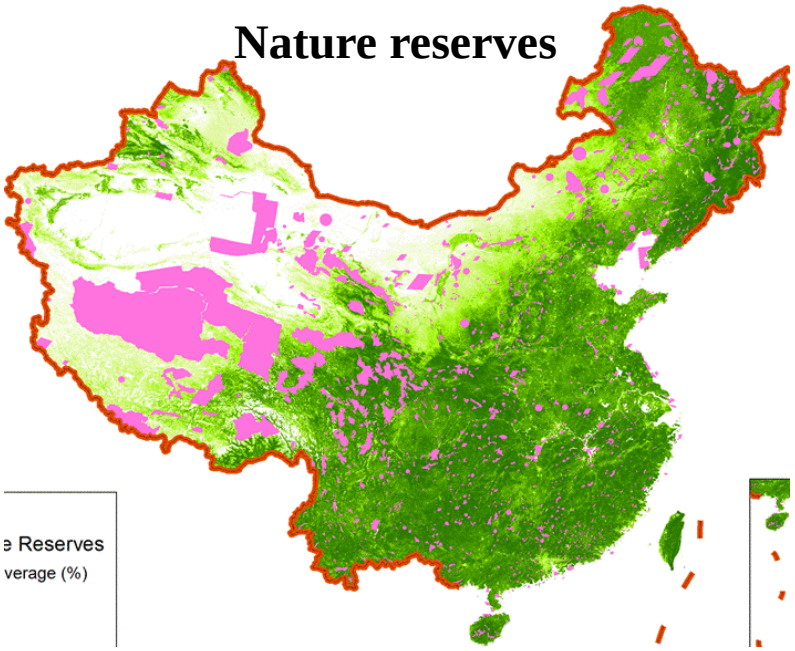




Threatened species habitats are mainly distributed in mountains areas and wetland areas in different regions of China.

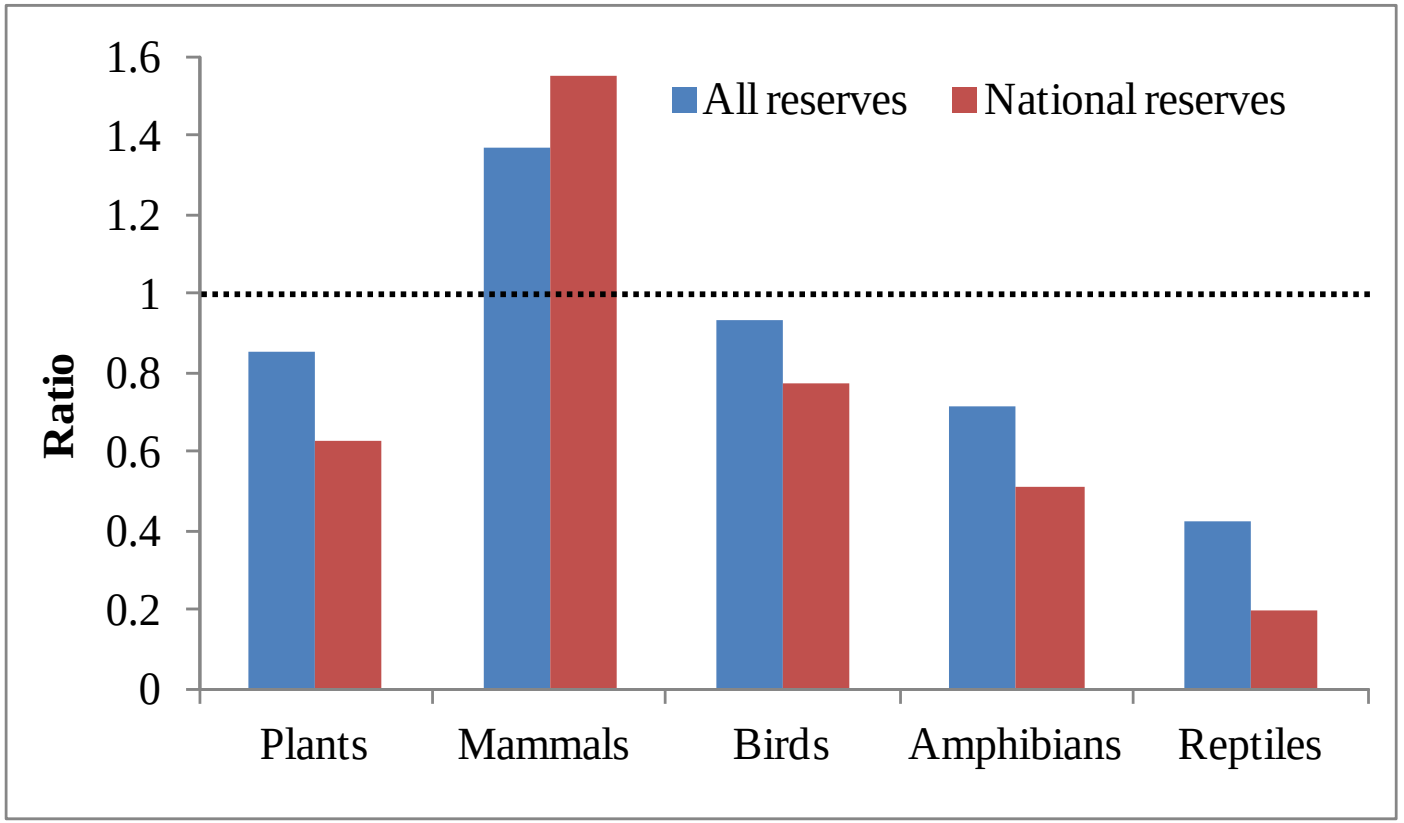
Habitat distribution of threatened species





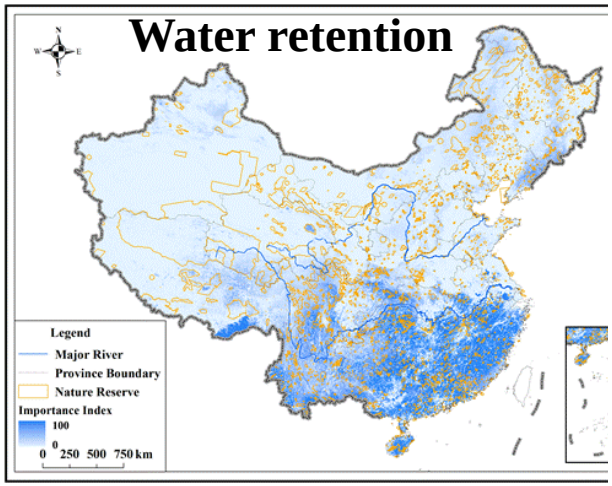
Habitat distribution of threatened species does not match well with nature reserves distribution

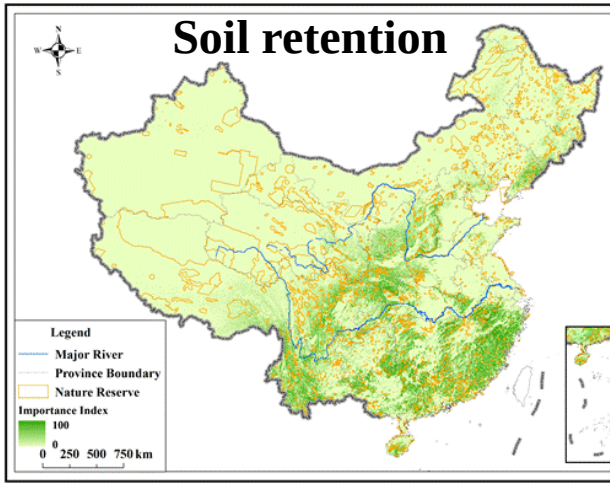
Representation of biodiversity in China's nature reserves

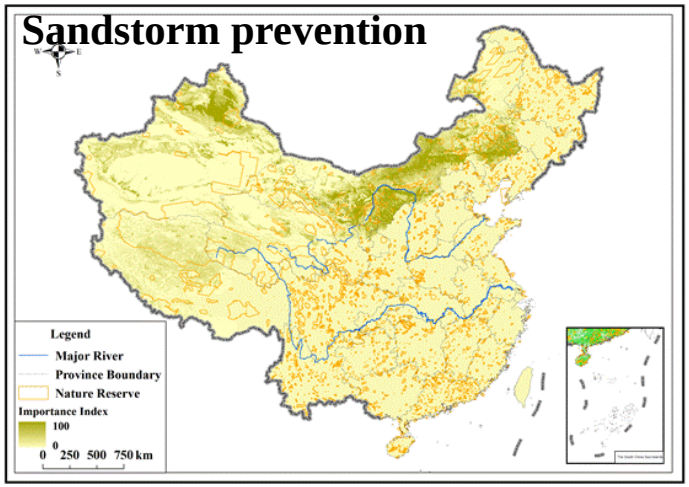


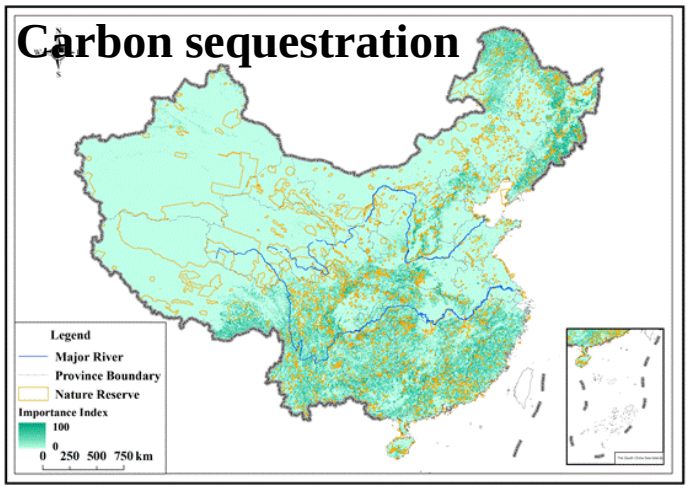
- The network has only a relatively good coverage of mammal habitat
- The unit area habitat amount in all reserves is 1.37 times of China's average for mammals, but a poor capture of the habitat for plants (0.85 times), birds (0.93 times), amphibians (0.71 times) and reptiles (0.43 times).
- China's reserves primarily focus on mammal protection but lack of enough attention to plants, birds, amphibians, and reptiles.

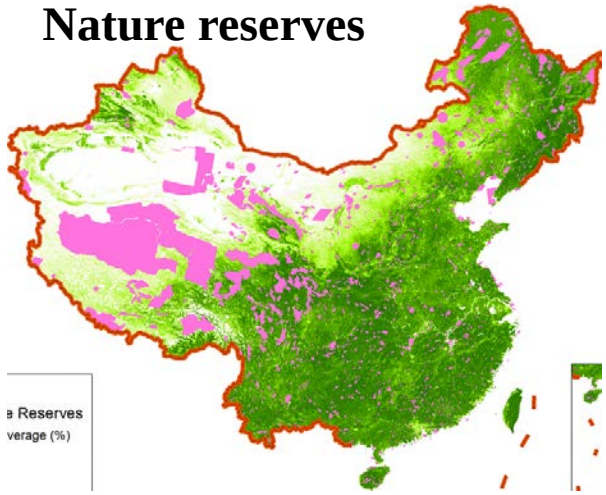
Ecosystem service distribution in China







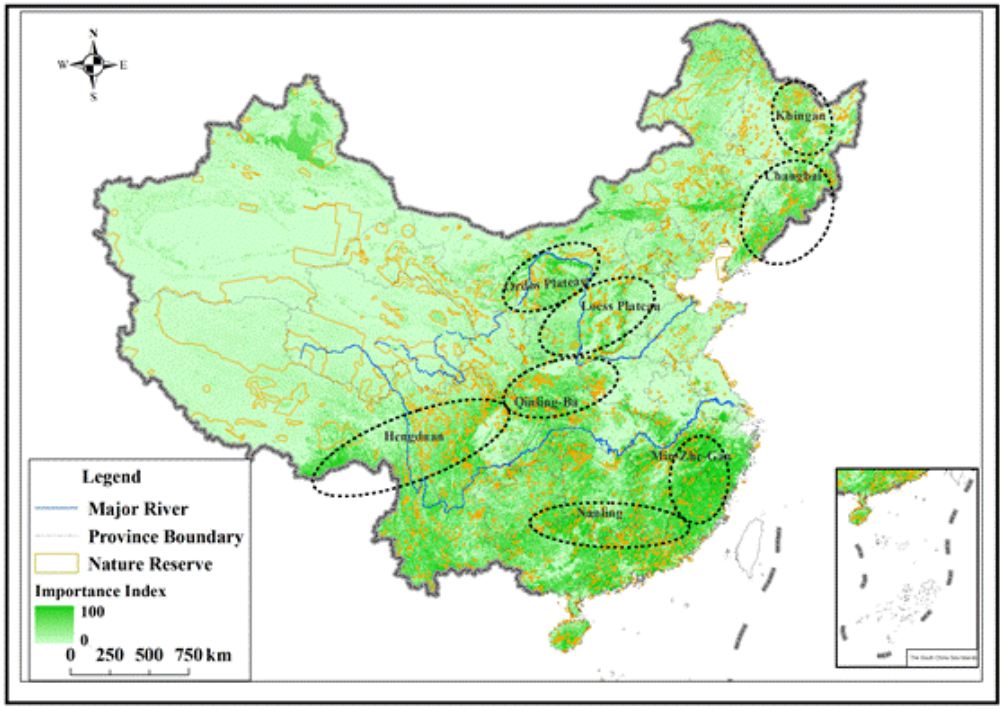




- The important areas for water retention, soil retention and carbon sequestration are mainly distributed in places with forests, shrubs, and wetlands in North, South, and Qinghai-Tibet regions in China

Ecosystem service distribution in China

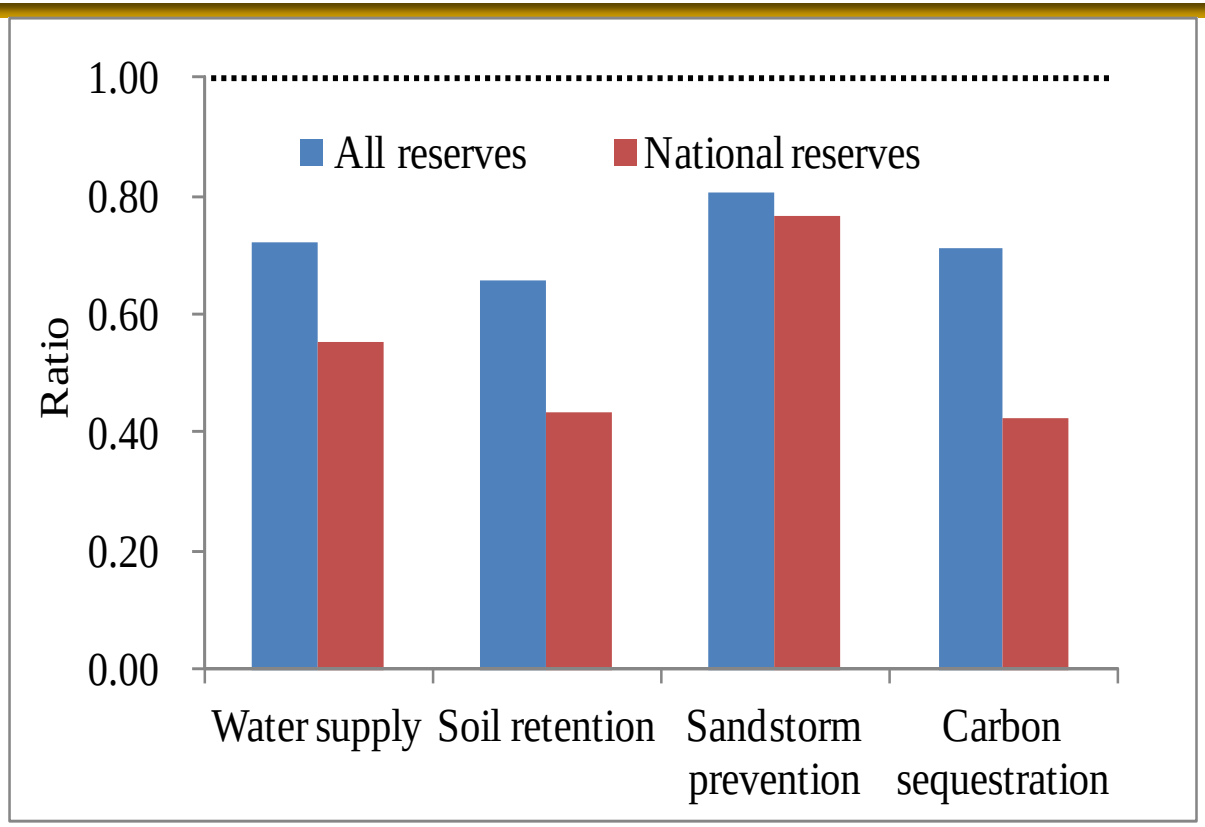
Integrated ecosystem services



Nature reserves

- The important areas for water retention, soil retention and carbon sequestration does not match well with nature reserves

Representation of ecosystem services in the nature reserves



- China's nature reserve network has a low coverage for all the four key ecosystem services.
- Relative to the national average value, the unit area ecosystem service supply (in biophysical amount) inside all reserves is only 0.72 for water retention, 0.66 for soil retention, 0.81 for sandstorm prevention, and 0.71 for carbon sequestration

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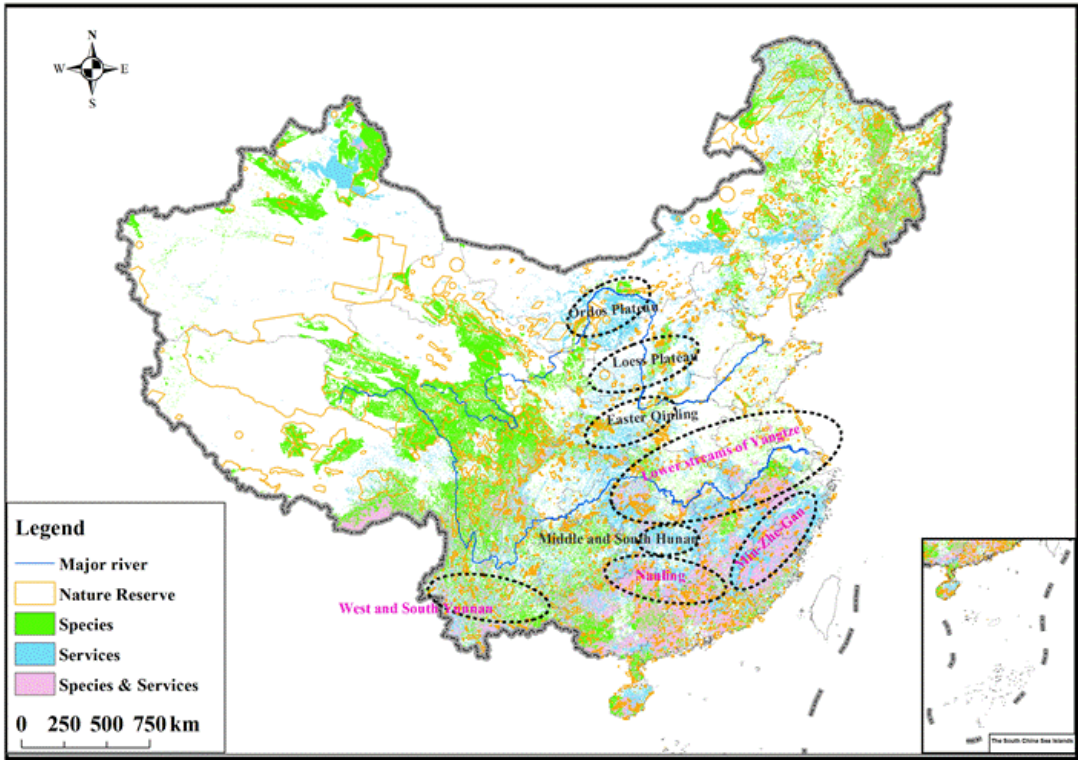
Discussion

- We recommend optimizing NR systems based on biodiversity and ecosystem service patterns.
- In areas where biodiversity is poorly protected, NRs need to be established or expanded, for threatened species.
- In areas where important ecosystem services are poorly protected, we propose to establish a new category of PA particularly for ecosystem service conservation



Discussion

- We suggest also creating this new category in the PA classification system by IUCN
- Above recommendations may also apply to the ongoing reform of China's national park system, eventually toward the establishment of an integrated PA system in China

Thank you!