



Energy research Centre of the Netherlands

Exceedance of Critical Loads for Nitrogen at the World's Protected Areas

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Convention on Biological Diversity

- 1992 – establishment of the Convention on Biological Diversity (CBD)
 - conservation of biological diversity
 - sustainable use of its components
 - fair and equitable sharing of the benefits arising out of the utilization of genetic resources
- Objective: halting the loss of biodiversity by 2010

Protected Areas

- 2004 – start of the Programme of Work on Protected Areas (POWPA)
 - ‘support the establishment and maintenance of comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas’

Protected Areas (PAs)

- Functions of PAs
 - set aside areas, maintaining functioning natural ecosystems,
 - benchmarks against which we understand human interactions with the natural world,
 - providing direct human benefits (i.e. ecosystem services)
 - conserving places of value such as sacred natural sites.
- Examples of PAs are: national parks, nature reserves, wilderness areas and wildlife management areas.

PAs database

- UN World Conservation and Monitoring Centre (Cambridge, UK) - collecting the data and maintaining the database
- Database contains spatial and attribute information about:
 - >120,000 PAs
 - covering about
 - 2 % of the Earth's land area
 - 6 % of the territorial seas
 - about 0.5% of the extra-territorial seas

Global Biodiversity Outlook

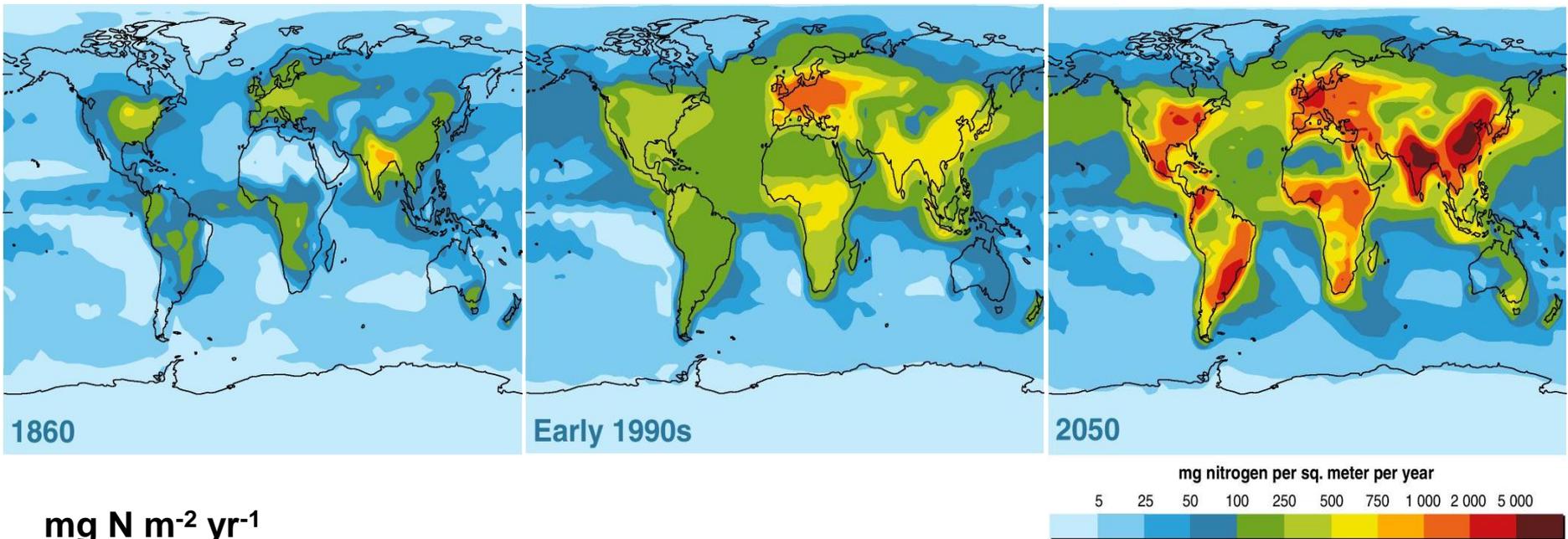
Global Biodiversity Outlook




*** good indicator methodology with globally consistent time course data;
 ** good indicator, but no time course data;
 * indicator requires further development and/or limited data.

↓	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socio-economic importance	★	***
↑	Coverage of protected areas	***	***
FOCAL AREA: Ecosystem integrity and ecosystem goods and services			
↓	Marine Trophic Index	***	***
↓	Connectivity – fragmentation of ecosystems	**	**
↓ ↑	Water quality of aquatic ecosystems	***	***
FOCAL AREA: Threats to biodiversity			
↑	Nitrogen deposition	***	***
↑	Trends in invasive alien species	★	★
↔	Ecological footprint and related concepts		***
FOCAL AREA: Status of traditional knowledge, innovations and practices			
↓	Status and trends of linguistic diversity and numbers of speakers of indigenous languages		★
FOCAL AREA: Status of access and benefit sharing			
?	Indicator of access and benefit-sharing to be developed		
FOCAL AREA: Status of resources transfers			
↓	Official development assistance (ODA) provided in support of the Convention		★

Atmospheric Deposition: Past, Present en Future



Source: Galloway et al. 2004

Millennium assessment

Global Biodiversity Outlook 2

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	↓	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socio-economic importance	★	★ ★
C	↑	Coverage of protected areas	★ ★ ★	★ ★
B		FOCAL AREA: Ecosystem integrity and ecosystem goods and services		★ ★
C	↓	Marine Trophic Index	★ ★ ★	★
	↓	Connectivity – fragmentation of ecosystems	★ ★	★ ★
	↓ ↑	Water quality of aquatic ecosystems	★ ★ ★	★ ★
		FOCAL AREA: Threats to biodiversity		★ ★
	↑	Nitrogen deposition	★ ★ ★	★
	↑	Trends in invasive alien species	★	★
	↓	Ecological footprint and related concepts		★ ★ ★
		FOCAL AREA: Status of traditional knowledge, innovations and practices		
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Question:

To what extent does nitrogen deposition threaten the Protected Areas?

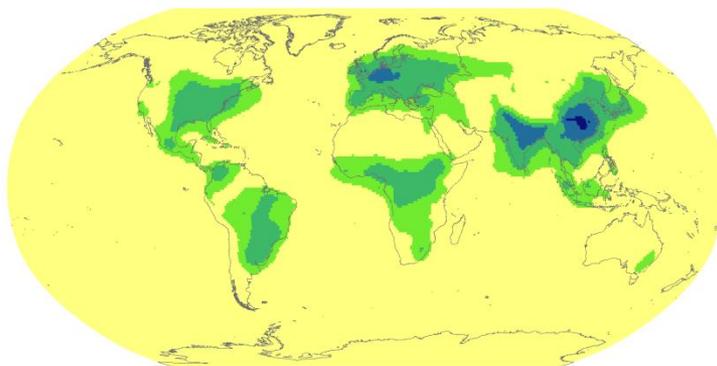
Setup of the research

- Collect data:
 - Protected Areas
 - Nitrogen Deposition
- Classify the Protected Areas
 - WWF Ecoregions
 - Biodiversity Hotspots
- Overlay the classified data with nitrogen deposition

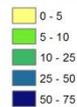
Nitrogen Deposition

- Study by F. Dentener et al. (2006)
- Ensemble mean of multi-model (23) comparison
- 1x1 degree resolution

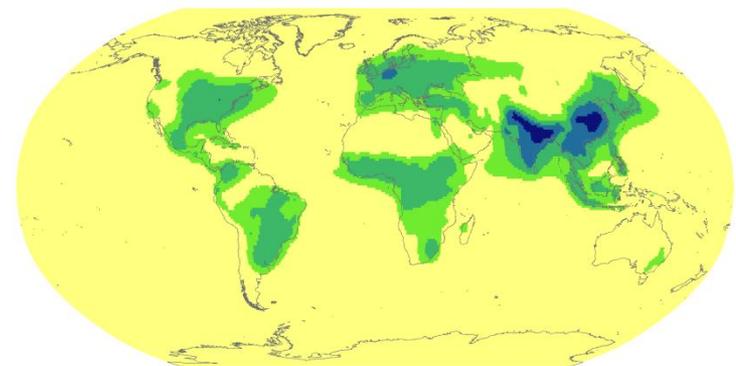
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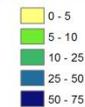
Total nitrogen deposition (kg N/ha/yr)



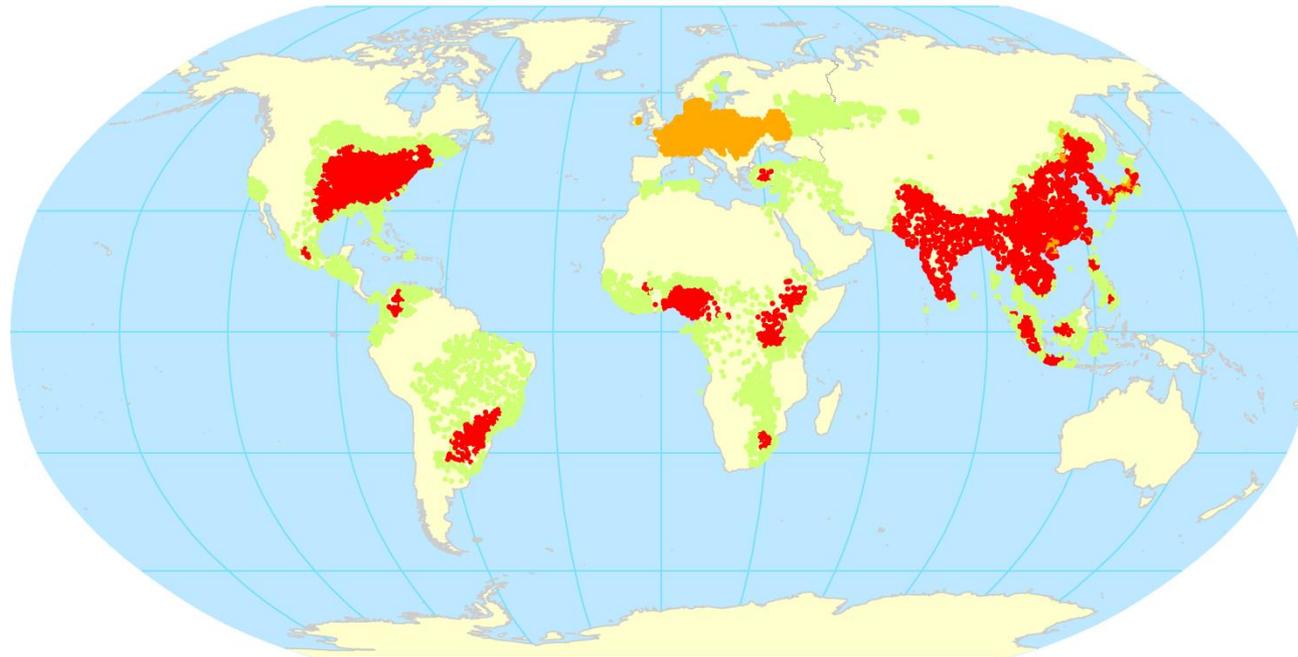
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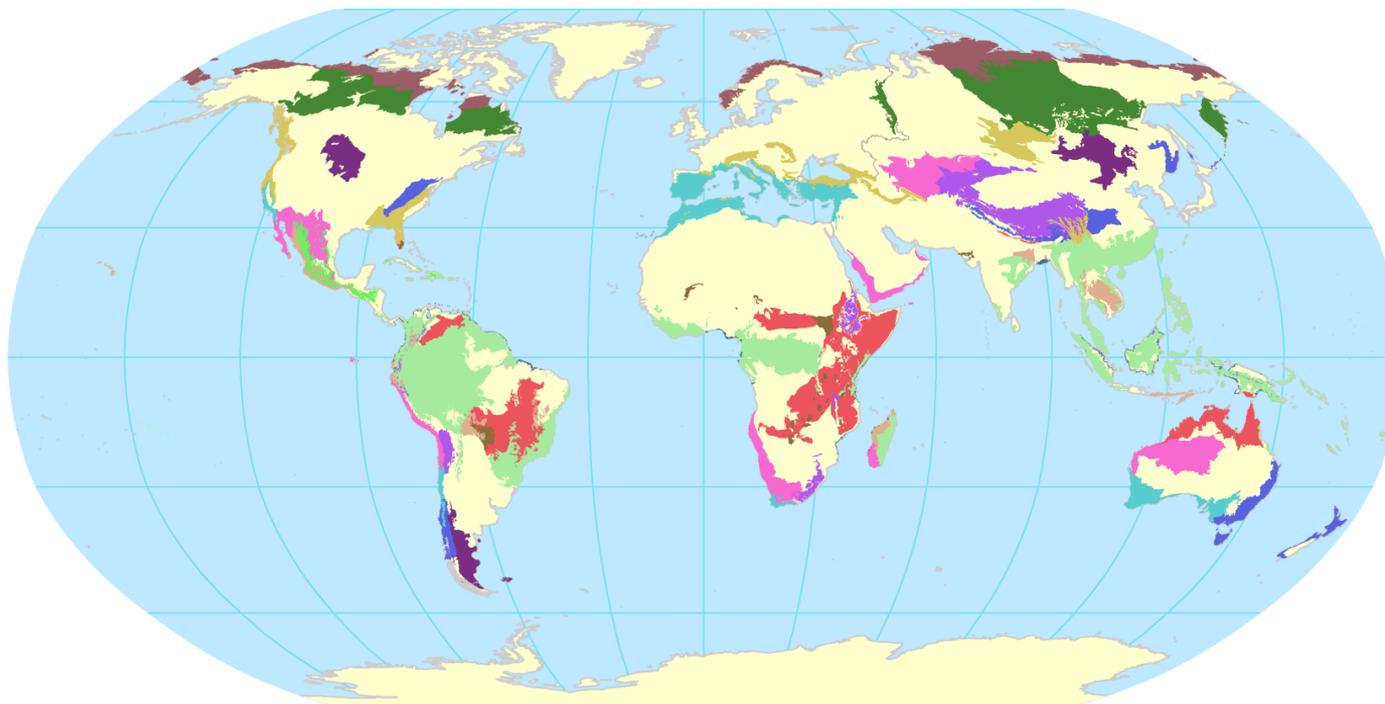
Total nitrogen deposition (kg N/ha/yr)



PAAs and Nitrogen

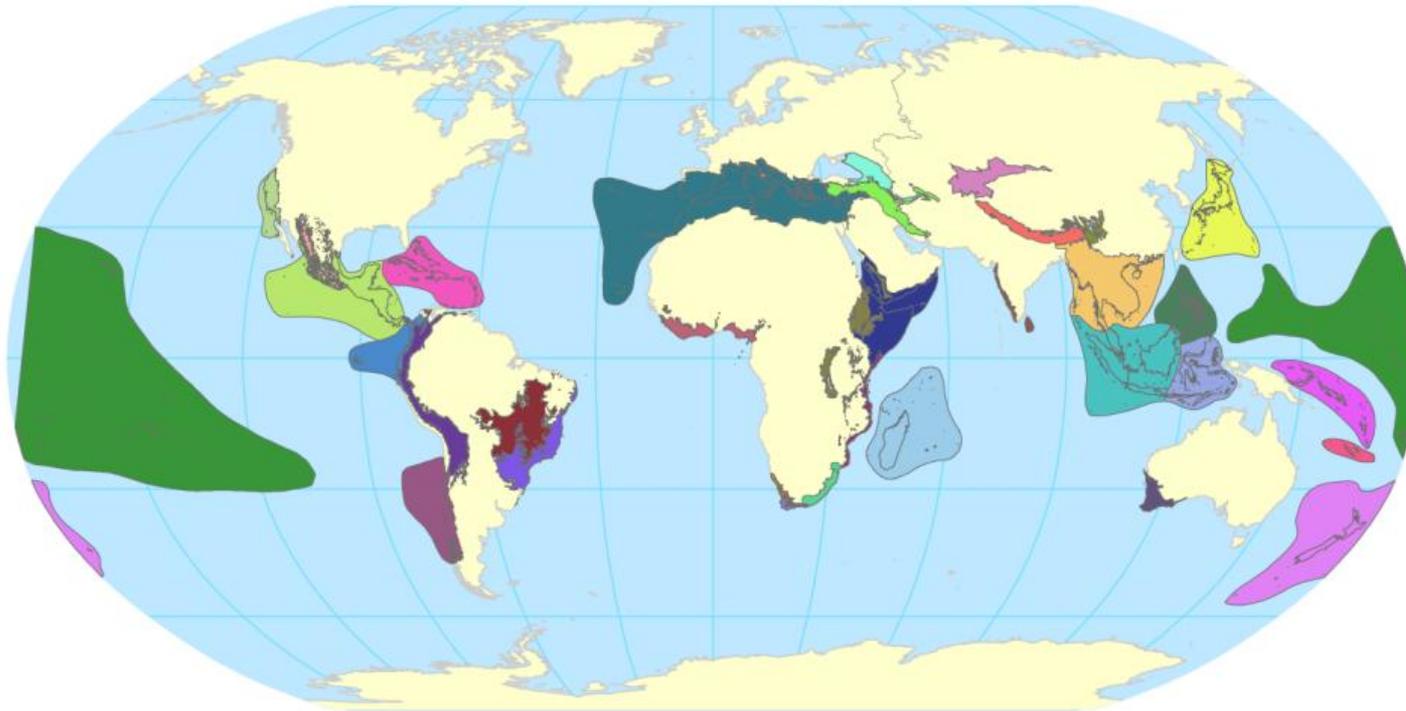


PA's & WWF Ecoregions



Terrestrial Major Habitat Types		
■ Tropical & Subtropical Moist Broadleaf Forests	■ Boreal Forests/Taiga	■ Tundra
■ Tropical & Subtropical Dry Broadleaf Forests	■ Tropical & Subtropical Grasslands, Savannas & Shrublands	■ Mediterranean Forests, Woodlands & Scrub
■ Tropical & Subtropical Coniferous Forests	■ Temperate Grasslands, Savannas & Shrublands	■ Deserts & Xeric Shrublands
■ Temperate Broadleaf & Mixed Forests	■ Flooded Grasslands & Savannas	■ Mangroves
■ Temperate Conifer Forests	■ Montane Grasslands & Shrublands	

PA's & Biodiversity Hotspots

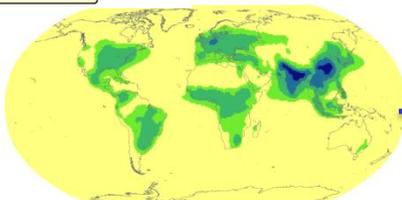
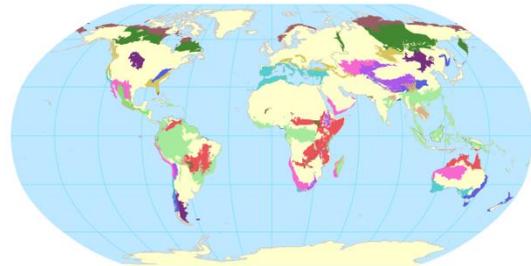


Hotspots				
Atlantic Forest	Chilean Winter Rainfall and Valdivian Forests	Horn of Africa	Maputaland-Pondoland-Albany	New Zealand
California Floristic Province	Coastal Forests of Eastern Africa	Indo-Burma	Mediterranean Basin	Philippines
Cape Floristic Region	East Melanesian Islands	Irano-Anatolian	Mesoamerica	Polynesia-Micronesia
Caribbean Islands	Eastern Afromontane	Japan	Mountains of Central Asia	Southwest Australia
Caucasus	Guinean Forests of West Africa	Madagascar and the Indian Ocean Islands	Mountains of Southwest China	Succulent Karoo
Cerrado	Himalaya	Madrean Pine-Oak Woodlands	New Caledonia	Sundaland
				Tropical Andes
				Tumbes-Choco-Magdalena
				Wallacea
				Western Ghats and Sri Lanka

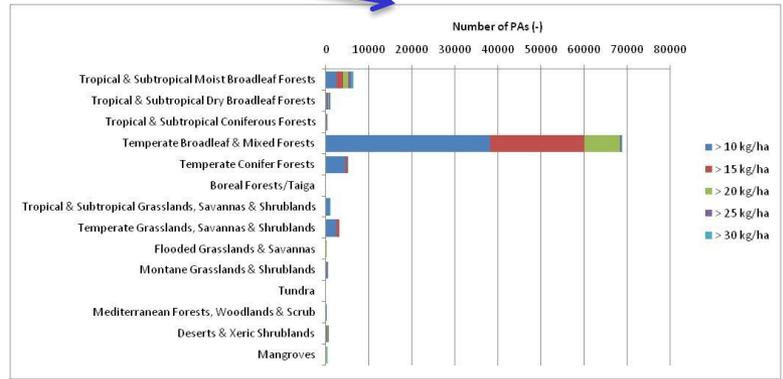
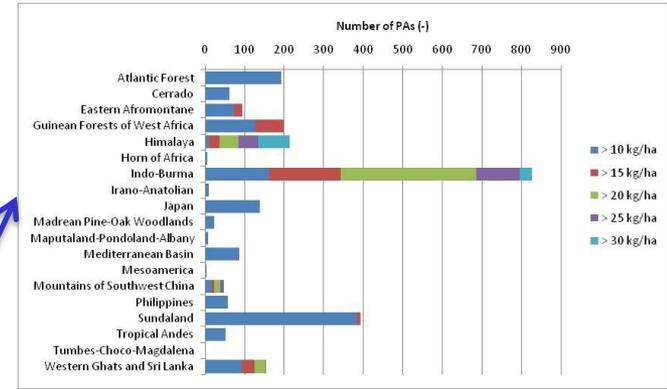
Overlaying the datasets

- By overlaying the three datasets (PAs, WWF G200 Ecoregions and Biodiversity Hotspots) information is available about the conservation value of the individual PAs and the number of endemic species simultaneously.
- Together, this shows the importance of these classified PAs when evaluating the exposure to high loads of N deposition.

Combining all the information



PAs



PAs and Critical Loads

- First step: 10 kg N/ha used as Critical Load (Bobbink et al., 1998)
- Recent work of Bobbink et al., 2010:
 - critical load may vary considerably
 - ecosystem types like 'Polar desert', 'Alpine tundra', 'Alpine/sub-alpine scrub and grassland' and 'temperate forest' - as low as 5 kg N/ha/yr
 - ecosystem types like 'temperate grasslands' - as high as 30 kg N/ha/yr
 - for tropical systems it was not possible to derive a critical load, but deposition higher than 20-30 kg N/ha/yr may potentially seriously affect these systems

Hotspots & Ecoregions & Deposition > 30 kg N/ha

<i>Number of PAs with > 30 kg N/h/yr</i>	<i>Hotspots</i>			<i>Grand Total</i>
	<i>Himalaya</i>	<i>Indo-Burma</i>	<i>Mountains of Southwest China</i>	
<i>G200 Regions</i>				
Eastern Himalayan broadleaf and conifer forests	4			4
Hengduan Shan conifer forests			2	2
Naga-Manapuri-Chin Hills moist forests		10		10
Southeast China-Hainan moist forests		20		20
Terai-Duar savannas and grasslands	16			16
Western Himalayan temperate forests	10			10
Grand Total	30	30	2	62

11.300 km²

62 sites under serious threat

NAME	COUNTRY	NAME	COUNTRY	NAME	COUNTRY
Gui Ping West Hill	China	Nongkhyllem	India	Dudhwa	India
Tongledashan	China	Askot Musk Deer	India	Royal Suklaphanta	Nepal
Didingshuiyuanlin	China	Koshi Tappu	Nepal	Katarniyaghat	India
Zhougonghe	China	Balphakram	India	Tirthan	India
Yangmeishuikushuiyuanlin	China	Baghmara Pitcher Plant	India	Daranghati	India
Daqingshan (Guangxi)	China	Nokrek	India	Shimla Catchment	India
Chapramari	India	Phulchoki	Nepal	Koshi Tappu	Nepal
Laggabaggha Protected Corridor	India	Barail	India	Garumara	India
Ghodaghodi Tal	Nepal	Xidamingshanshuiyuanlin	China	Garampani	India
Buxa NP	India	Longhushantianranyaowu	China	Siju	India
Gorumara	India	Xialeishuiyuanlin	China	Pac Bo	Viet Nam
Mikhir Hills	India	Nonggang	China	Trung Khanh	Viet Nam
Nongkhlaw	India	Qinglongshanshuiyuanlin	China	Shivapuri	Nepal
Karbi Anglong	India	Chunxiushuiyuanlin	China	Phala/Kuthnar	Pakistan
Thang Hen	Viet Nam	Gulongshanshuiyuanlin	China	Vatala	Pakistan
Ghodaghodi Lake Area	Nepal	Dizhoushuiyuanlin	China	Ayub 'National Park'	Pakistan
Renuka Wetland	India	Ayub	Pakistan	Rupi Bhaba	India
Jagadishpur Reservoir	Nepal	Kim Hy	Viet Nam	Buxa	India
Beeshazar and Associated Lakes	Nepal	Royal Bardia	Nepal	Bara	Nepal
		Banli	China	Royal Manas	Bhutan
		Bapen	China		
		Encheng	China		
		Laojunshanshanzhegu	China		

Gui Ping West Hill (China)

Gui Ping West Hill Scenic Area
 Gui Ping West Hill, [China](#)

Information Discussion

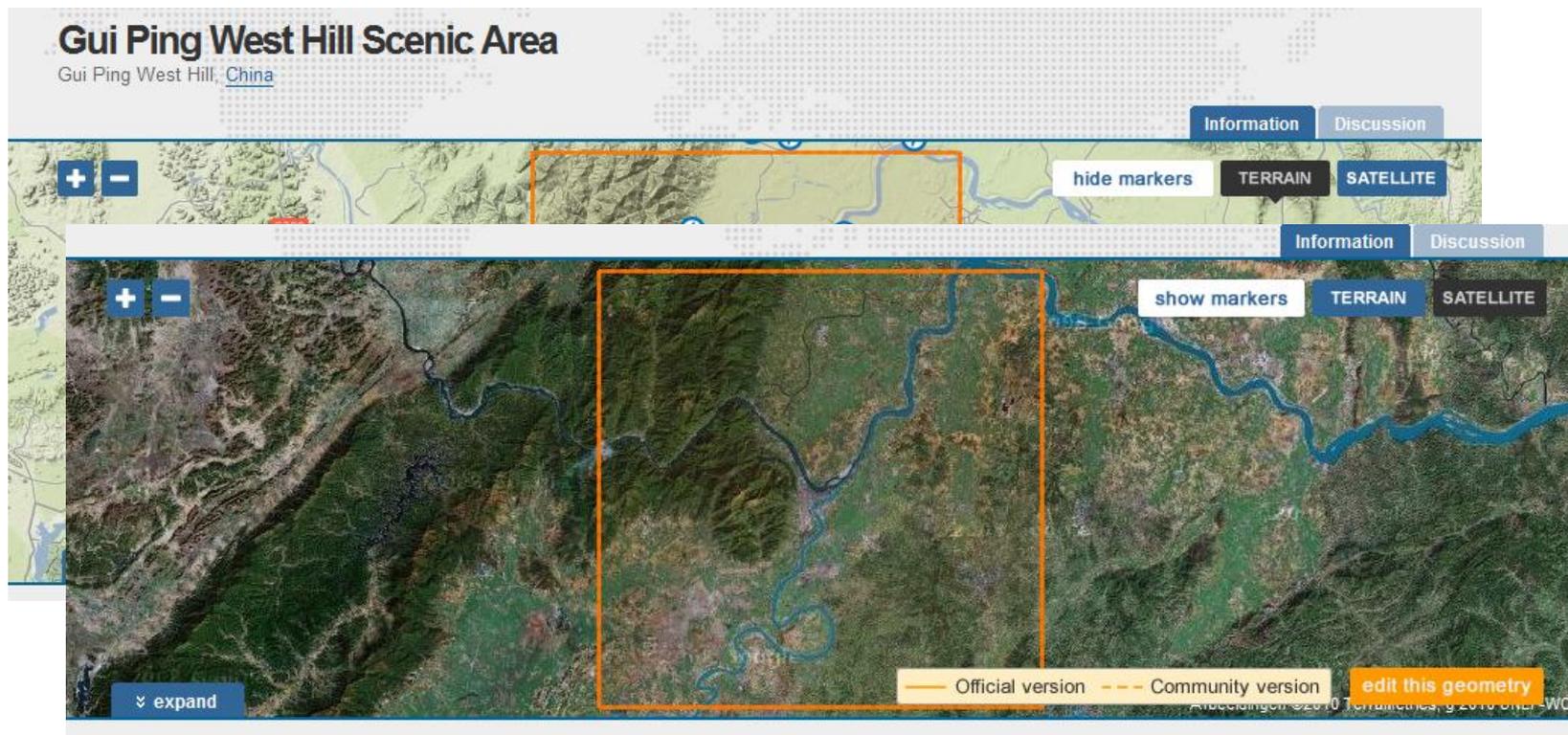
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Information Discussion

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Final statements

- The results show that N deposition is a significant and growing issue for biodiversity in many parts of the world, especially in Asia.
- It is important to look at N deposition impacts on a site by site basis, as the sensitivity of terrestrial ecosystems to N deposition effects and deposition characteristics are often very site specific.
- The analyses done here makes it possible to go into individual site assessments, but further work is needed to investigate the (local) causes of high nitrogen loads.