



浙江大学

Zhejiang University

# Turning pints of global anthropogenic nitrogen creation and their climate effect

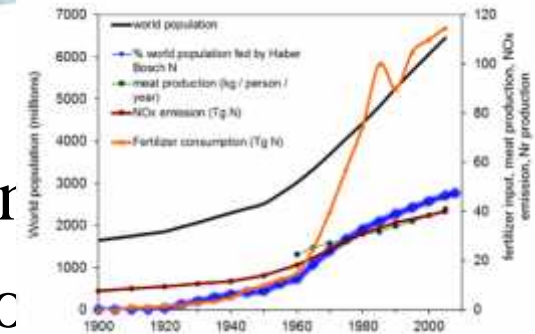
Baojing Gu<sup>\*</sup>, Xiaotang Ju, Yiyun Wu, Jan Willem Erisman, Albert Bleeker, Stefan Reis, Mark Sutton, Shu Kee Lam, Pete Smith, Oene Oenema, Rognvald Smith, Deli Chen, Xuehe Lu, Xinyue Ye

Melbourne 2016

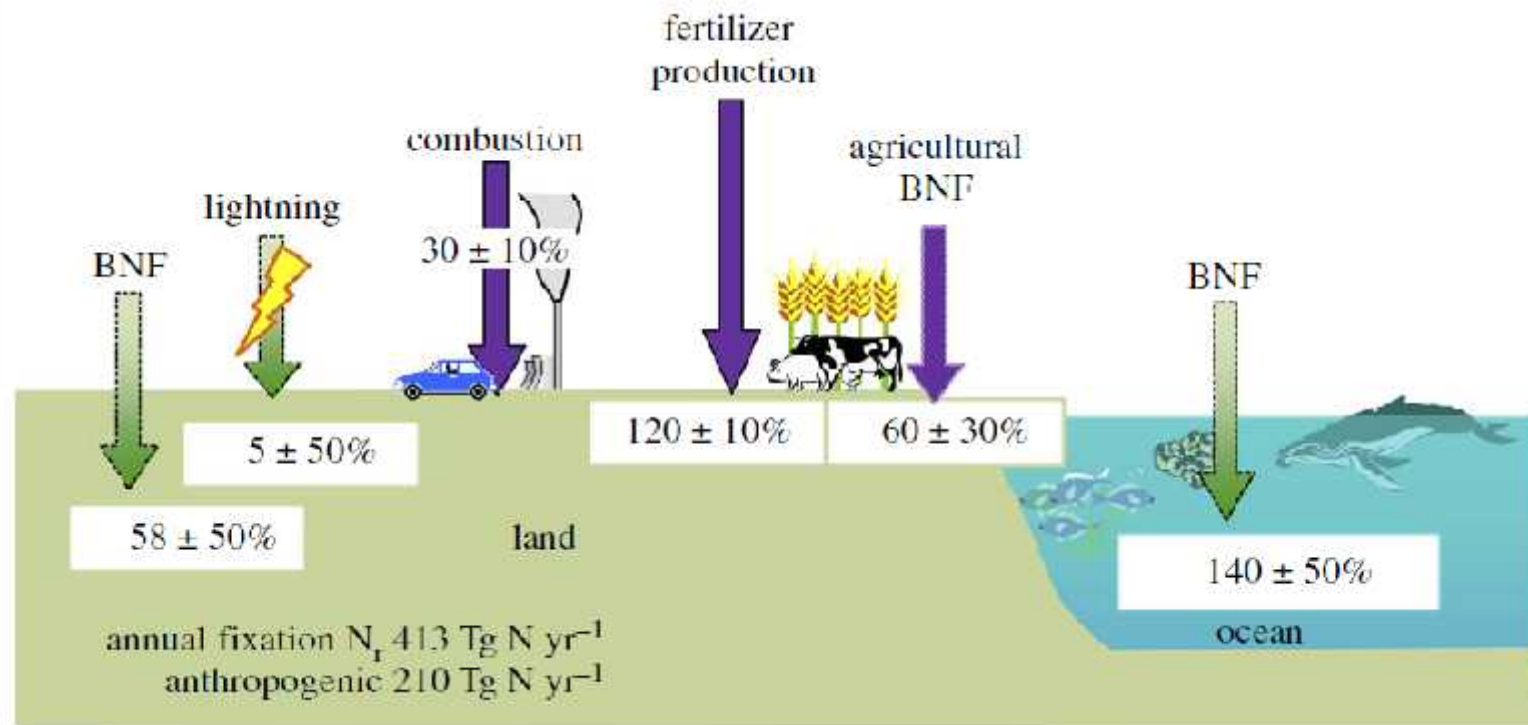


# Managing Reactive Nitrogen

- **Positive aspects:**
  - Food production, both vegetal and animal
  - Goods production, nylon, explosive, etc.
- **Negative aspects:**
  - Main pollutant to air ( $PM_{2.5}$ ,  $O_3$ ),
  - water, soil, climatic change
  - biodiversity loss

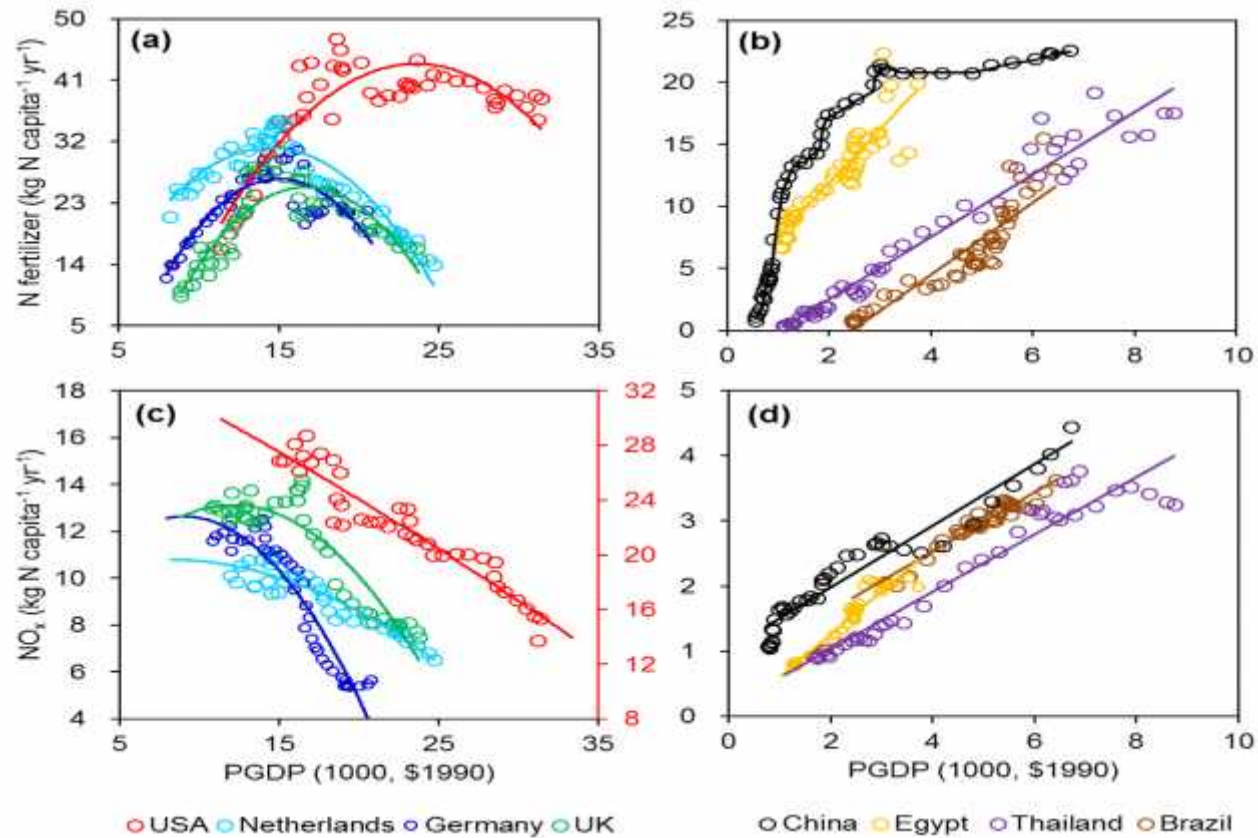


# Nr inputs

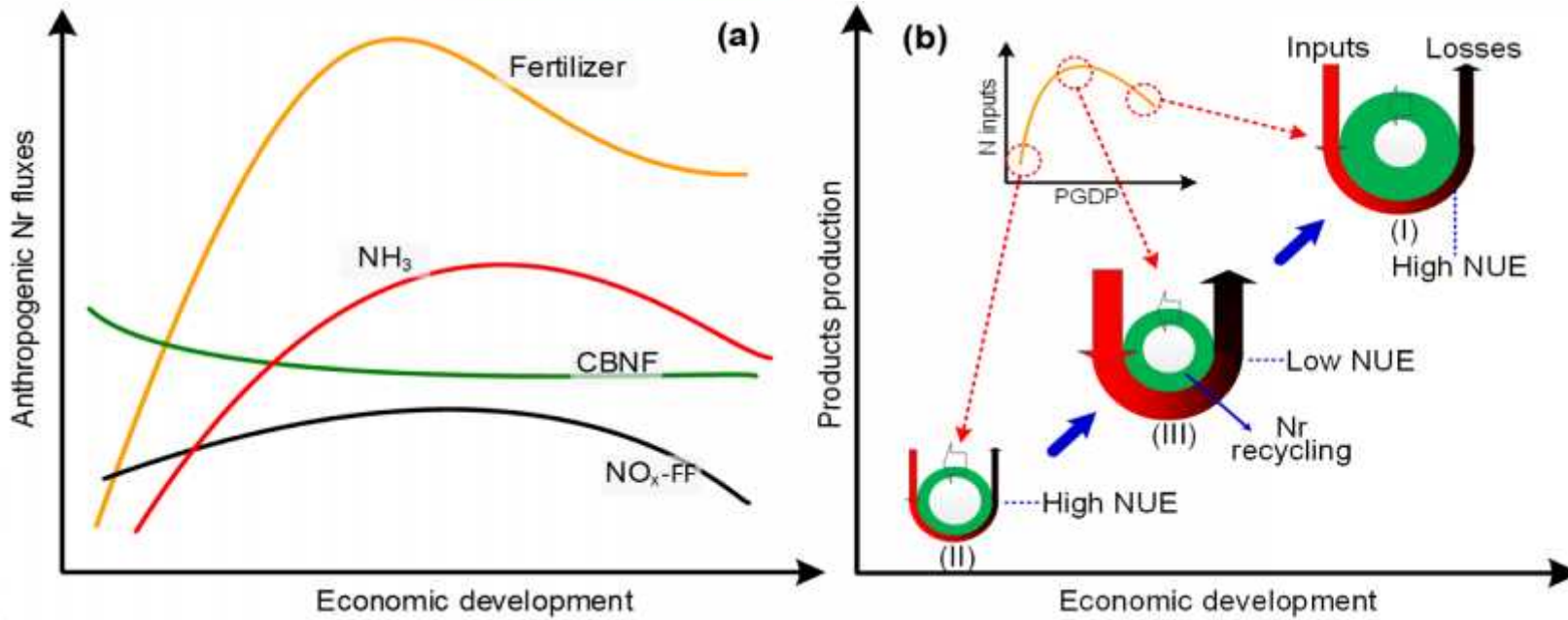


Fowler et al., 2013

# Typical cases



# Hypothesis (EKC)



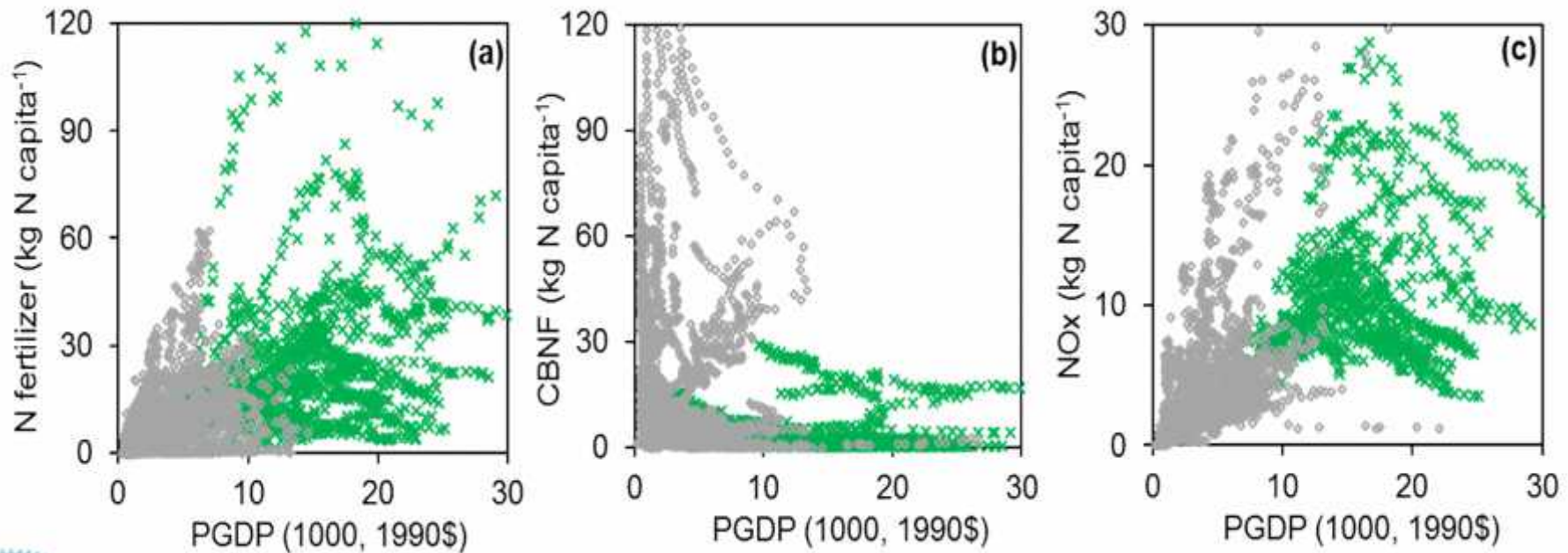
# Data & Methods

- **Data (132 countries, 1961-2008):**
  - N inputs,  $\text{NO}_x$ ,  $\text{NH}_3$ ,  $\text{N}_2\text{O}$ ,  $\text{CO}_2$ , and total GHG
  - PGDP (PPP), Energy consumption, Yield, cropland area, sown area...
- **Methods:**
  - Stepwise linear regression
  - Panel data model,
  - Integrated Biosphere Simulator (IBIS)

# Panel model results

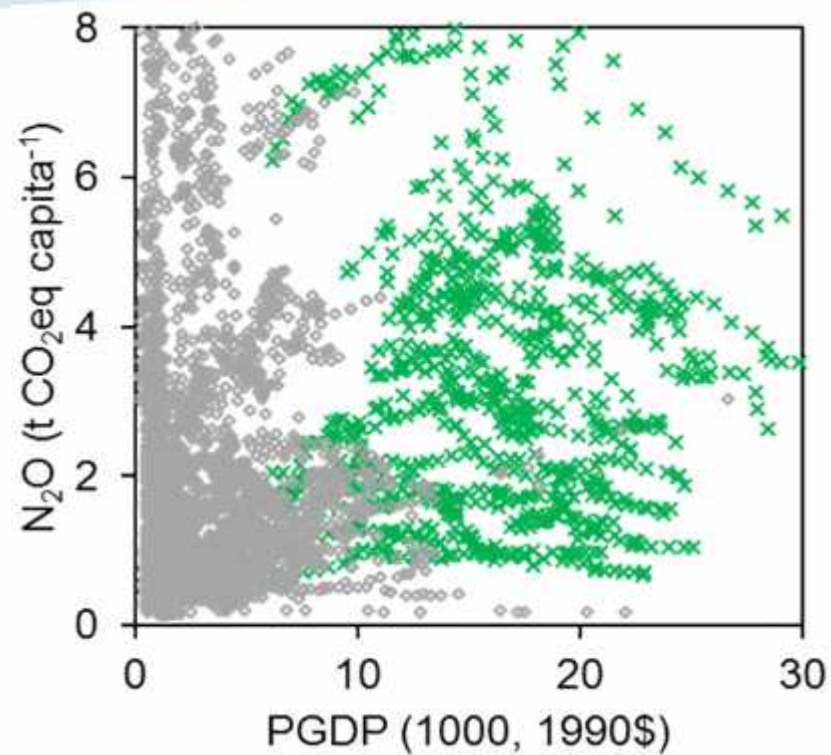
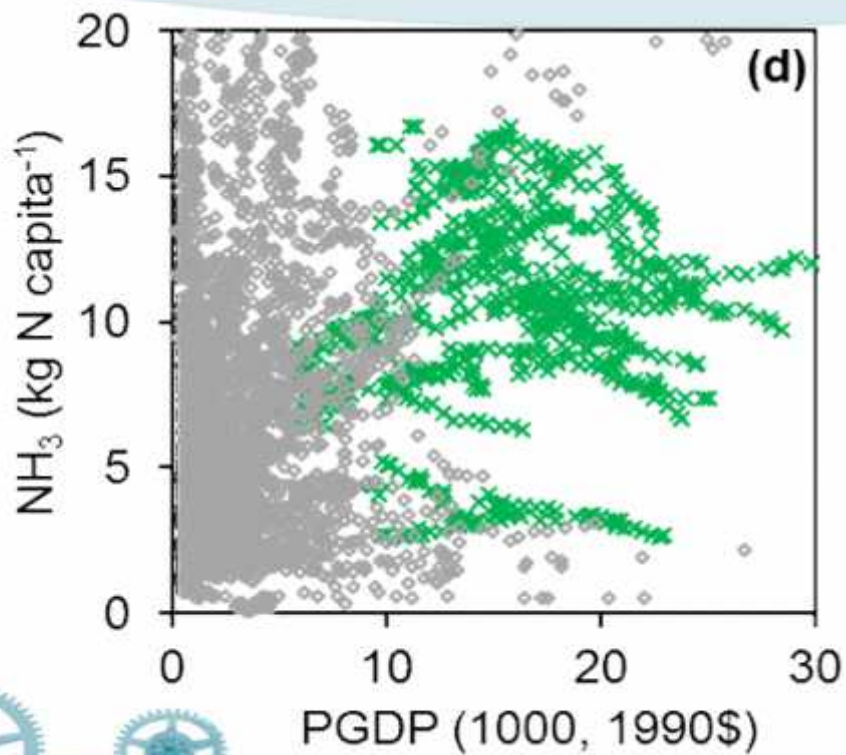
Variables	N Fertilizer	NO <sub>x</sub>	CBNF	NH <sub>3</sub>	CO <sub>2</sub>	CO <sub>2</sub> /(NO <sub>x</sub> +NH <sub>3</sub> )
Per-capita GDP	0.630*** (0.185)	0.309*** (0.064)	-0.733*** (0.013)	0.043 (0.088)	0.571*** (0.084)	0.468*** (0.090)
Population	0.875*** (0.225)	0.126 (0.094)	-0.031*** (0.012)	-0.200 (0.115)	0.153 (0.147)	0.477*** (0.130)
Urbanization	-0.011 (0.009)	0.000 (0.004)	MC	0.011* (0.005)	-0.001 (0.005)	0.000 (0.005)
Group dummy	2.547** (0.864)	3.472*** (0.399)	NA	0.043 (0.064)	1.460*** (0.342)	NA
PGDP × dummy	-1.002*** (0.307)	-1.295*** (0.136)	NA	-0.358 (0.184)	-0.571*** (0.125)	NA
Intercept	-1.271*** (0.330)	0.291 (0.174)	3.222*** (0.030)	2.737*** (0.223)	0.394 (0.263)	3.395 (0.283)
N	5595	3842	4336	3347	3811	3347
R <sup>2</sup> -within	0.223	0.550	0.457	0.264	0.540	0.280

# Turning points of N input

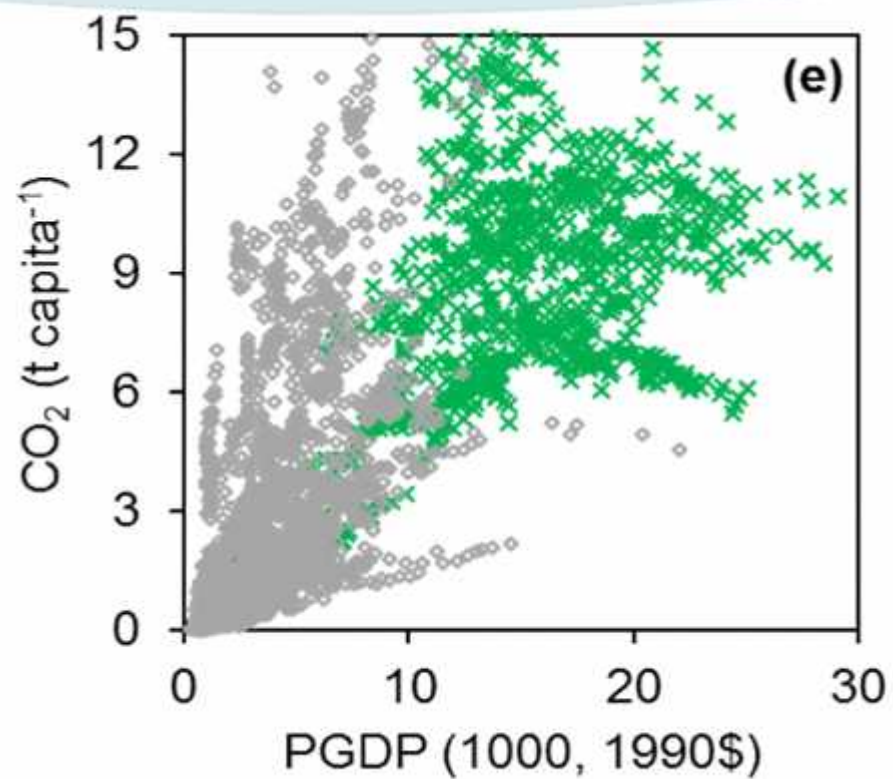




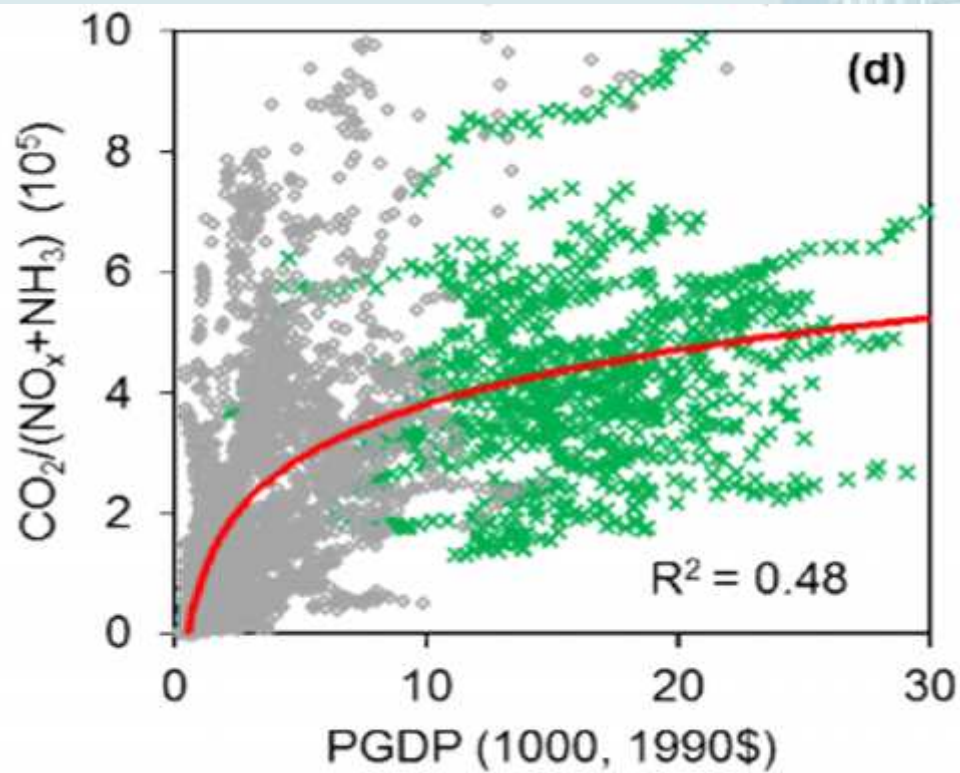
# How about NH<sub>3</sub> and N<sub>2</sub>O?



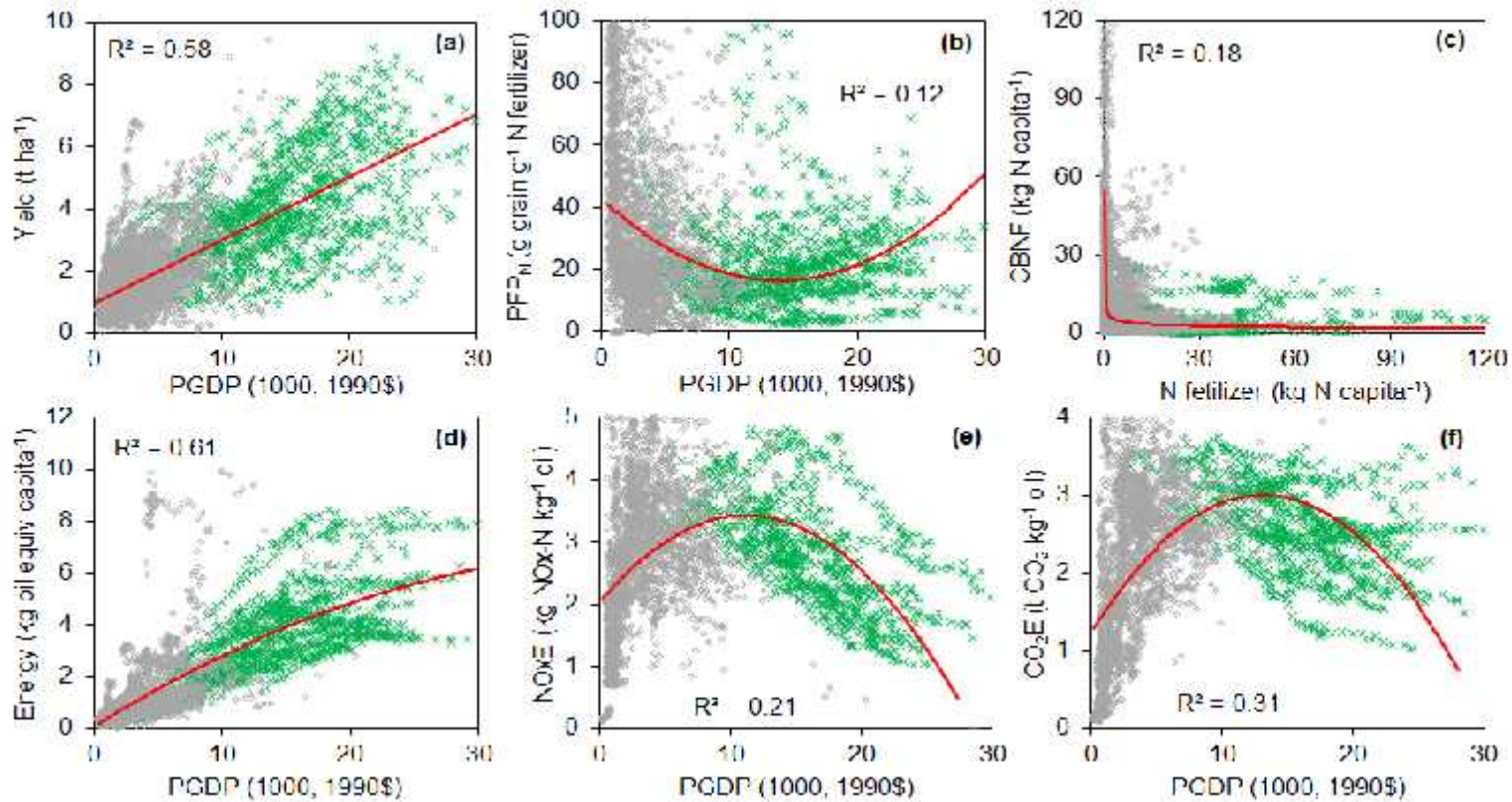
# EKC of CO<sub>2</sub> emission



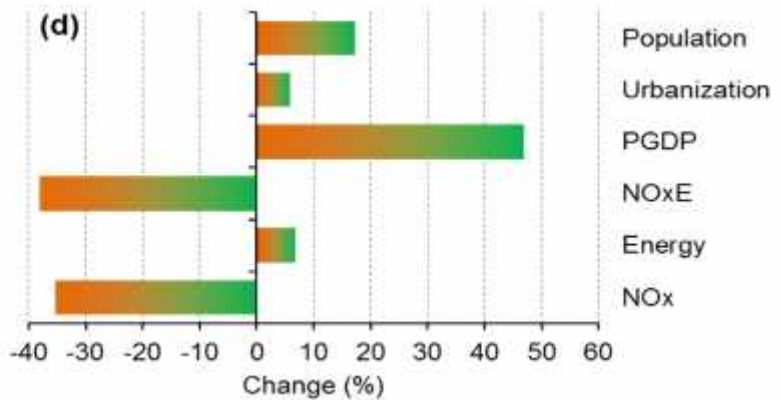
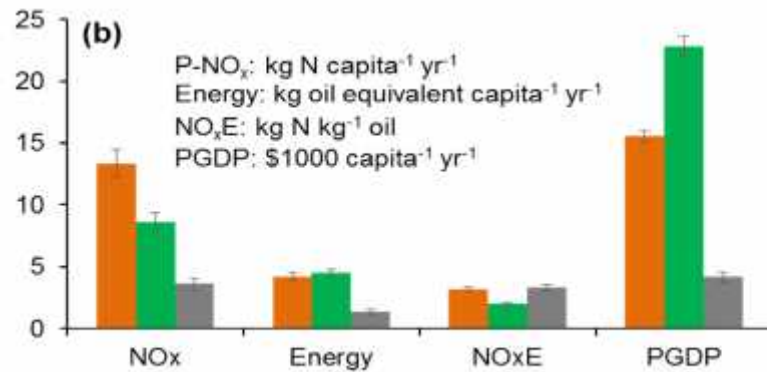
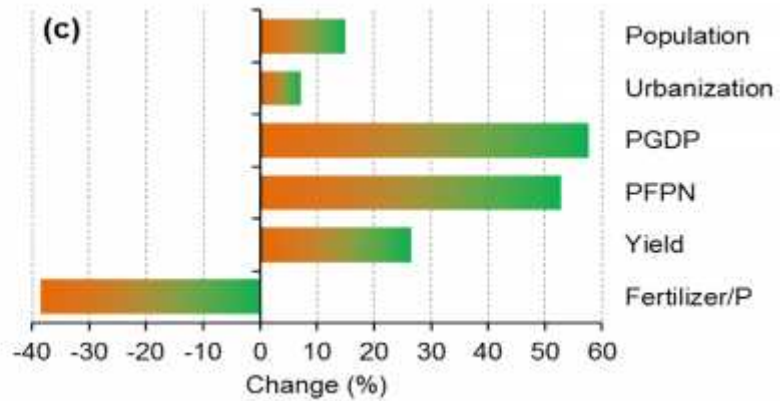
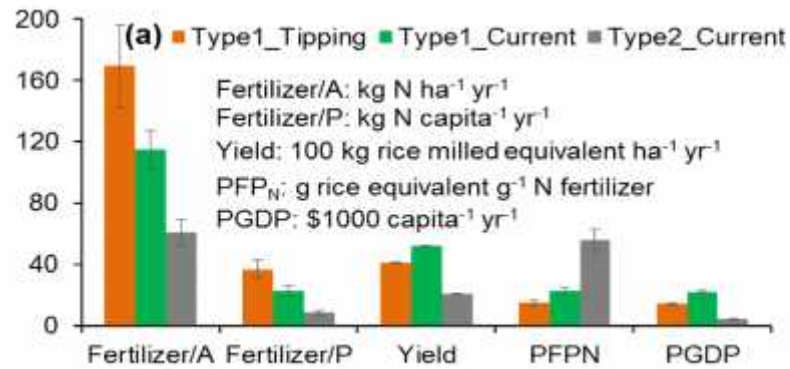
# No turning points for C/N ratio



# Explanations?

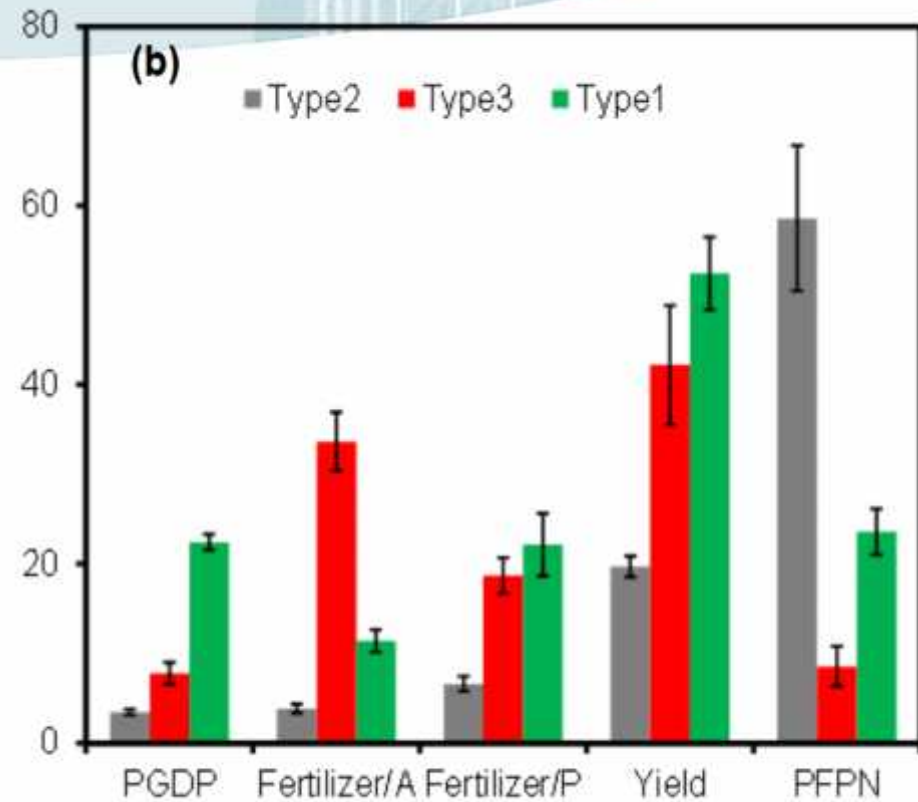
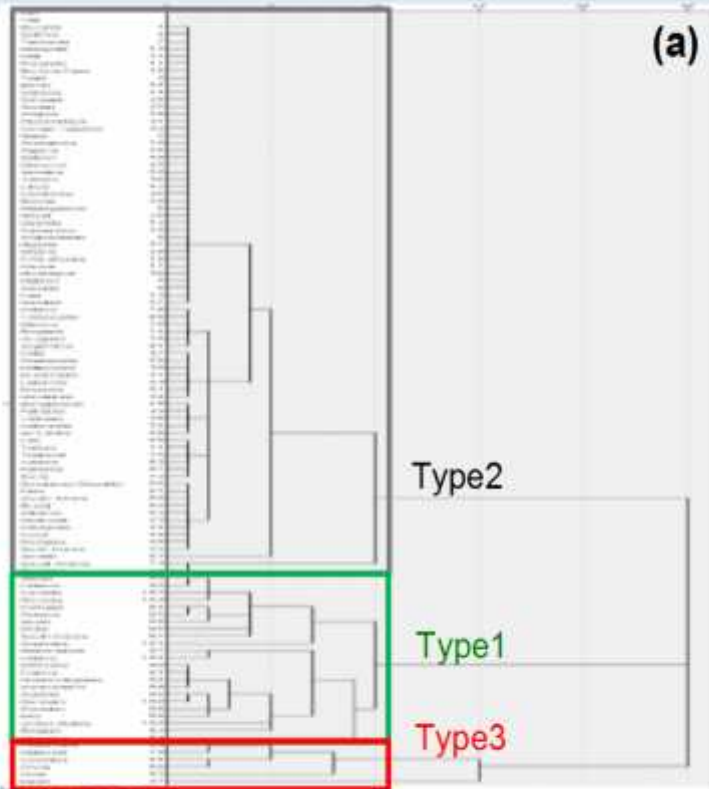


# Reality...

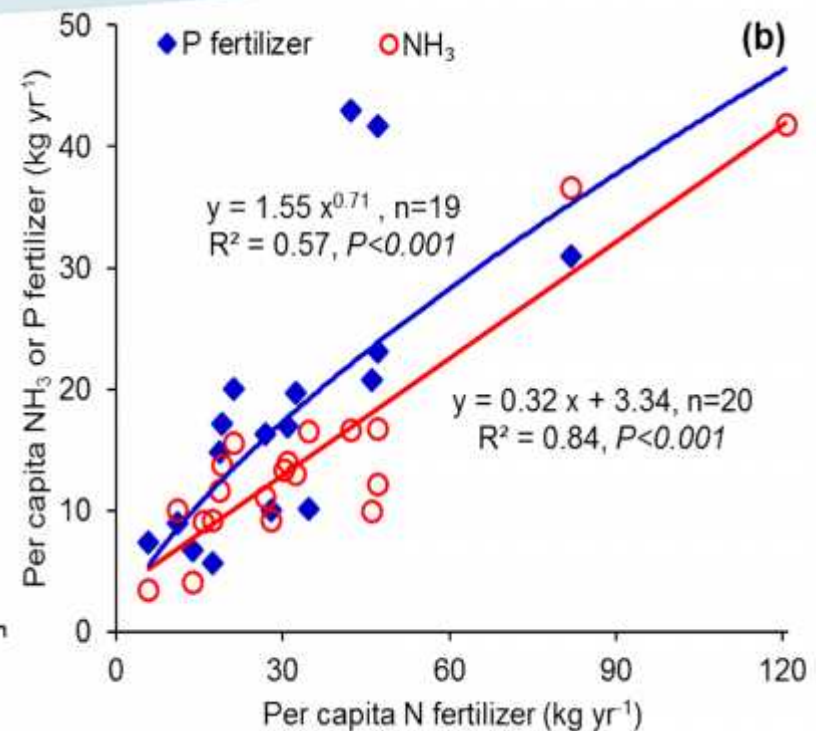
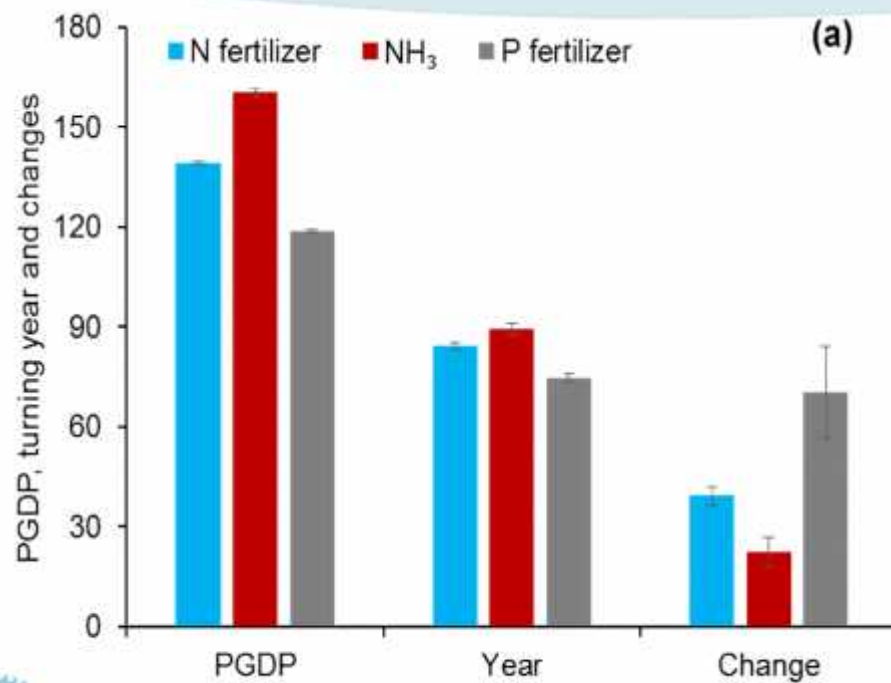


# How about per area basis?

Cluster analysis based on PGDP, Fertilizer/A and Yield



# Turning points of N, NH<sub>3</sub> and P



# Carbon sink potential?





Q&A?

**Thank you!**

