Atmospheric N wet deposition in China

Guirui Yu, Nianpeng He, Qiufeng Wang, Wenping Sheng, Xiaoyun Zhan, Jianxing Zhu, **Yanlong Jia**

Institute of Geographic Sciences and Natural Resources Research, CAS

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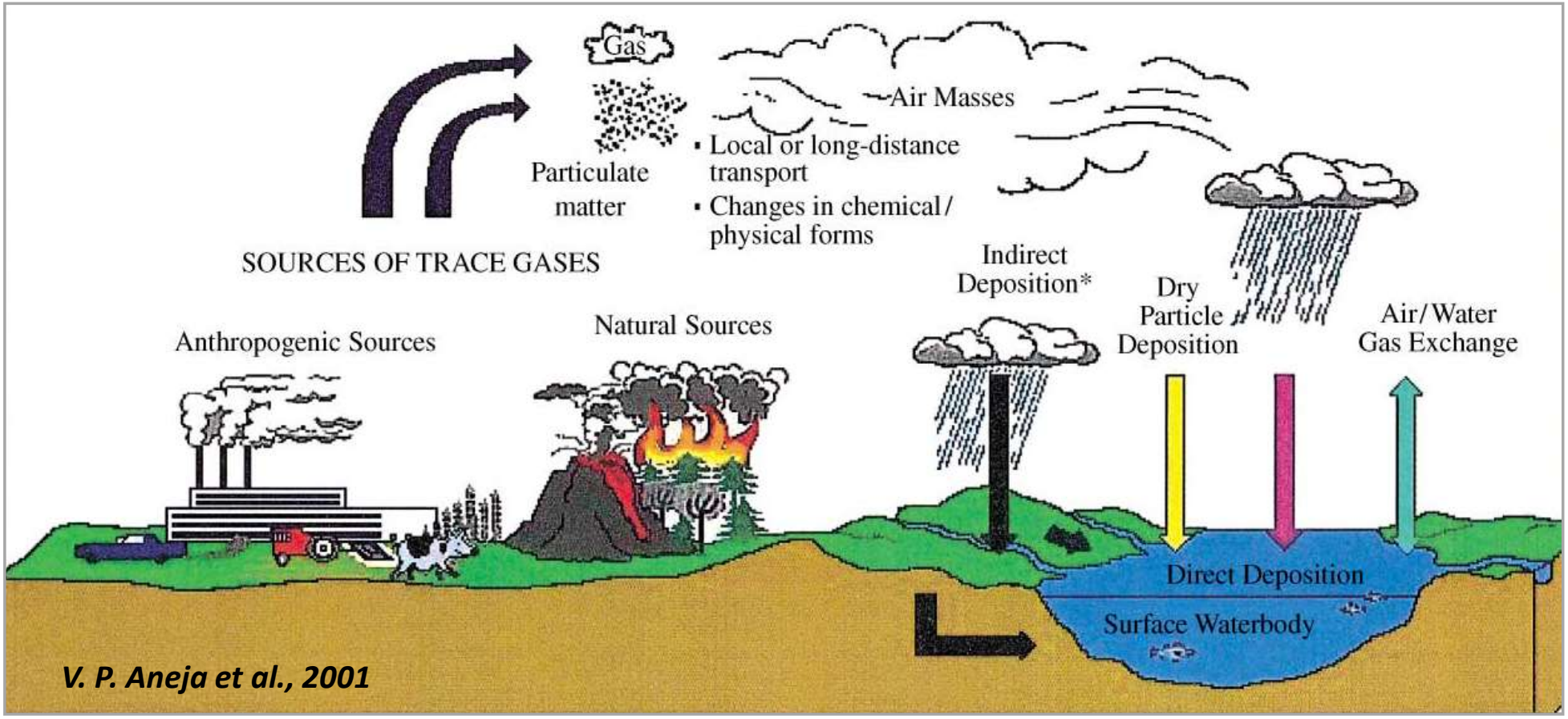
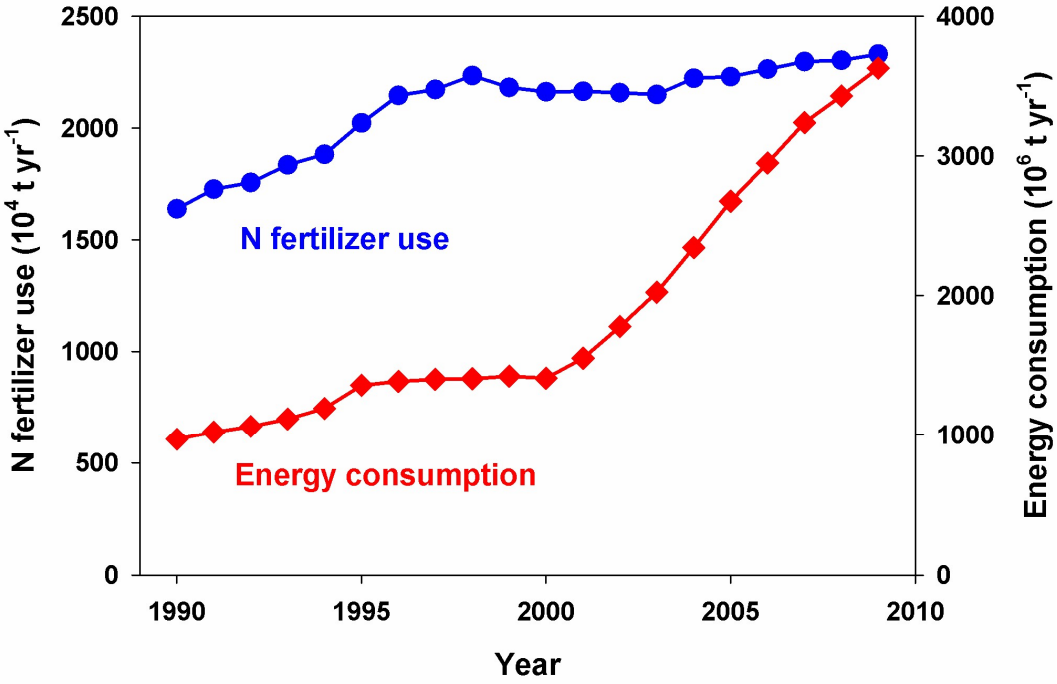
What is N deposition?



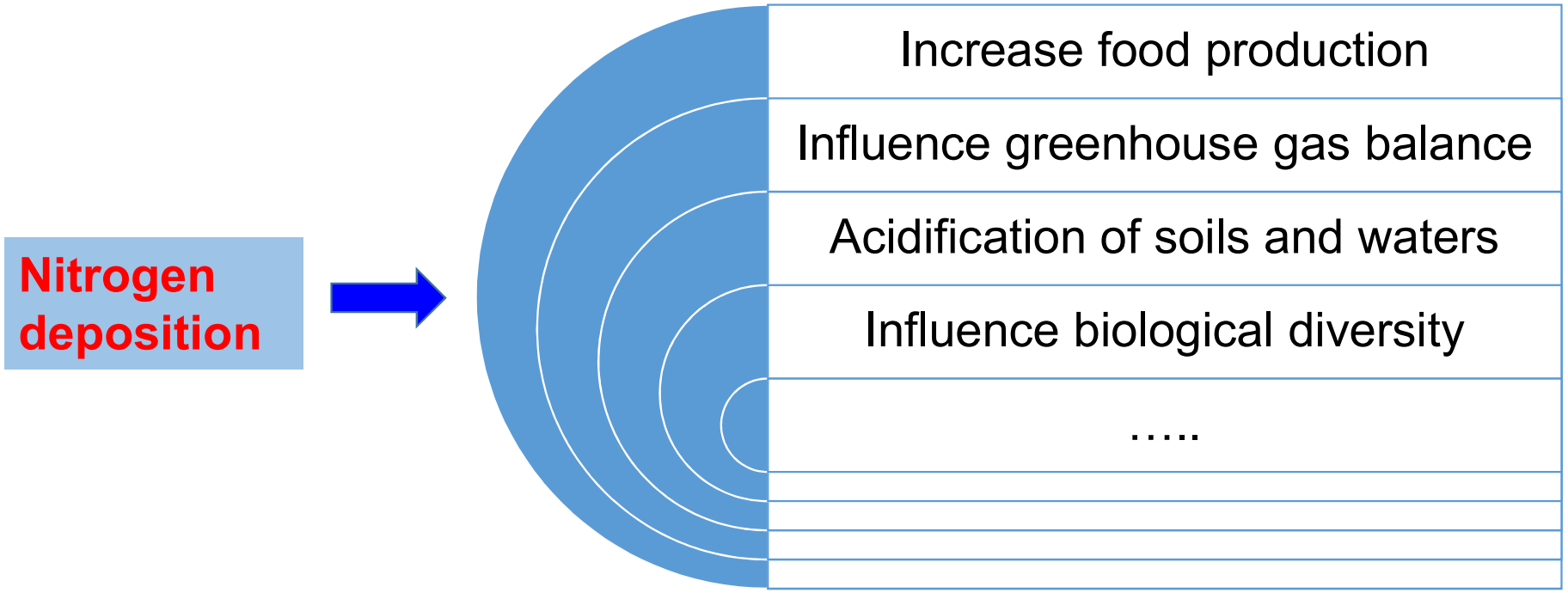
Atmospheric deposition of nitrogen to ecosystems has increased dramatically in the past few decades.

What happened in China?



Anthropogenic emissions → ? → Nitrogen deposition

Why we do this research?

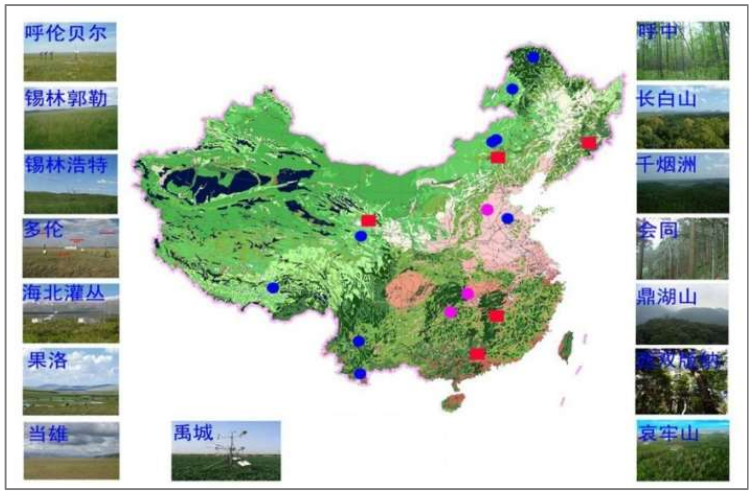


➢ Understanding the pattern and their controlling factors of nitrogen deposition is useful for the researches on its effects on ecosystems, and can provide scientific background for global change research.

What we do in this research?

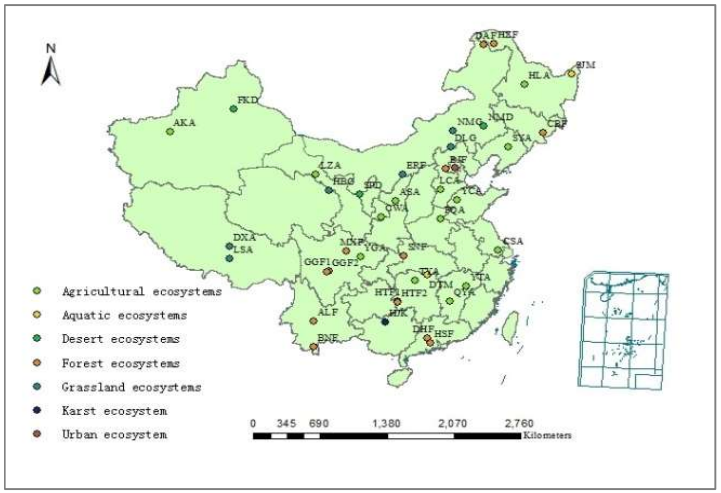
Three stages in our study

The first stage: **14 sites**



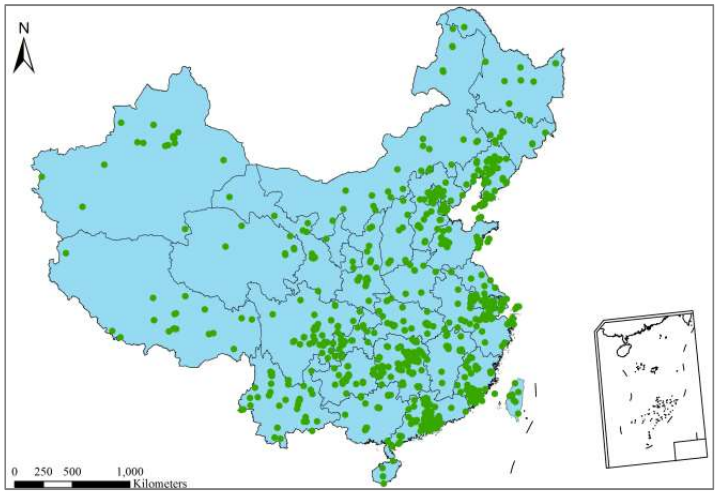
2008-2012

The second stage: **41 sites**



2013-now

The third stage: **300 sites**



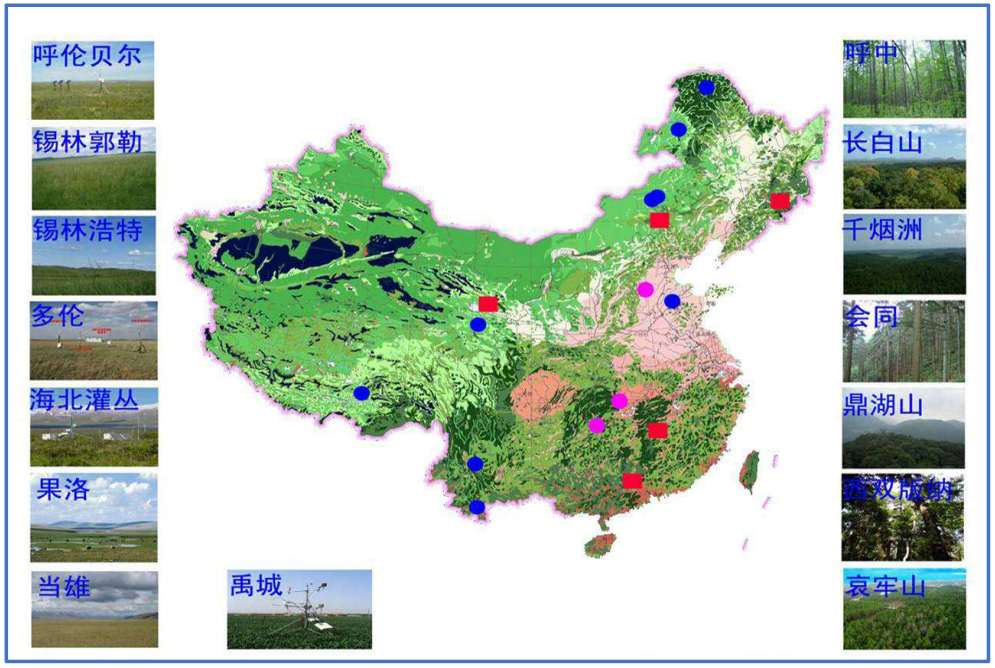
1990-2015

Research topic

Wet N deposition in typical forest ecosystems	Spatial pattern of wet N deposition in China	Spatial and decadal variations of wet N deposition in China

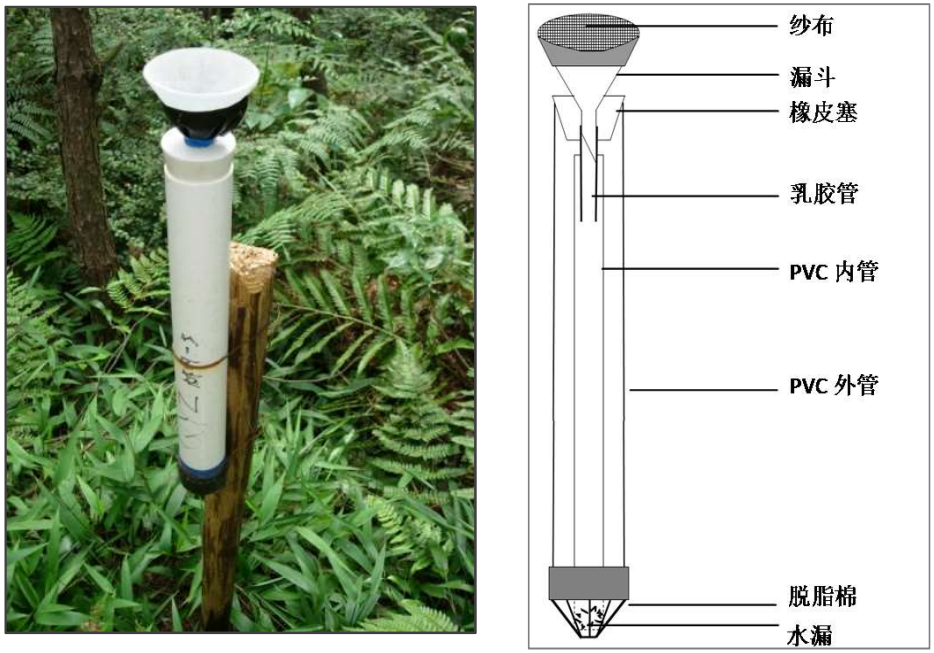
Stage 1st Wet N deposition in typical forest ecosystems

14 forest sites in China



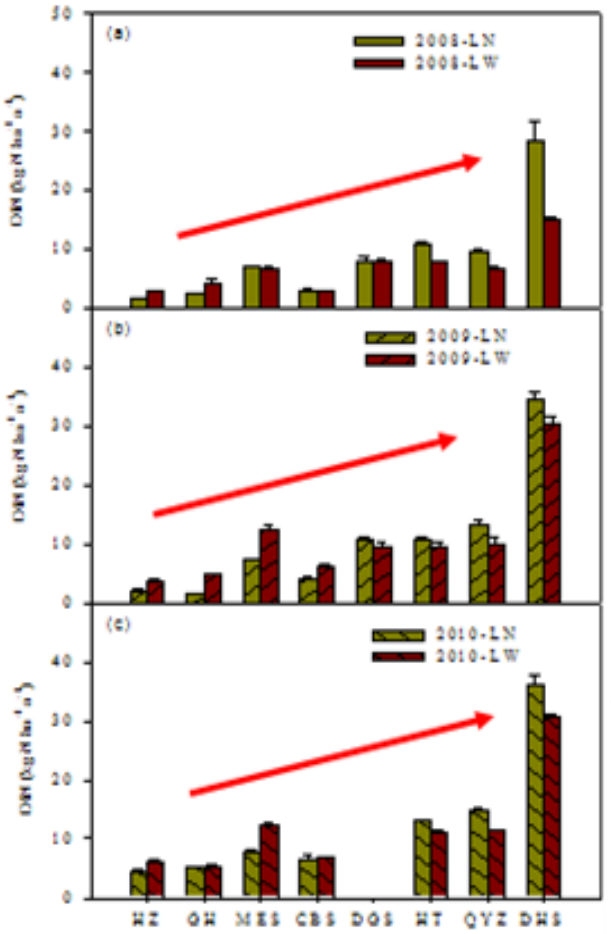
Distribution of monitoring sites

Ion-exchange resin (IER) columns



Sample collection: every month

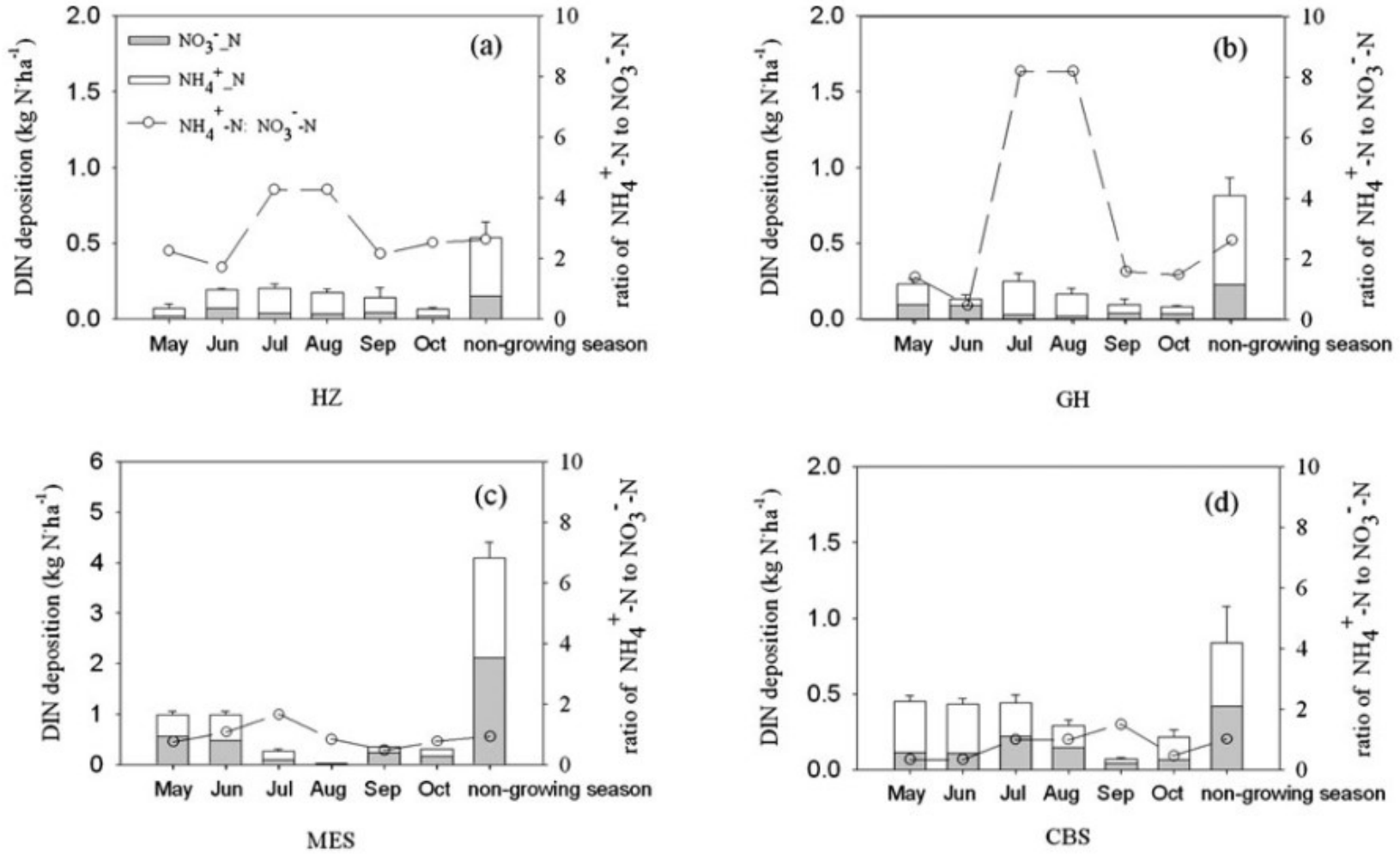
Main results: Wet N deposition in typical forest ecosystems



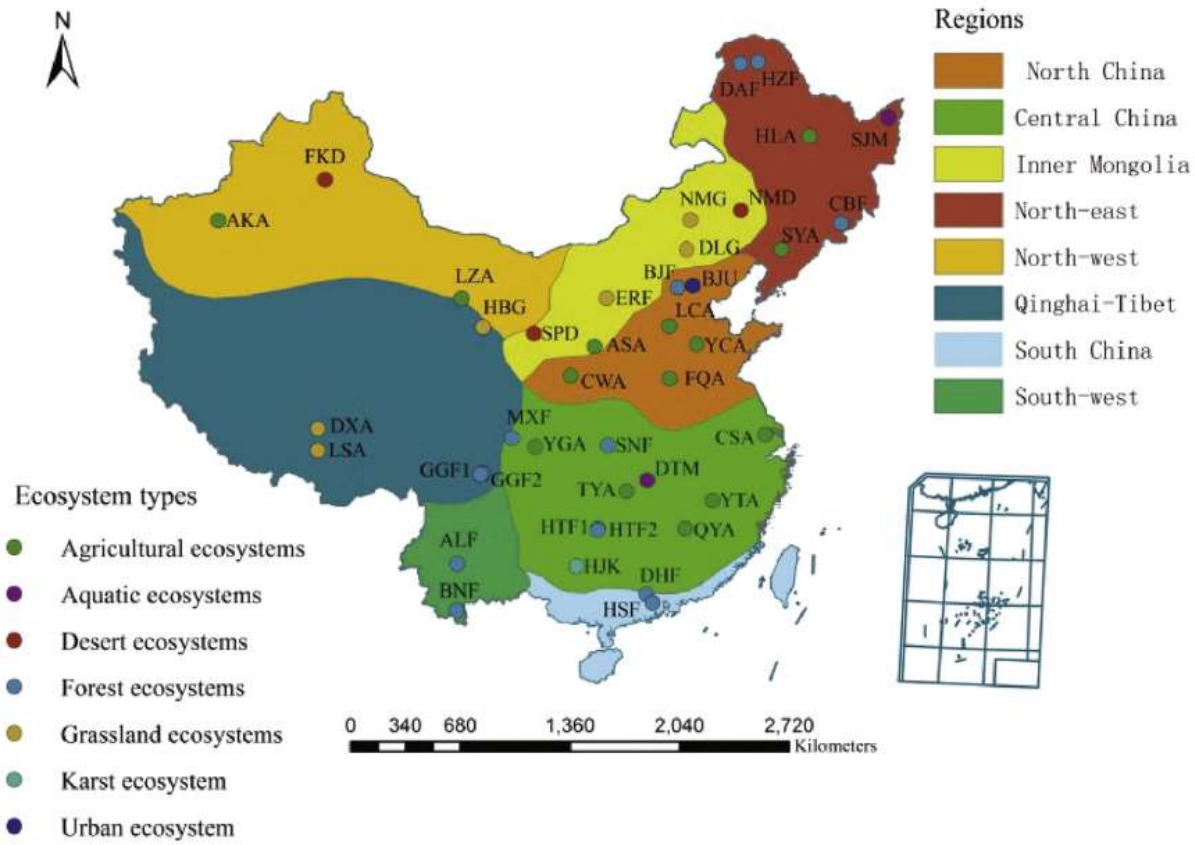
North → South

Sites	LN-DIN (kg N ha^{-1} a^{-1})			LW-DIN (kg N ha^{-1} a^{-1})		
	NH_4^+-N	NO_3^--N	DIN	NH_4^+-N	NO_3^--N	DIN
HZ	1.9(0.6)c	0.9(0.3)d	2.7(0.9)d	2.8(0.6)b	1.3(0.3)c	4.1(0.9)b
GH	2.0(0.6)c	1.1(0.5)d	3.1(1.0)d	3.0(0.4)b	1.8(0.5)c	4.8(0.3)b
MES	3.7(0.5)c	3.7(0.3)bc	7.4(0.3)c	6.7(1.5)b	3.8(0.3)b	10.5(1.8)b
CBS	2.8(1.1)c	1.8(0.1)cd	4.6(1.0)cd	3.0(0.8)b	2.3(0.6)bc	5.3(1.2)b
DGS	6.6(1.3)bc	2.8(0.1)c	9.3(1.4)bc	6.1(0.4)b	2.7(0.4)bc	8.8(0.8)b
HT	7.9(1.1)b	3.7(0.5)bc	11.6(0.7)b	7.3(0.7)bc	2.3(0.2)bc	9.6(0.8)b
QYZ	8.2(1.6)b	4.4(0.4)b	12.6(1.5)b	6.4(1.1)b	2.9(0.5)bc	9.4(1.3)b
DHS	22.0(2.3)a	11.0(0.4)a	33.0(2.3)a	17.9(4.0)a	7.5(1.4)a	25.4(5.1)a
Mean	6.9(1.4)	3.7(0.7)	10.6(2.0)	6.7(1.1)	3.1(0.4)	9.8(1.5)

Main results: Monthly variation of wet N deposition



Stage 2nd Spatial pattern of wet N deposition in China



Distribution of N deposition observation sites

Sites: 41

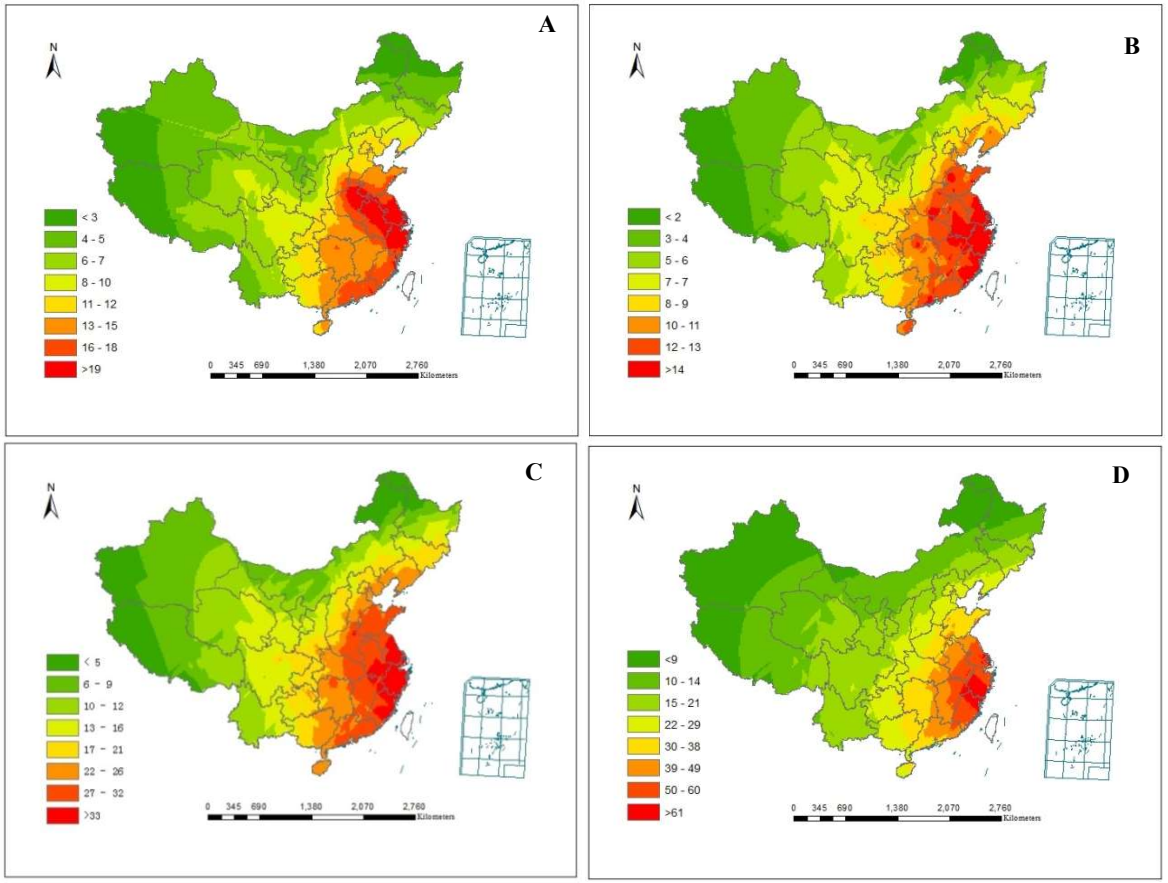
Ecosystem types:

- Forest
- Grassland
- Desert
- Lake
- Karst
- Urban

Method:

Precipitation was collected into plastic buckets each month.

Main results: Spatial pattern of wet N deposition in China



A, NH_4^+–N; B, NO_3^-–N; C, TDN; D, TN

Annual N input of China in 2013

- TN: 16.48 Tg N a^{-1}
- TDN: 12.52 Tg N a^{-1}
- NH_4^+-N: 6.63 Tg N a^{-1}
- NO_3^--N: 5.42 Tg N a^{-1}

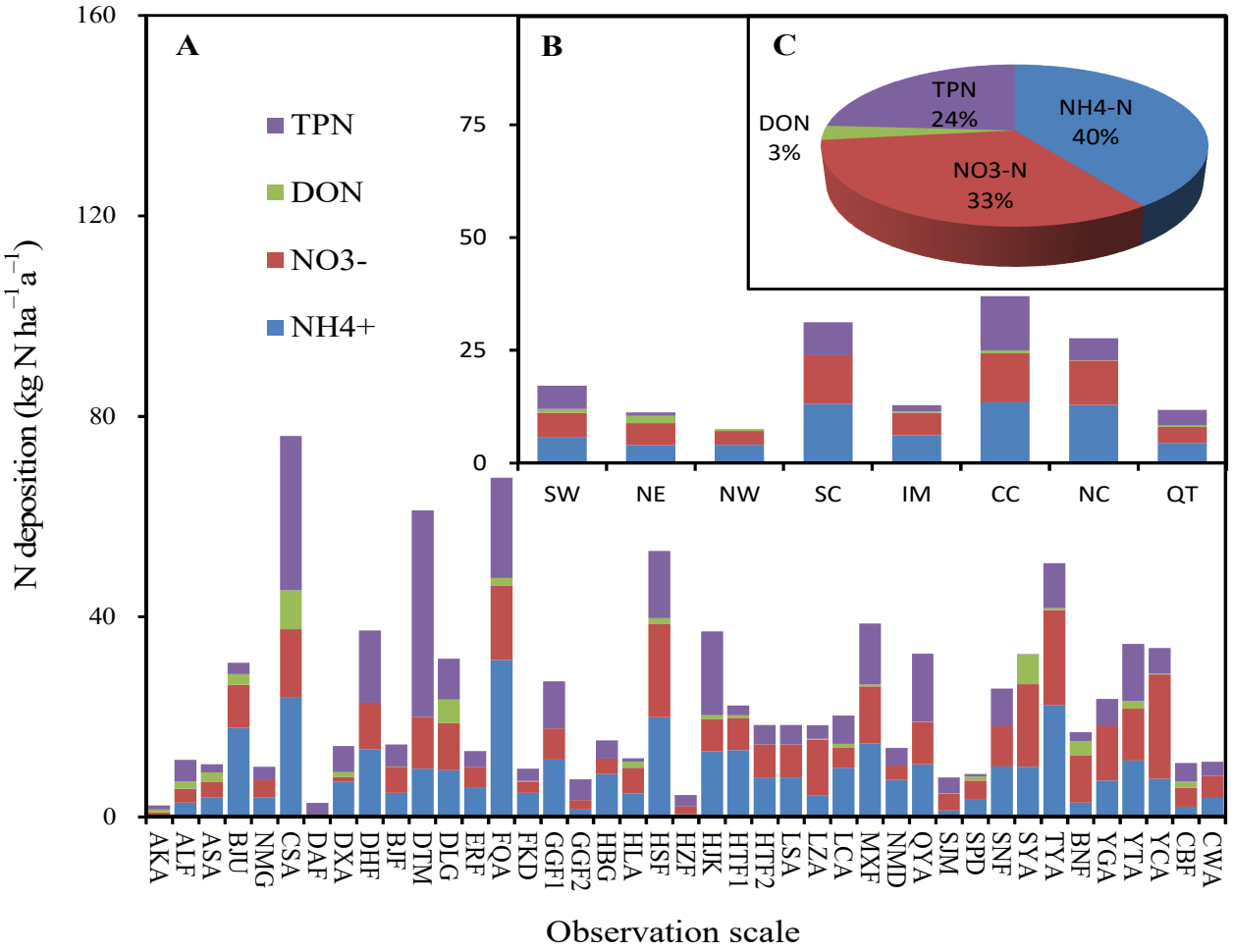
High N deposition region:

Central China and South China

Low N deposition region:

Northwest, Northeast, and Southwest

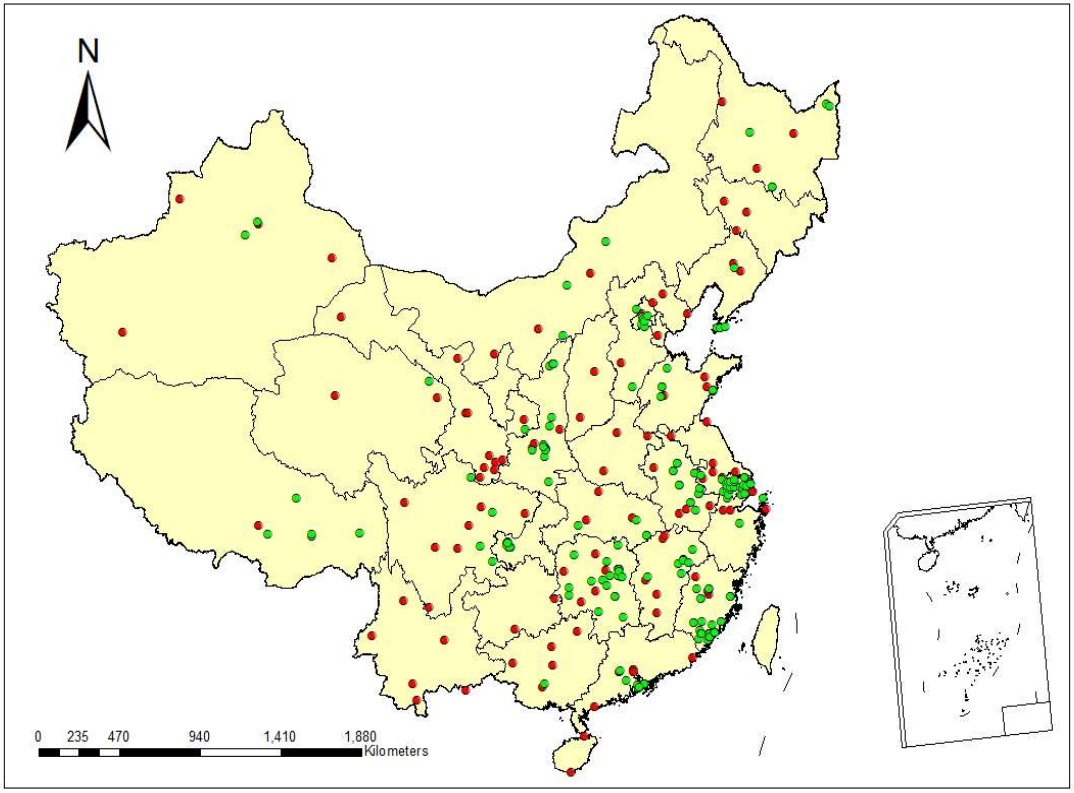
Main results: Composition of wet N deposition in China



Components:

- NH_4^+-N: 40%
- NO_3^--N: 33%
- TPN: 24%
- DON: 3%
- NH_4^+/NO_3^-: 1.22

Stage 3rd Spatial and decadal variations of wet N deposition



Distribution of nitrogen deposition monitoring sites

● 1990s ● 2000s

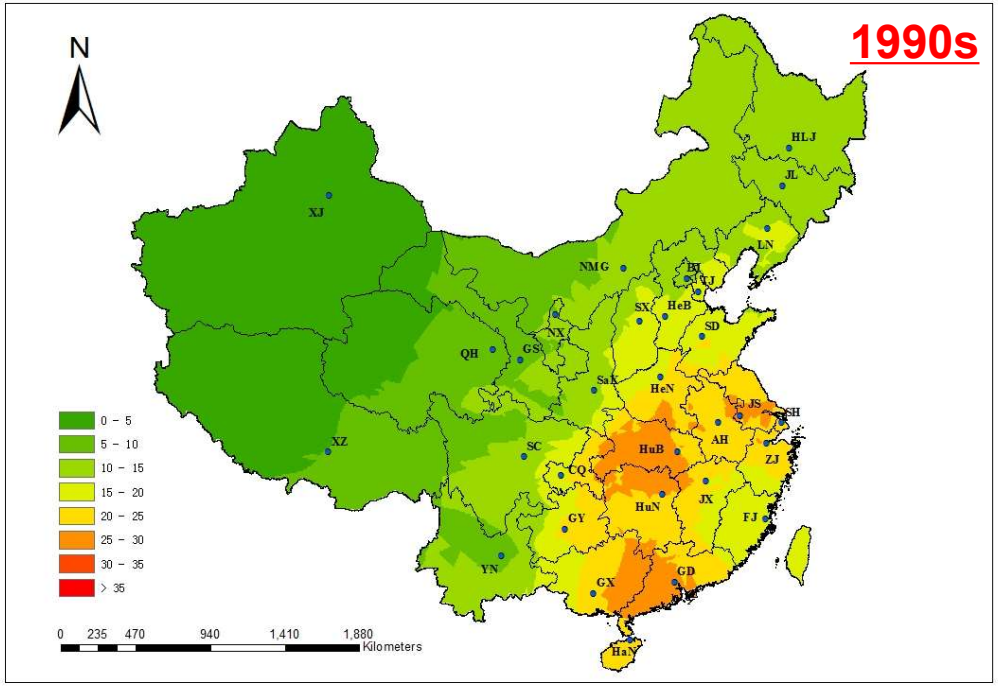
Data source:

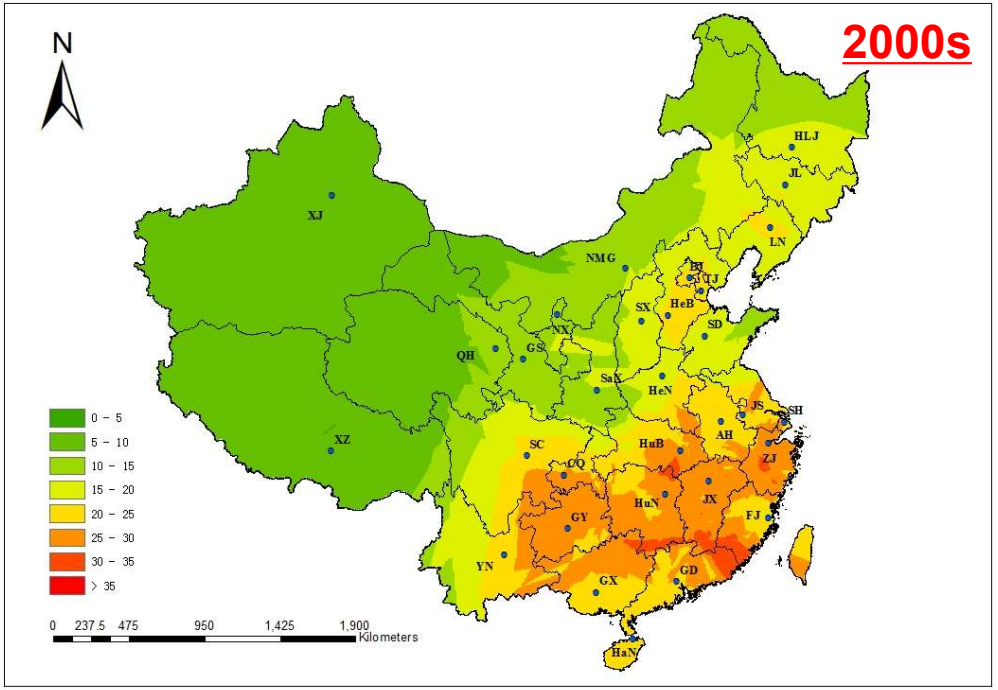
- published papers
- Chinese Ecosystem Research Network

Method:

- The spatial patterns of wet nitrogen deposition were obtained from Kriging interpolation.

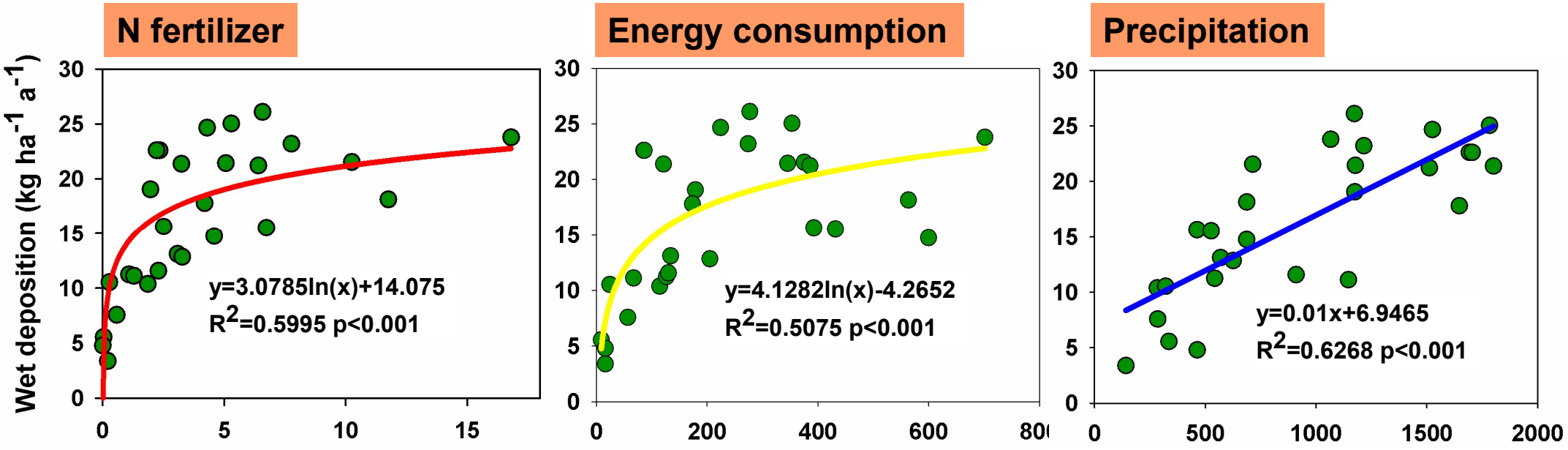
Main results: Spatial patterns of wet deposition in 1990s and 2000s





- Mean wet deposition over China were 11.11 and 13.87 kg ha^{-1} a^{-1} in the 1990s and 2000s, respectively.
- Compared to 1990s, in the 2000s wet deposition almost increased over the whole China, especially in southern China.

Main results: The controlling factors of wet N deposition



- Wet deposition respond to these factors differently.
- These factors all influence wet deposition significantly.

Conclusion

1. Wet N deposition was higher in southern forest than northern forest.

2. Ammonium N was the main component of wet N deposition in China.

3. The mean wet N deposition over China increased about 25% between 1990s and 2000s.

Publications

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3. Zhan X, Yu G, He N, Jia B, Zhou M, Wang C, Zhao J, Zhao G, Wang S, Liu Y, Yan J. 2015. Inorganic nitrogen wet deposition: Evidence from the North-South Transect of Eastern China. Environmental Pollution, 204: 1-8.
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5. He NP, Zhu JX, Wang QF. 2015. Uncertainty and perspectives in studies of atmospheric nitrogen deposition in China: A response to Liu et al.(2015). Science of The Total Environment, 520: 302-304.
6. Jia YL, Yu GR, Gao YN, He NP, Wang QF, Jiao CC, Zuo Y. 2016. Global inorganic nitrogen dry deposition inferred from ground- and space-based measurements. Scientific Reports, 6:19810.

Thank you!

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