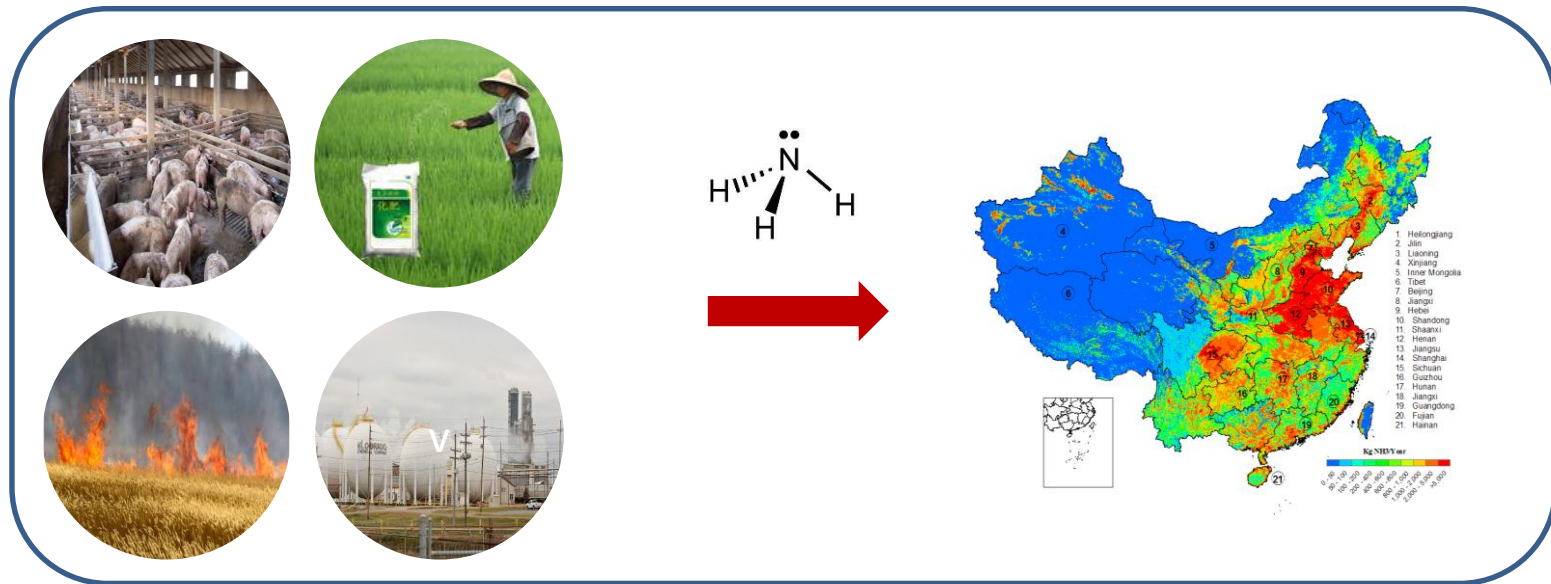


High-resolution ammonia emissions inventories in China from 1980–2012

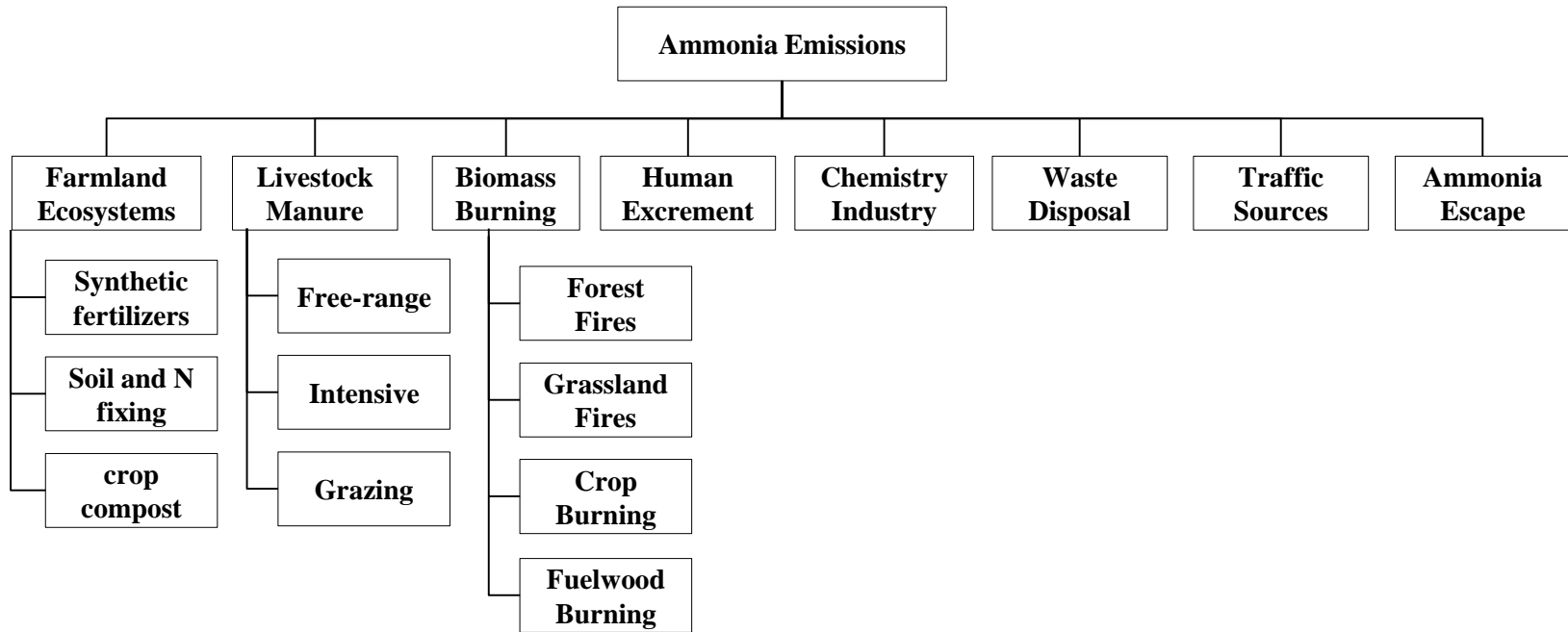
Yaning Kang, Mingxu Liu, **Yu Song**, Xuhui Cai, Ling Kang, Tong Zhu

State Key Joint Laboratory of Environmental Simulation and Pollution Control, Department of Environmental Science, Peking University, Beijing, China



2. Methodology

◆ Emission Sources



◆ Emission Factors

- Update EFs based on published results;
- Carry out field measurements in North China Plain

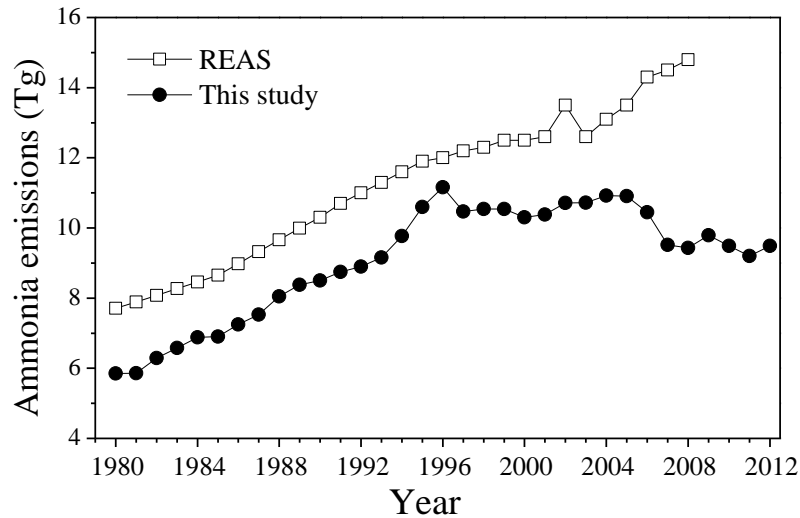


2. Methodology

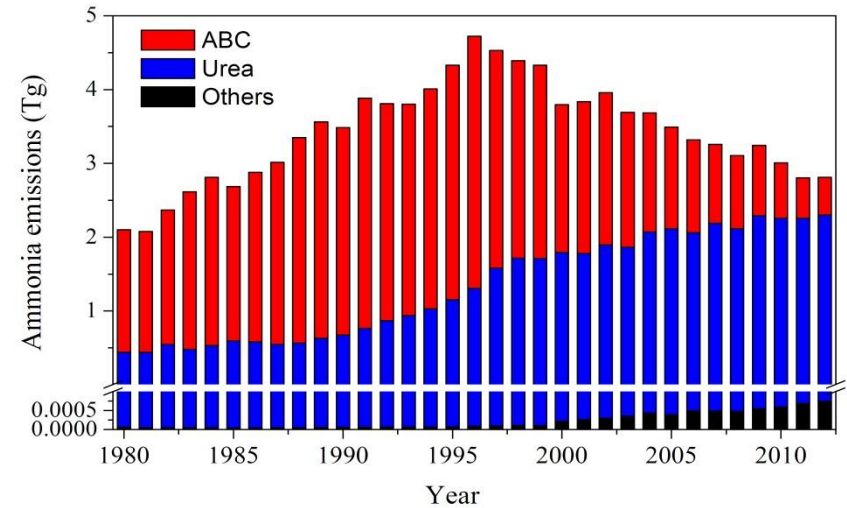
Sources	Synthetic Fertilizers	Livestock Manure
Flow Chart	<pre> graph TD A[Original emission factors (EFs)] --> B[Specific EFs] C[16 major plants] --> D[Fertilizer consumption] E[Five types of fertilizers] --> D F[Application Methods: Soil pH, Wind speed, Temperature] --> B B --> G[Ammonia emissions] D --> G H[Land use] --> G </pre>	<pre> graph TD I[Grazing] --> J[TAN] K[Free-range] --> J L[Intensive] --> J J --> M[Outdoors] J --> N[Housing] M --> O[Ammonia emissions] N --> P[Storage] P --> Q[Spreading] Q --> O </pre>
Activities Data	<p>Five types of fertilizers: <u>urea</u>, <u>ammonium bicarbonate (ABC)</u>, <u>ammonium nitrate</u>, <u>ammonium sulfate</u> and <u>other</u> (calcium ammonium nitrate and ammonium phosphates)</p>	<p>Twenty-three livestock classes: different animal categories, gender and age.</p>

3. Results

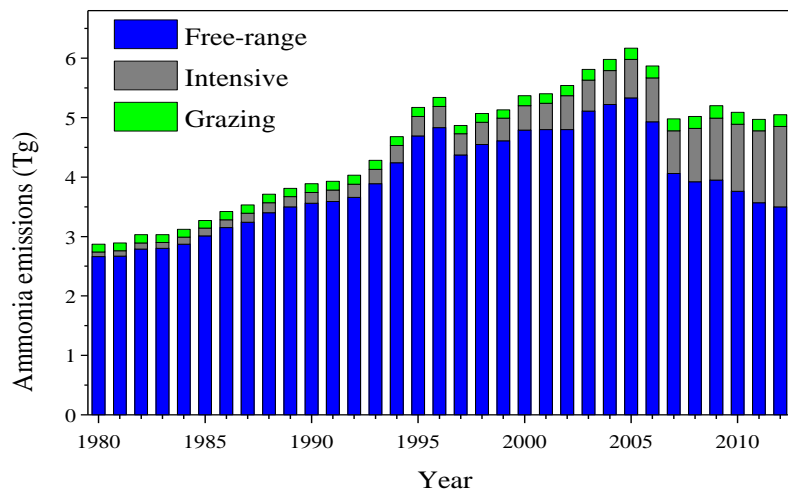
(a) Total emissions



(b) Synthetic fertilizers



(c) Livestock wastes



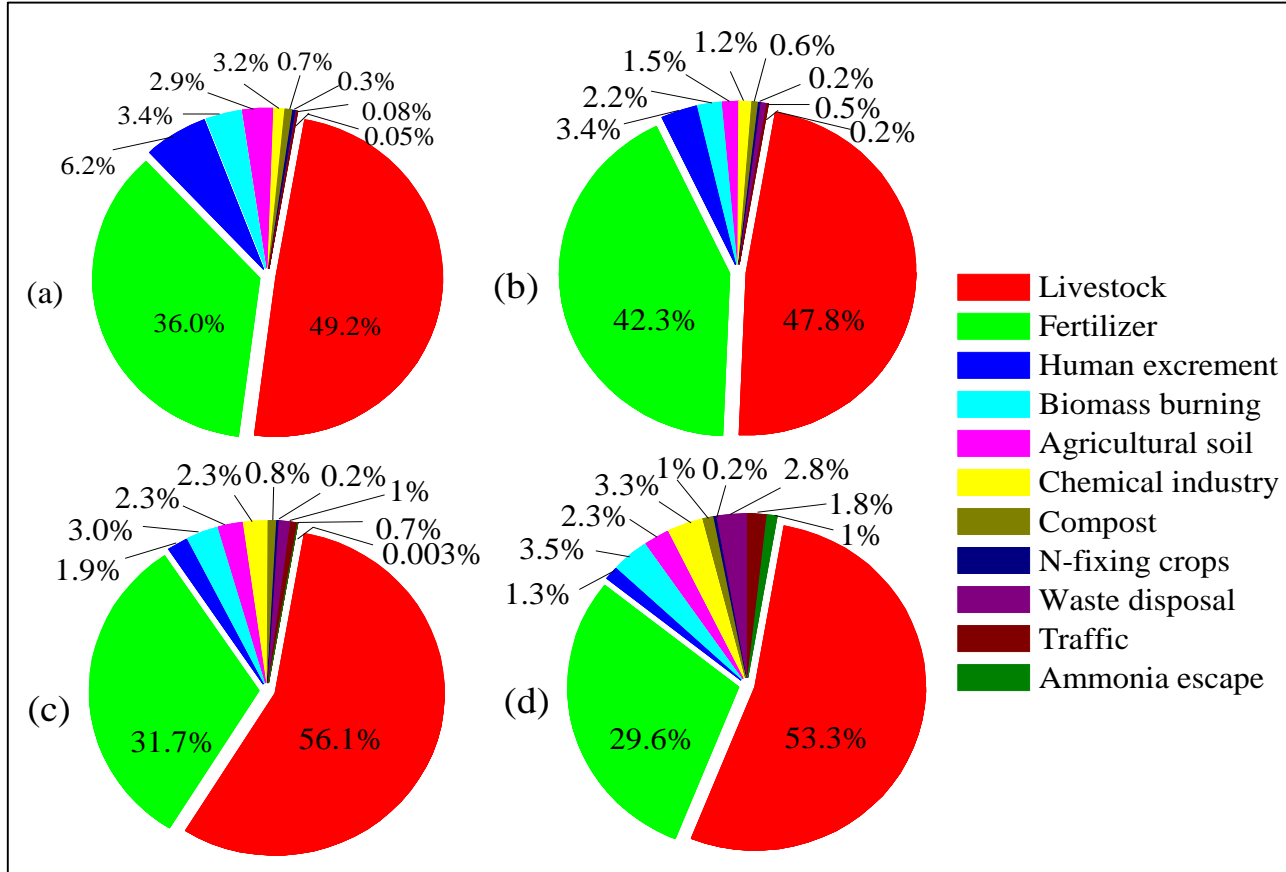
(a) Total NH_3 emissions in China from 1980 to 2012, compared to Regional Emission Inventory in Asia (REAS);

(b) Ammonia Emissions from synthetic fertilizers;

(c) Livestock ammonia emissions in China

3. Results

Contributions from Different Sources

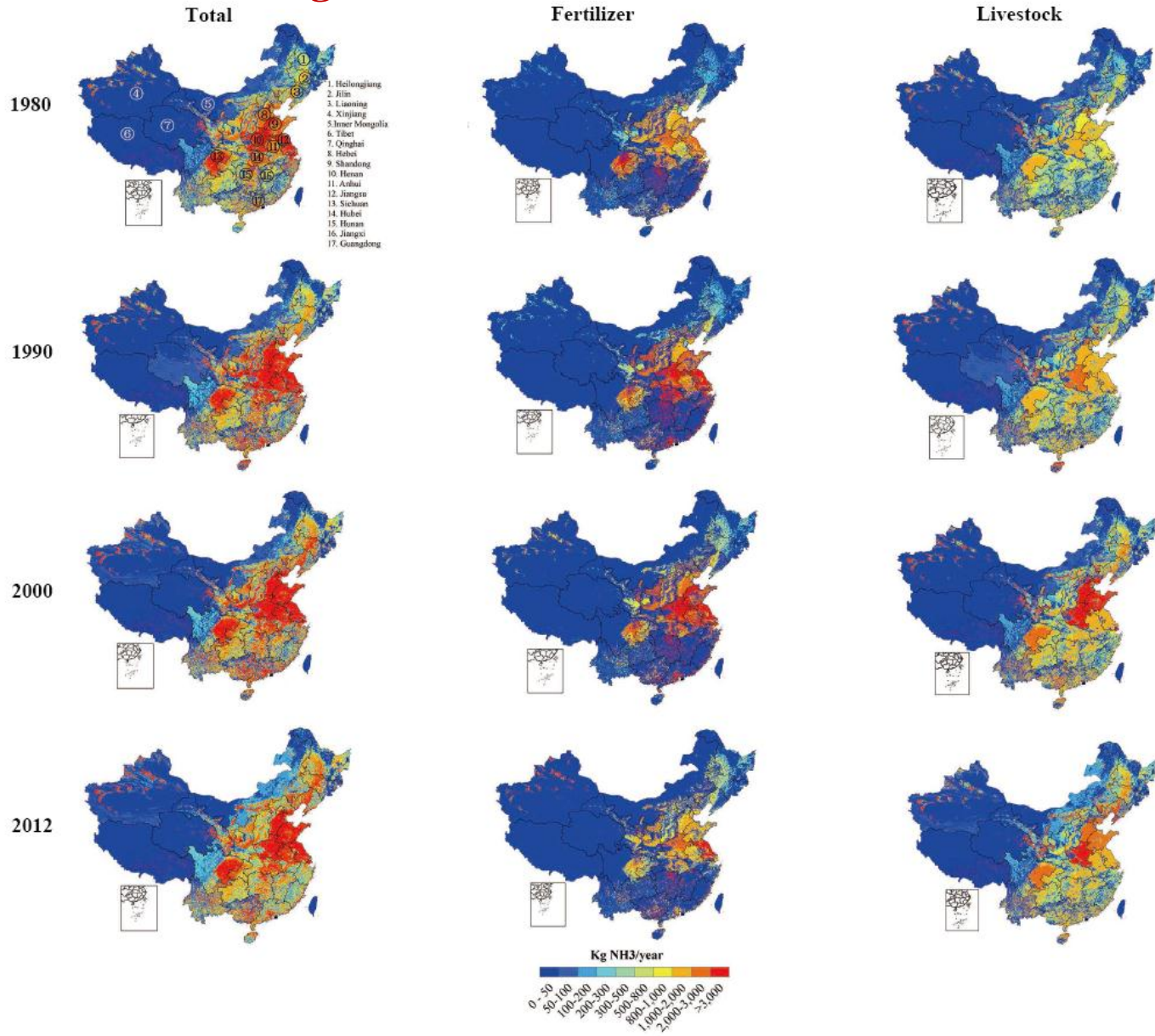


- Human excrement ↓
- Biomass burning ↑
- Agricultural soil —
- Chemistry industry ↑
- Waste disposal ↑
- Traffic ↑
- Ammonia escape ↑

Source contributions (%) to NH₃ emissions in China in (a) 1980, (b) 1996, (c) 2006, and (d) 2012

3. Results

□ Spatial distribution during decades



4. Publication

- Huang Xin, Song Yu, Zhao Chun, Cai Xuhui, Zhang Hongsheng, Zhu Tong. Direct radiative effect by multicomponent aerosol over China. *Journal of Climate*, 2015, 28(9), 3472-3495
- Huang Xin, Song Yu, Zhao Chun, Li Mengmeng, Zhu Tong, Zhang Qiang, Zhang Xiaoye. Pathways of sulfate enhancement by natural and anthropogenic mineral aerosols in China. *Journal of Geophysical Research-Atmosphere*, 2014, 119(24), 14165-14179
- Huang Xin, Song Yu, Li Mengmeng, Li Jianfeng, Huo Qing, Cai Xuhui, Zhu Tong, Hu Min, Zhang Hongsheng. A high-resolution ammonia emission inventory in China. *Global Biogeochemical Cycles*, 2012, 26, GB1030, 10.1029/2011GB004161.
- Huo Qing, Cai Xuhui, Kang Ling, Zhang Hongsheng, Song Yu, Zhu Tong. Estimating ammonia emissions from a winter wheat cropland in North China Plain with field experiments and inverse dispersion modeling. *Atmospheric Environment*, 2015, 104, 1-10.
- Yaning Kang, Mingxu Liu, Yu Song et. al. High-resolution ammonia emissions inventories in China from 1980–2012. *Atmos. Chem. Phys. Discuss.*, 15, 26959-26995, 2015.

Thank you