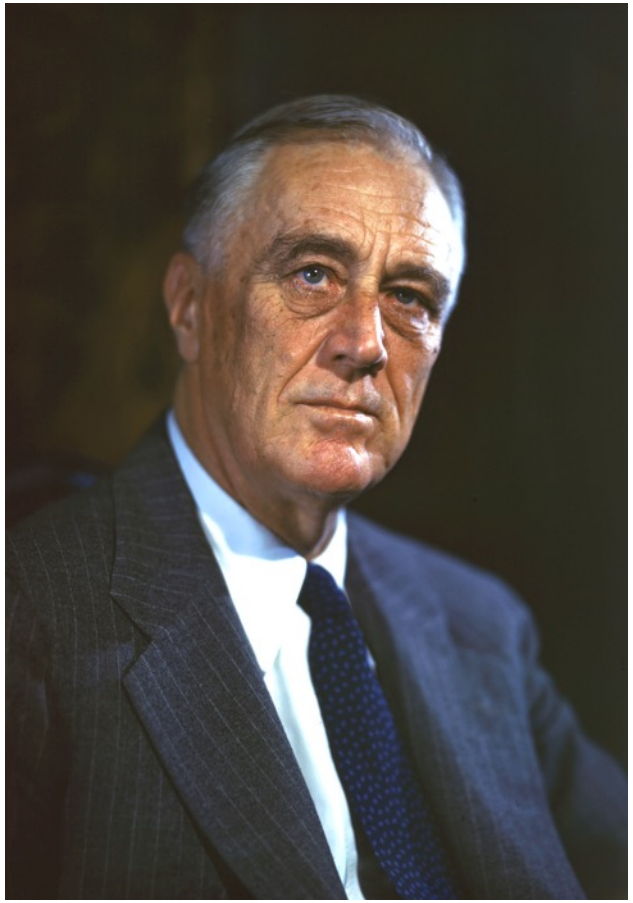
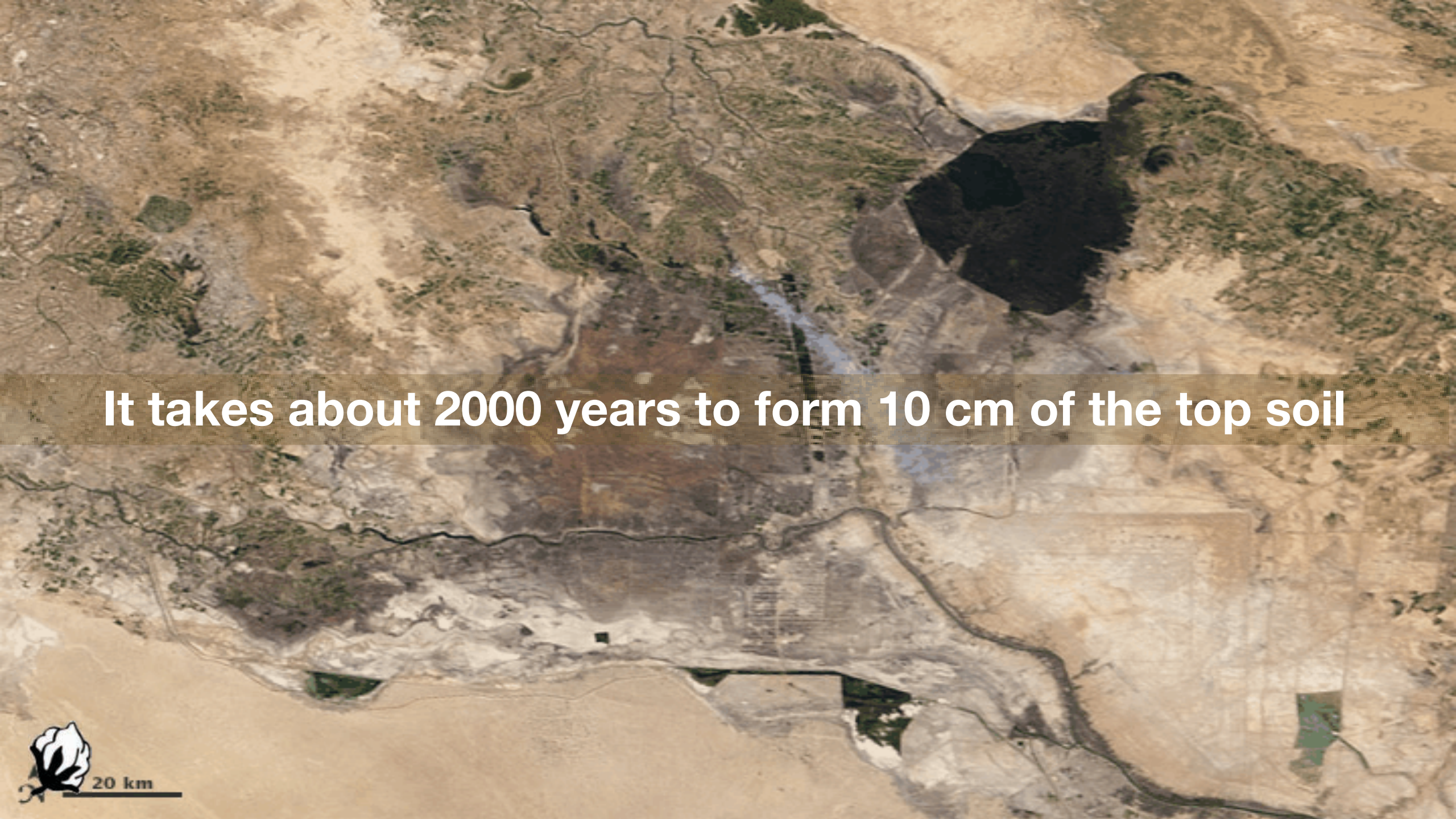
“The nation that destroys its soil destroys itself.”



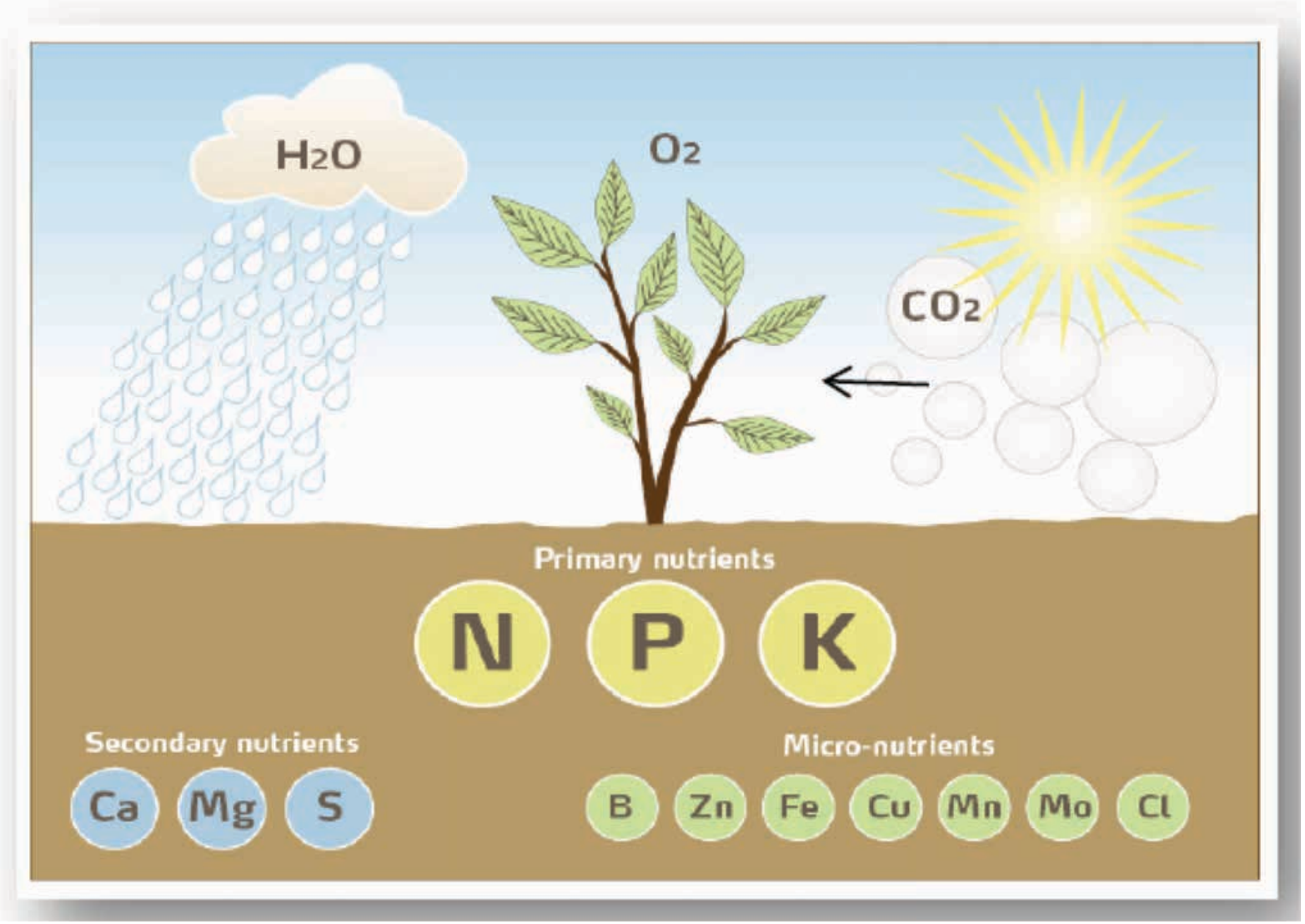
President Franklin D Roosevelt


It takes about 2000 years to form 10 cm of the top soil
20 km

A handful of soil contains
more organisms and micro-organisms
than the planet’s entire human population

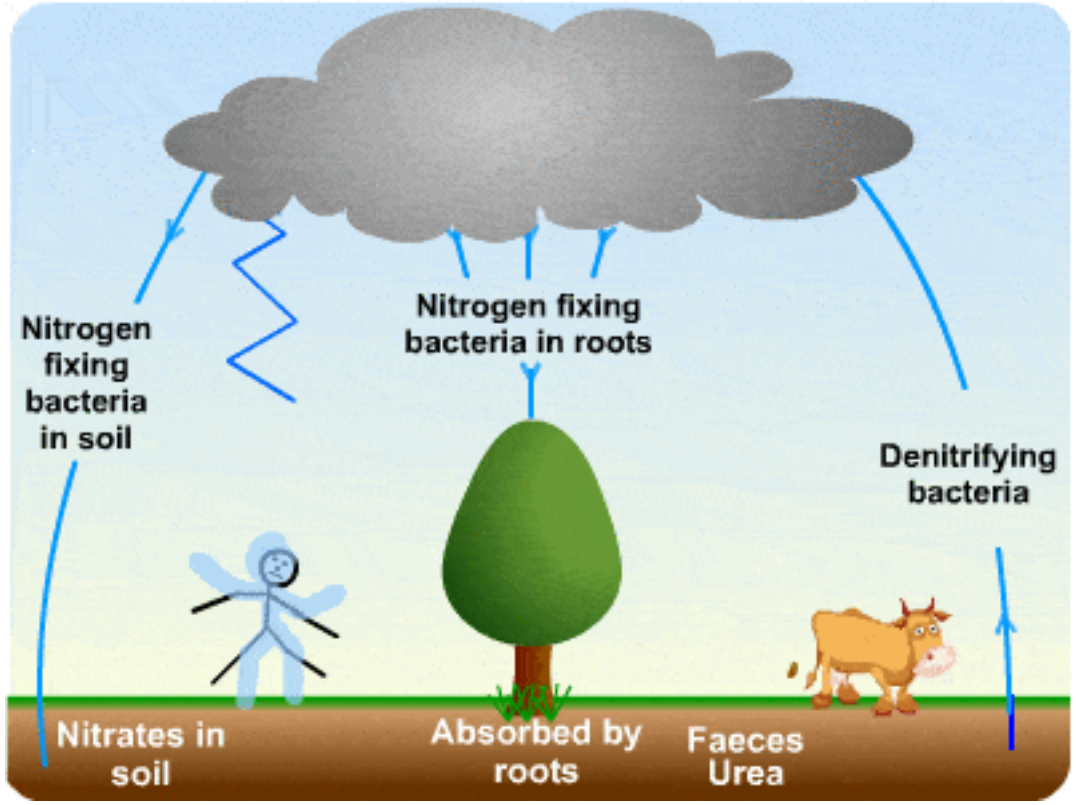
Soil organisms make nutrients & make a soil healthy

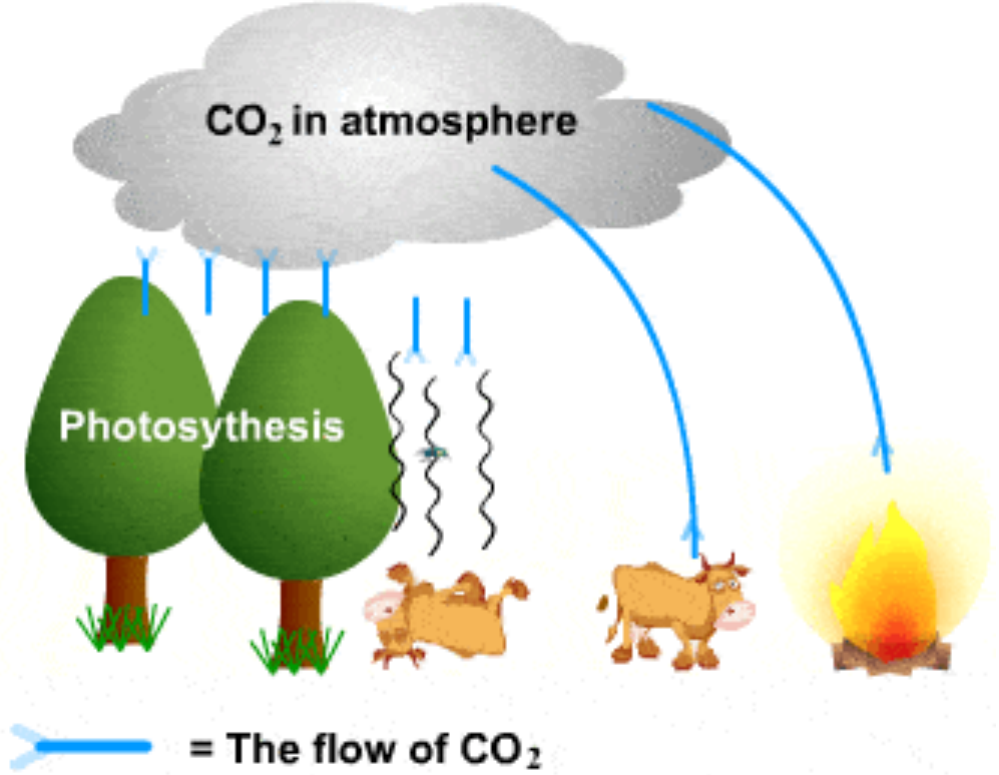
Plants need Sunlight, Air, Water and Soil



Nutrients are replenished in nature due to biomass recycling

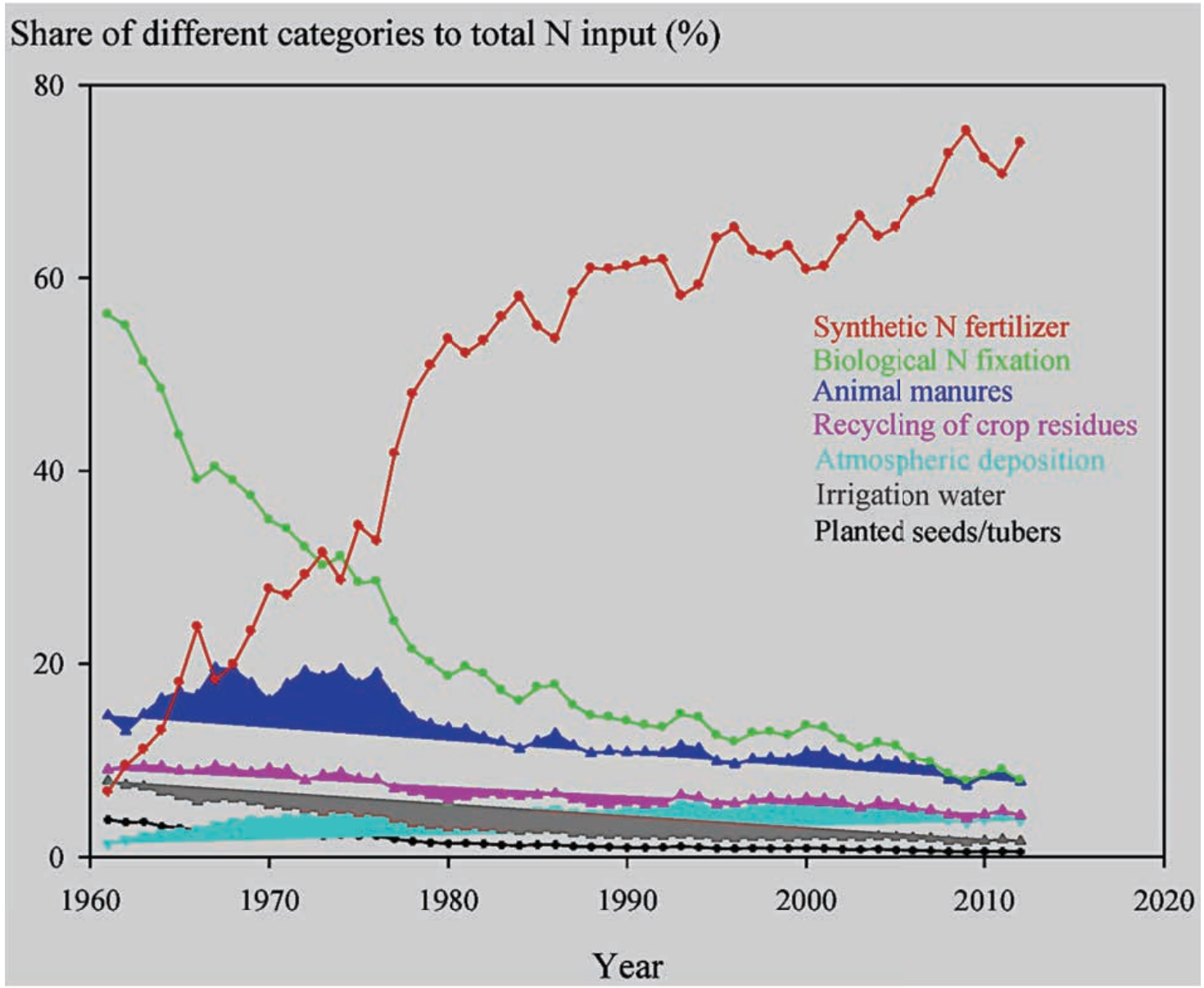
Soil microbes, Lightening and legume plants fix atmospheric Nitrogen
Soil organisms and microorganisms convert animal and plant waste into nutrients (NPK + others)
Carbon cycle sustains all forms of life



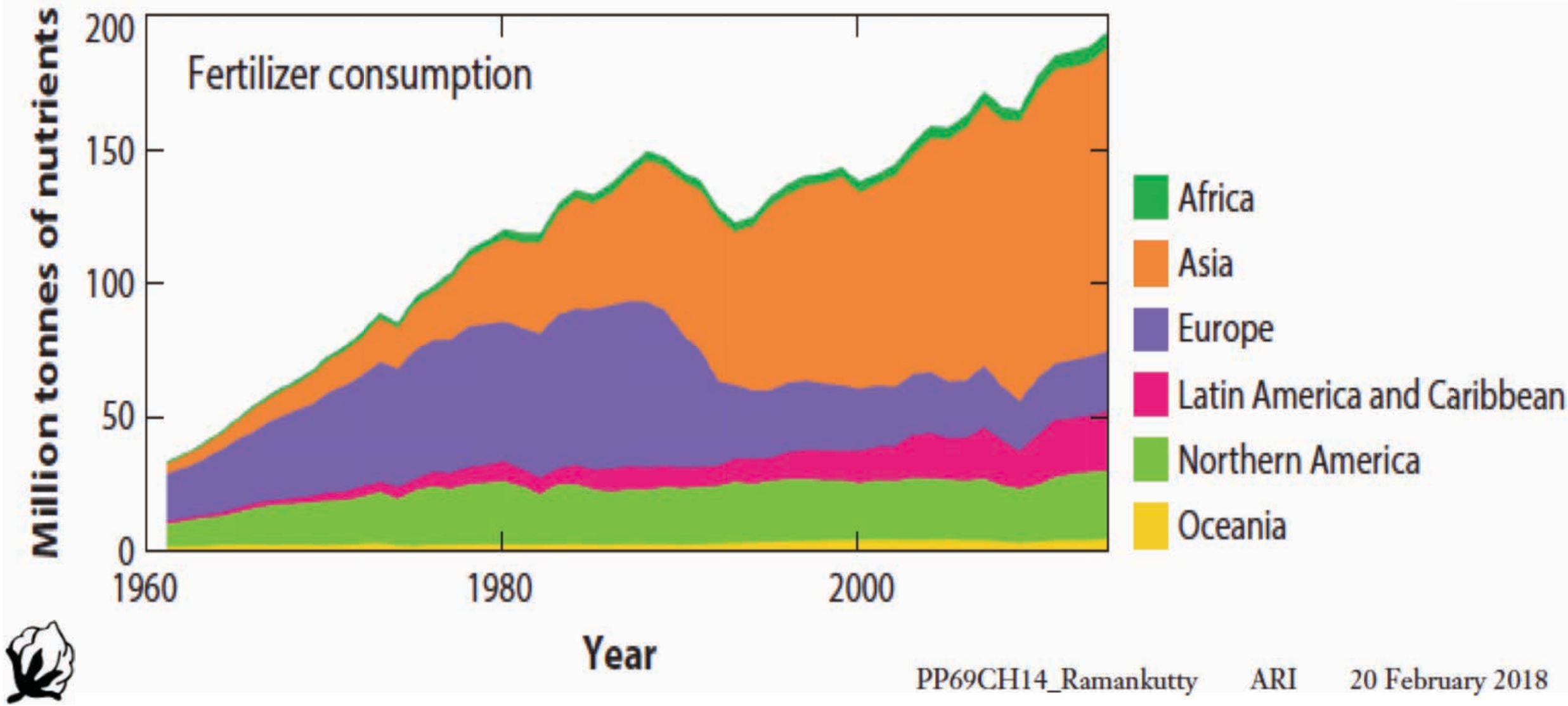


Chemicals (fertilizers and pesticides) disturb the natural soil balance

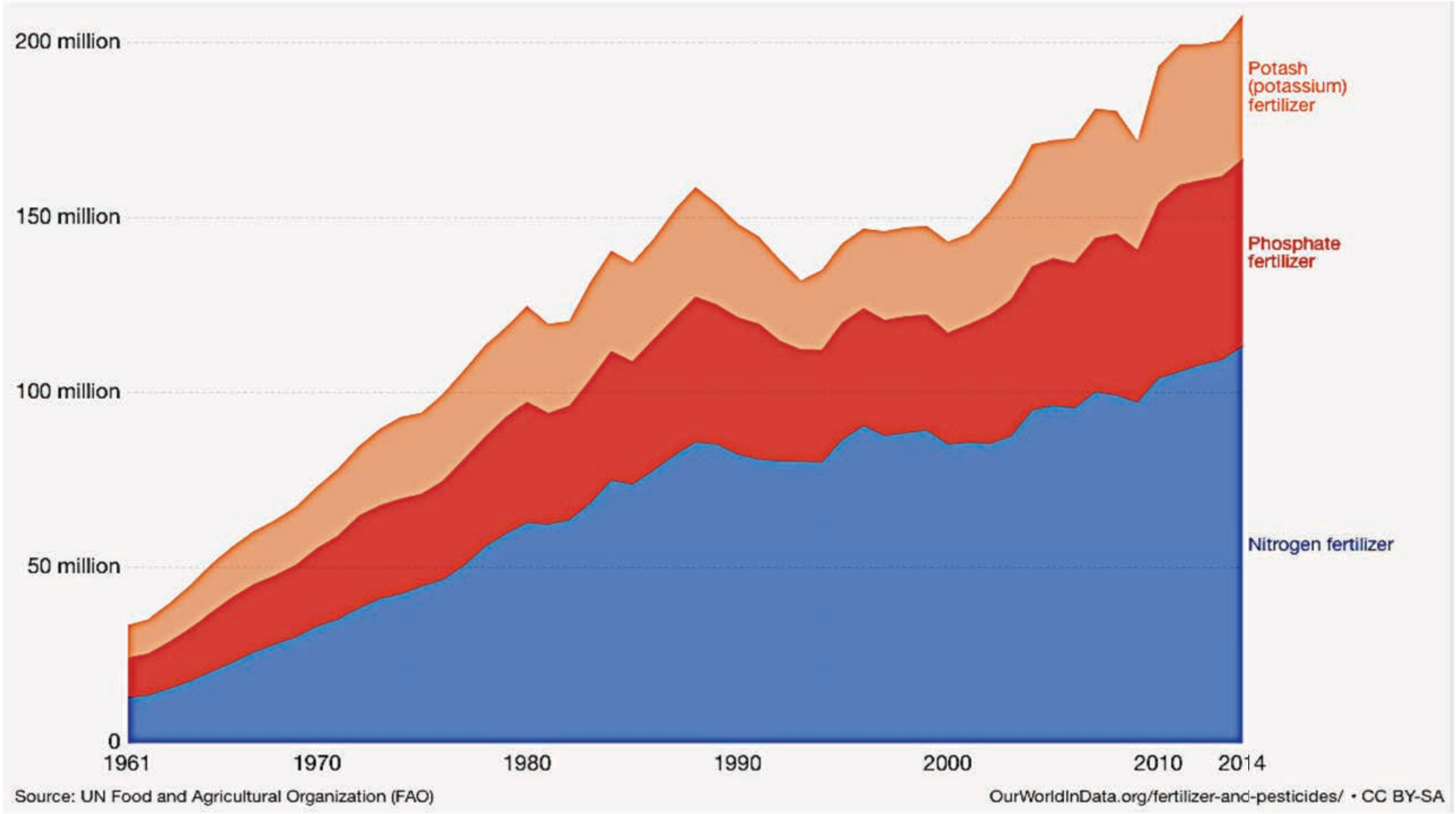
As chemical fertilizers increased, biological Nitrogen fixation declined



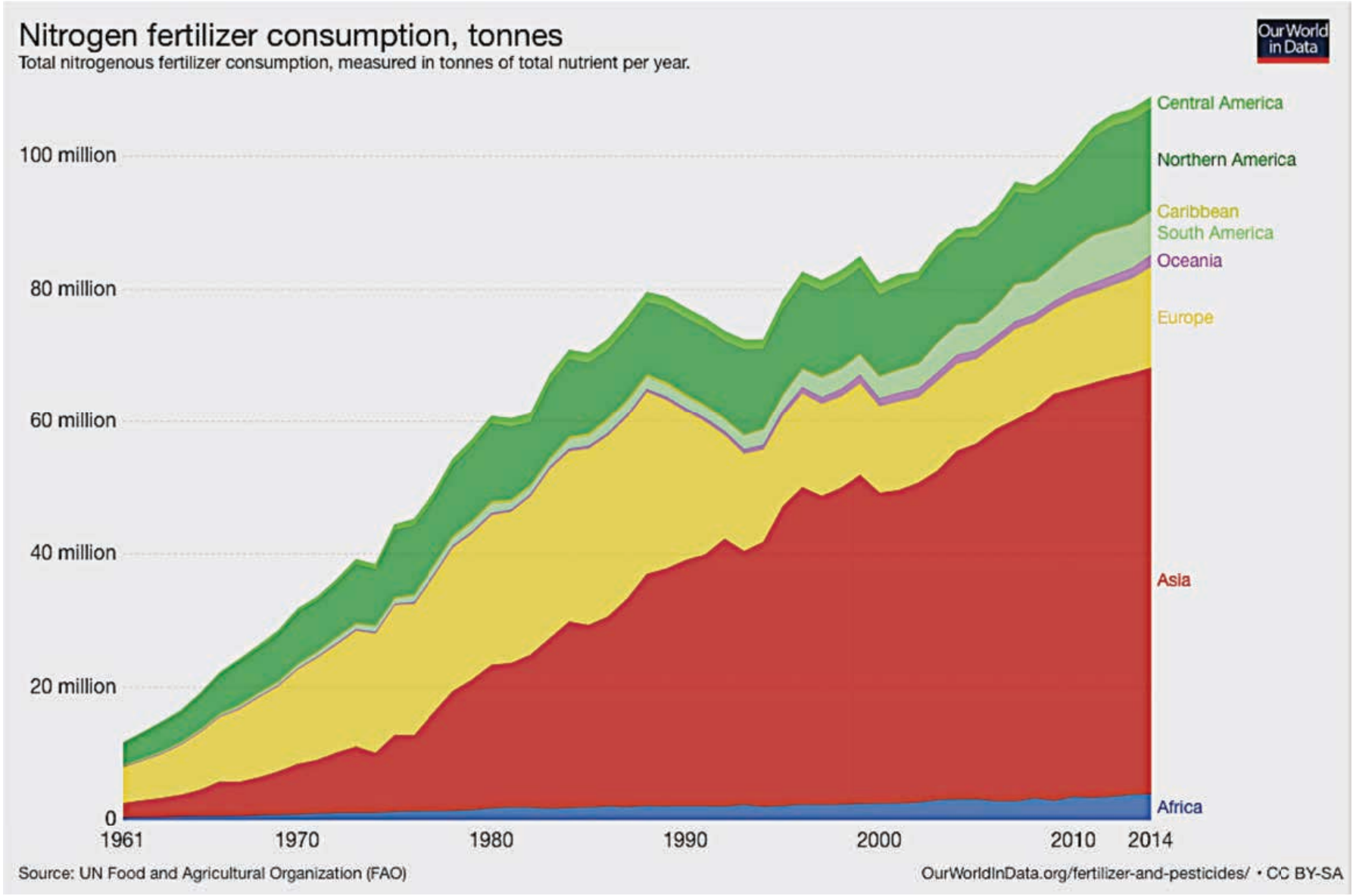
Global Fertilizer Use is Highest in Asia



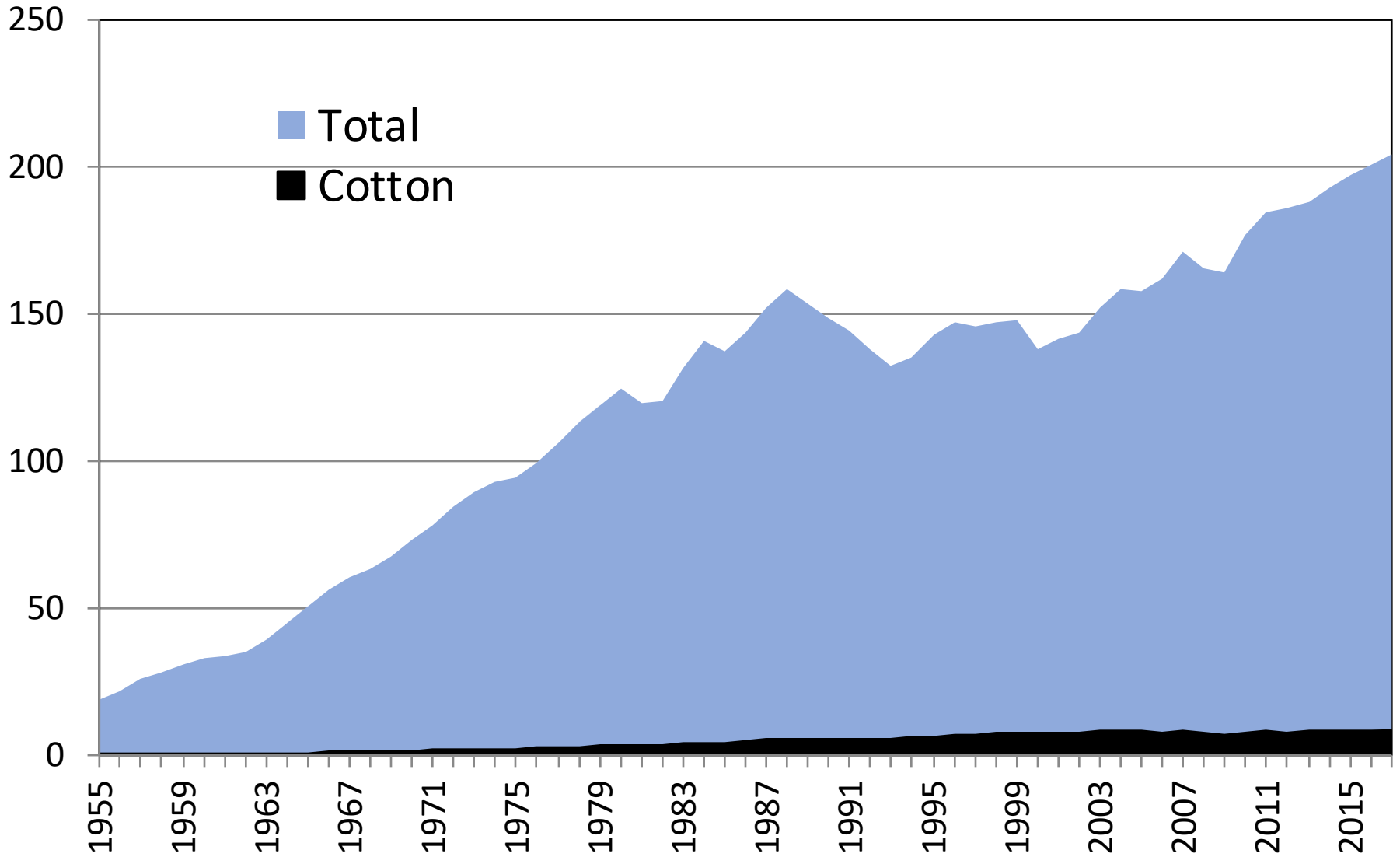
Nitrogen Fertilizer Use is the Highest



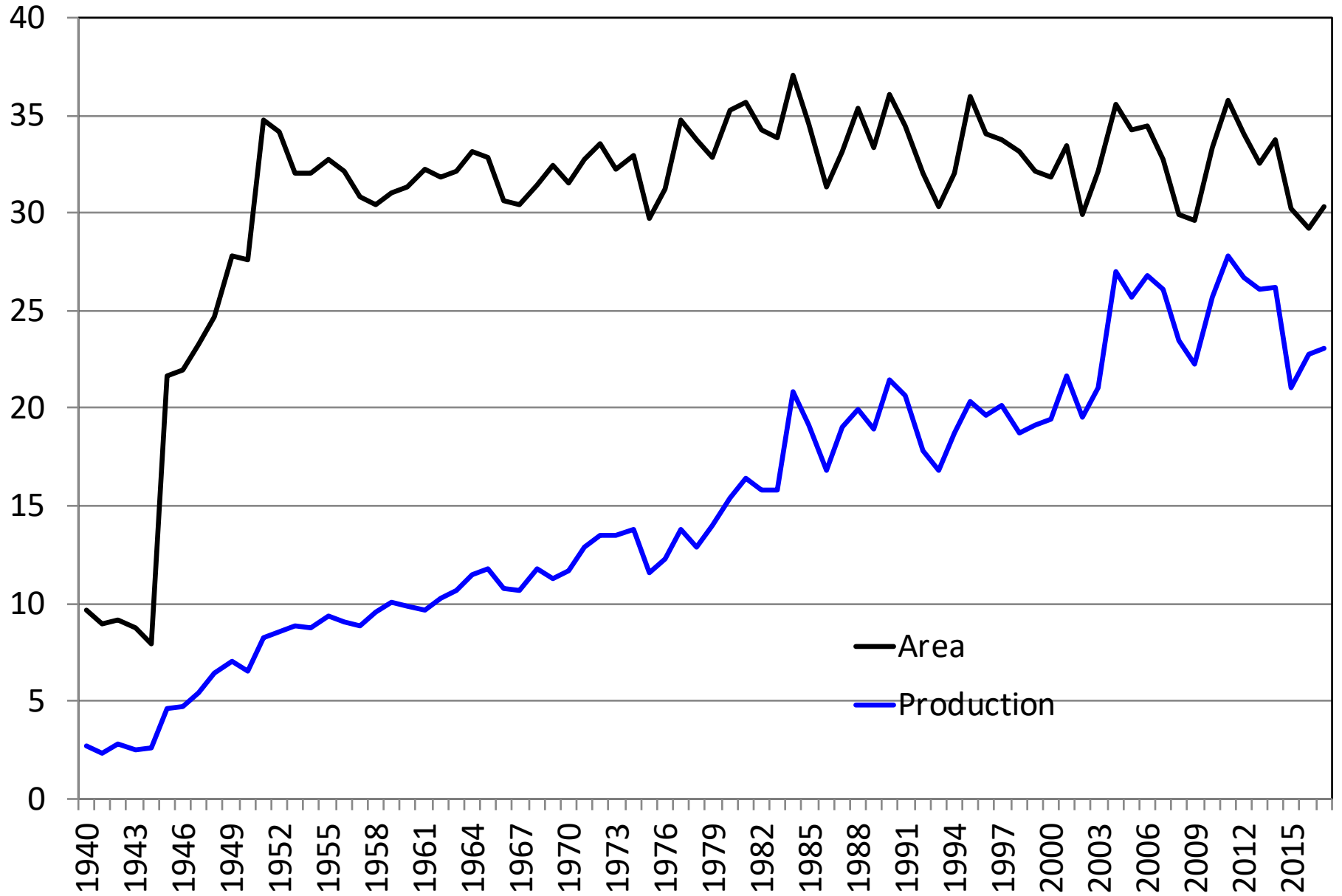
Nitrogen Consumption is Highest in Asia



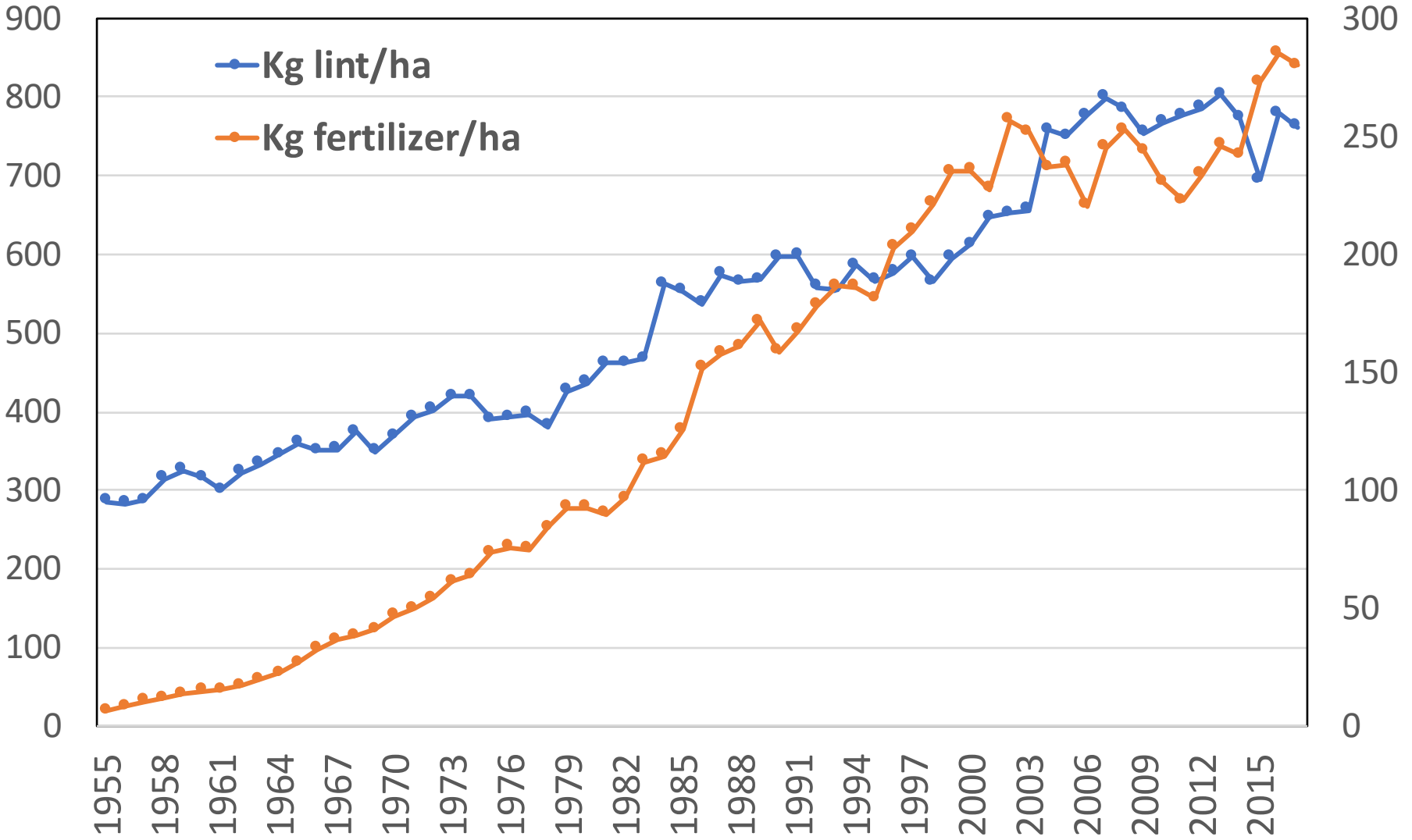
Global Fertilizer Use (Million Tonnes) in Cotton



Cotton Area (million Ha) and Production (million Tons)

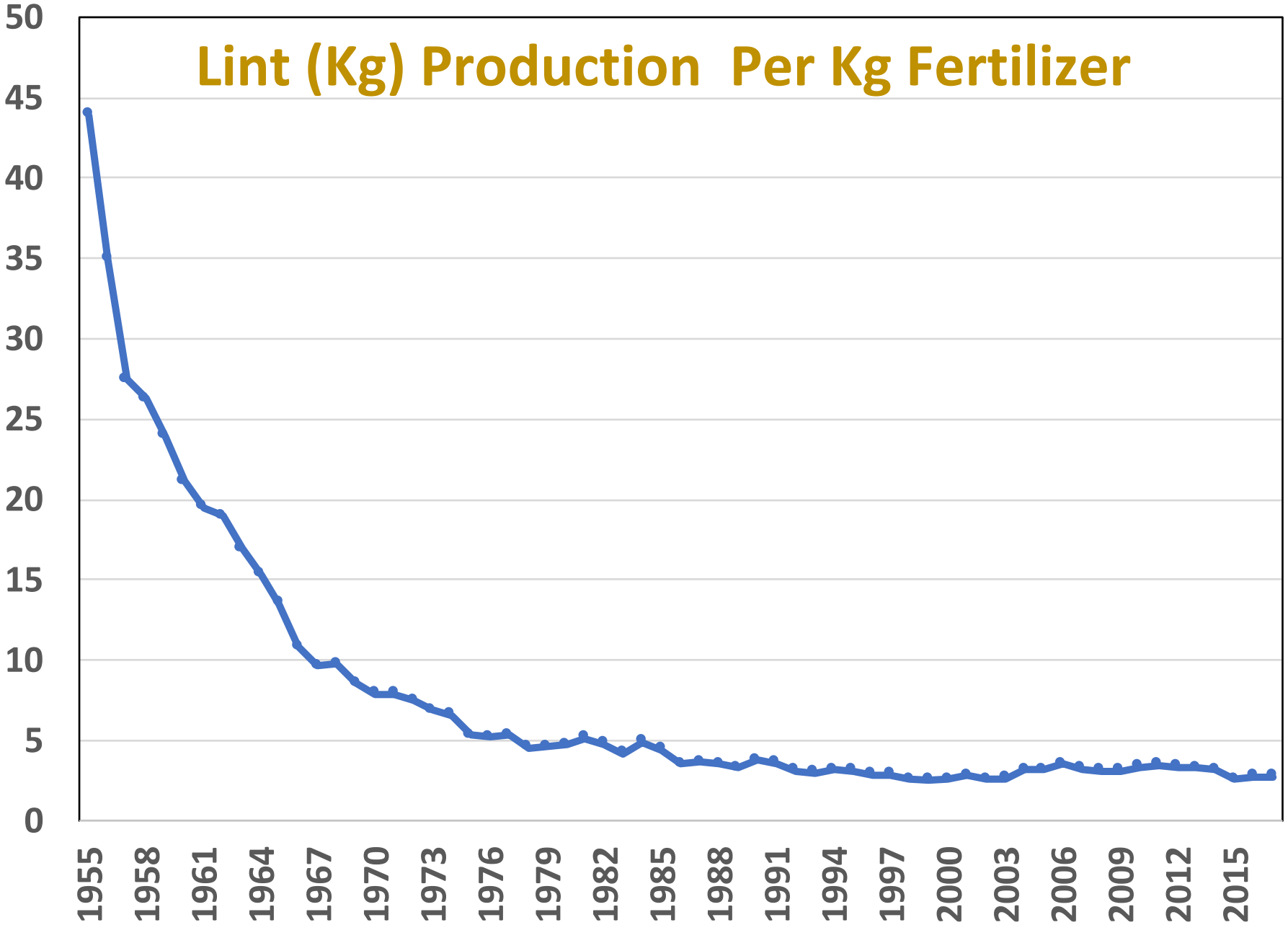


Cotton Yield Response to Fertilizers

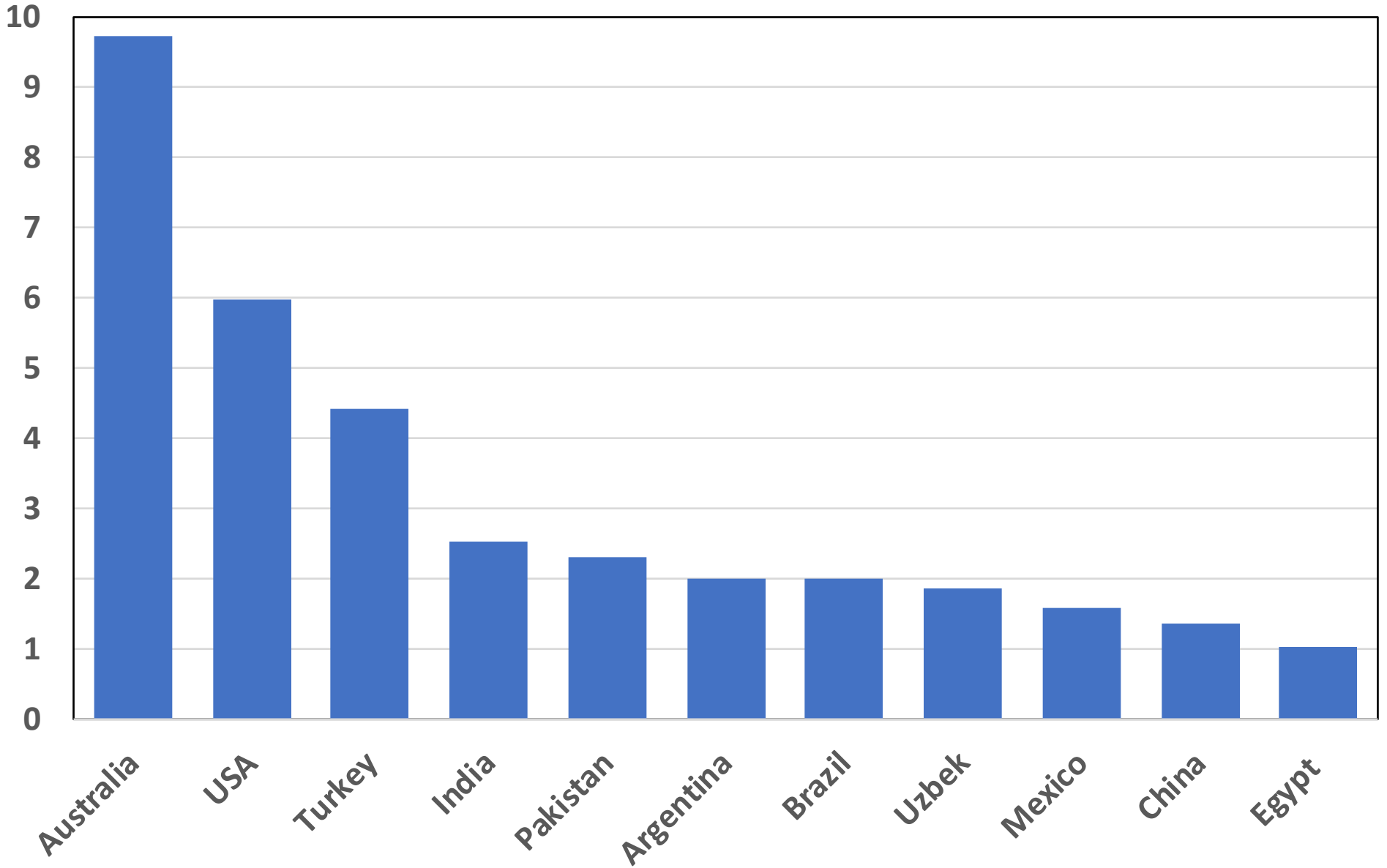


Over 30 years after the 1940s

As the fertilizer use increased, crop response decreased


Lint (Kg) Production Per Kg Fertilizer
50
45
40
35
30
25
20
15
10
5
0
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015

Lint (Kg) Production Per Kg Fertilizer



Requirements to get 1000 Kg lint

44-45 Kg Nitrogen-N
11-12 Kg Potash-N
14-15 Kg Phosphorus-P
267 mm water (Rain)

Good control of weeds, diseases and insect pests

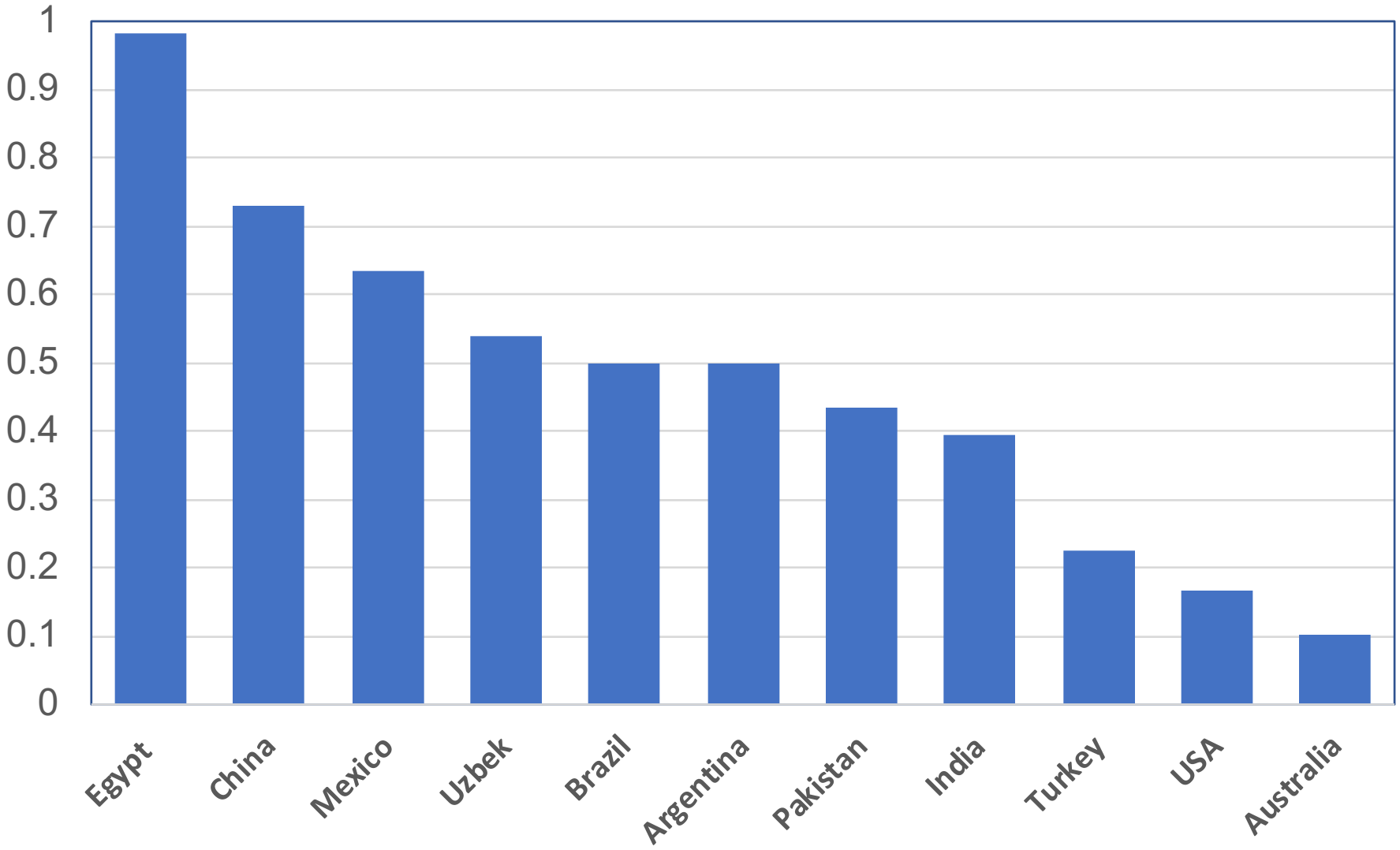
Precision fertilizer use –Australian design

TABLE 1: Nutrient removal at various yield levels in bales/ha. Green shaded area represents macronutrients, yellow shaded area represents micronutrients (note change in units of measurement).

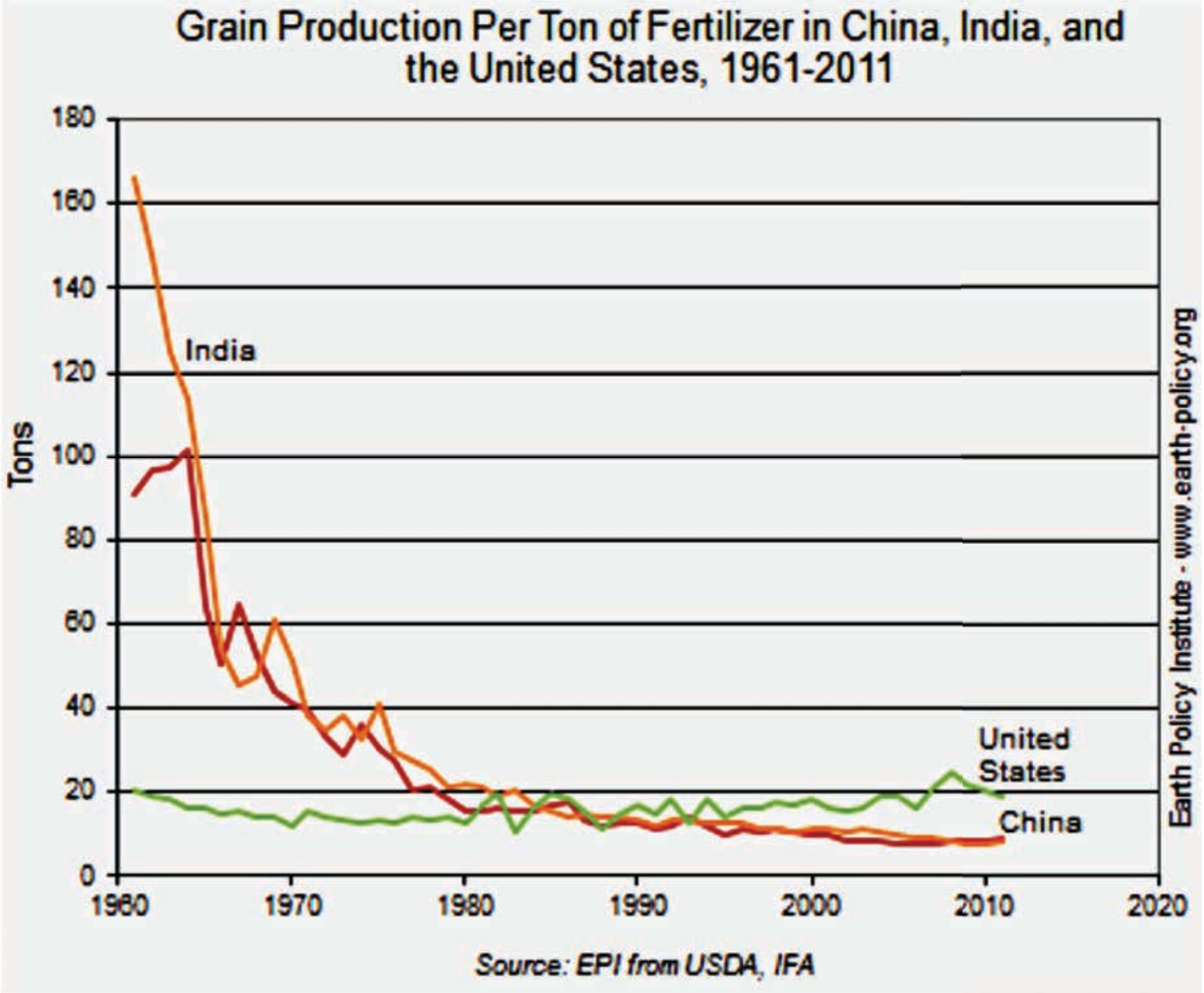
Yield	N	P	K	S	Ca	Mg	Na	B	Cu	Zn	Fe	Mn
b/ha	kg/ha							g/ha				
4	33	11	12	4	2	7	0.13	8	11	56	91	18
5	50	13	17	5	3	8	0.14	18	13	64	99	24
6	65	15	22	6	3	9	0.15	28	15	73	109	30
7	81	17	26	7	4	11	0.15	36	18	85	122	36
8	95	19	30	8	5	12	0.16	43	20	97	138	42
9	109	21	33	9	5	13	0.17	49	22	112	156	48
10	123	23	36	10	6	14	0.18	55	24	128	176	54
11	136	25	39	11	6	15	0.18	59	26	145	199	60
12	148	27	41	12	6	16	0.19	62	28	164	224	66
13	160	29	43	13	7	18	0.2	65	30	185	252	72
14	171	31	45	14	7	19	0.2	66	32	207	283	78
15	182	33	46	15	7	20	0.21	67	34	231	316	84
16	192	35	47	17	7	21	0.22	66	36	257	352	90
17	201	37	48	18	8	22	0.22	65	38	284	390	96
18	210	39	48	19	8	24	0.23	62	41	312	431	101
19	219	41	48	20	8	25	0.24	59	43	343	474	107

Source: Rochester (2014) final report.
P removal is reduced in the new small seeded varieties to between 1.5–2.0 kg/ha/yield compared to the 2.2–2.8 used in this table (Mike Bell and Brendan Griffiths).

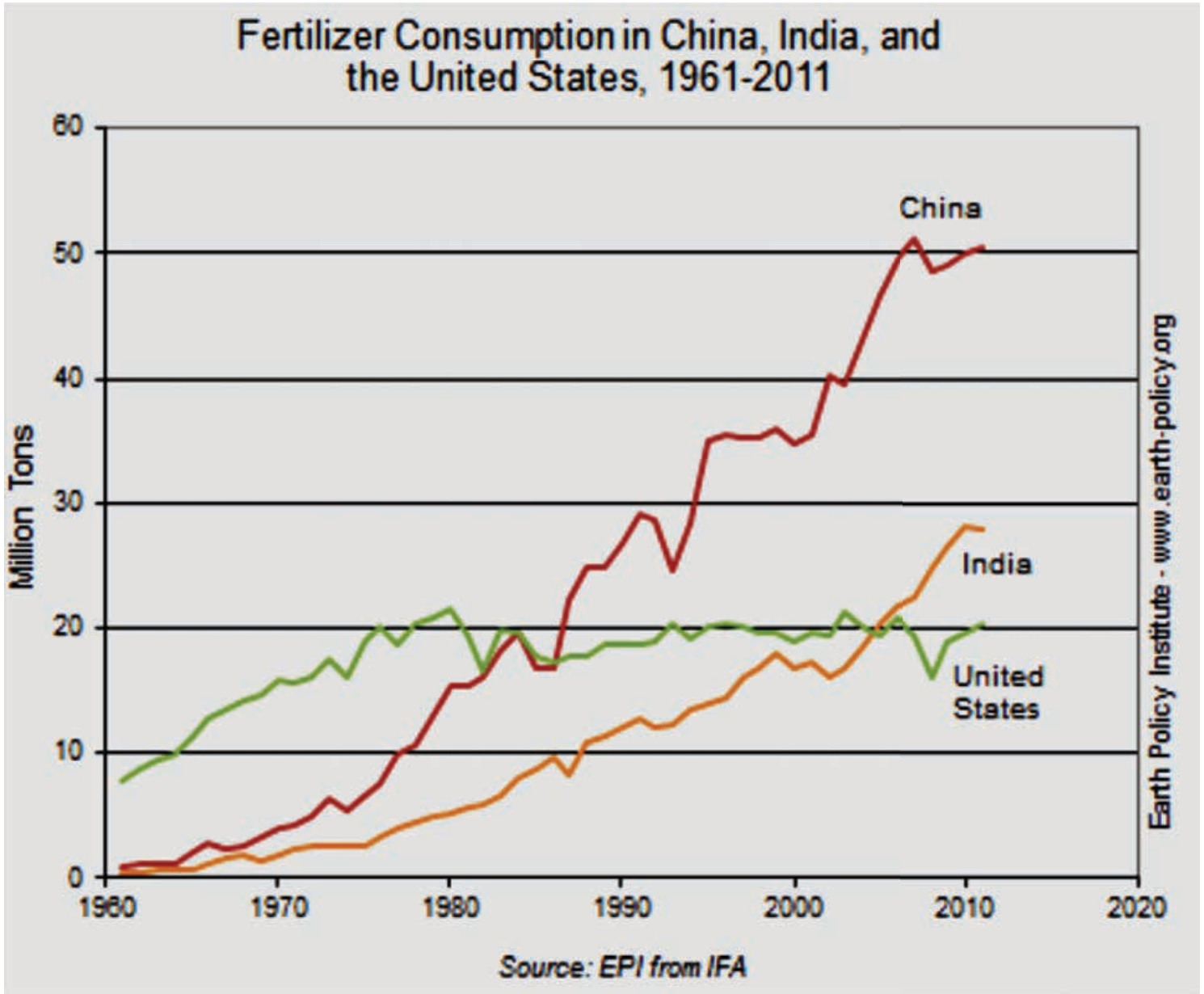
Fertilizer (Kg) used per Kg lint 2017



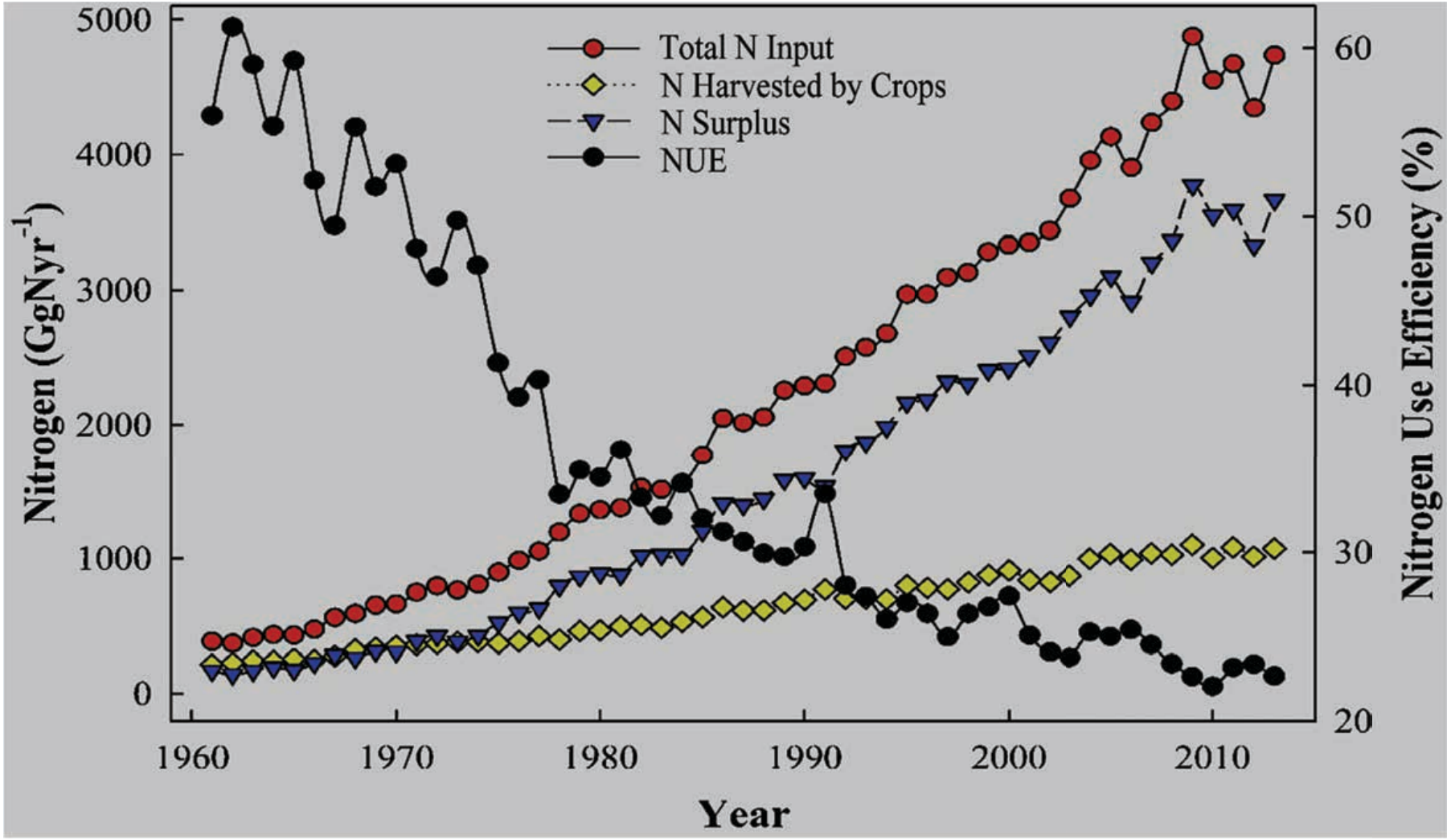
Almost all crops became less efficient in using fertilizers



Fertilizer use increased, but with minimum yield increments



As Nitrogen use-efficiency declined, wasteful use of 'N' increased



Environmental Impact of Deforestation, Excess Fertilizer & Irrigation

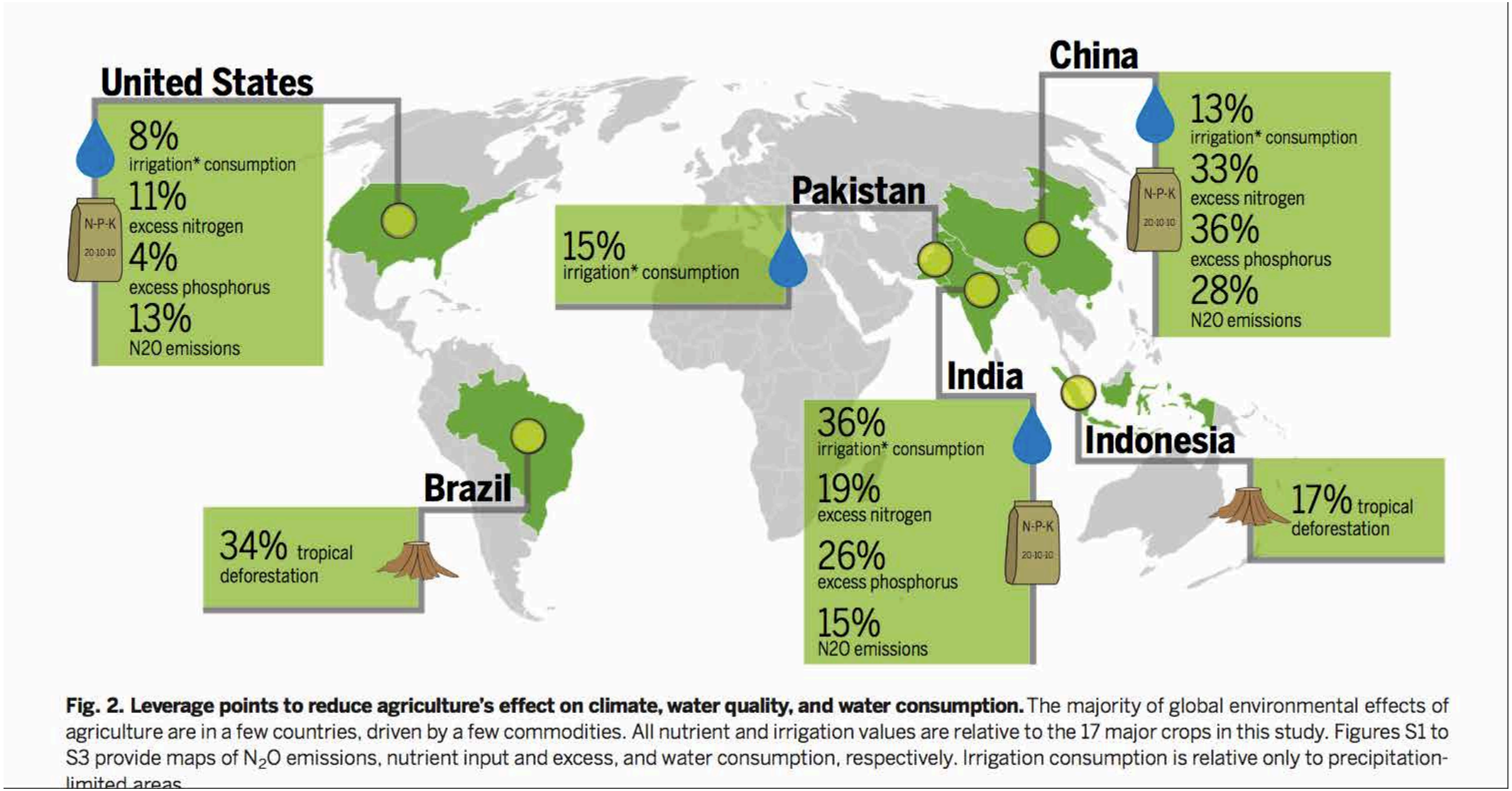
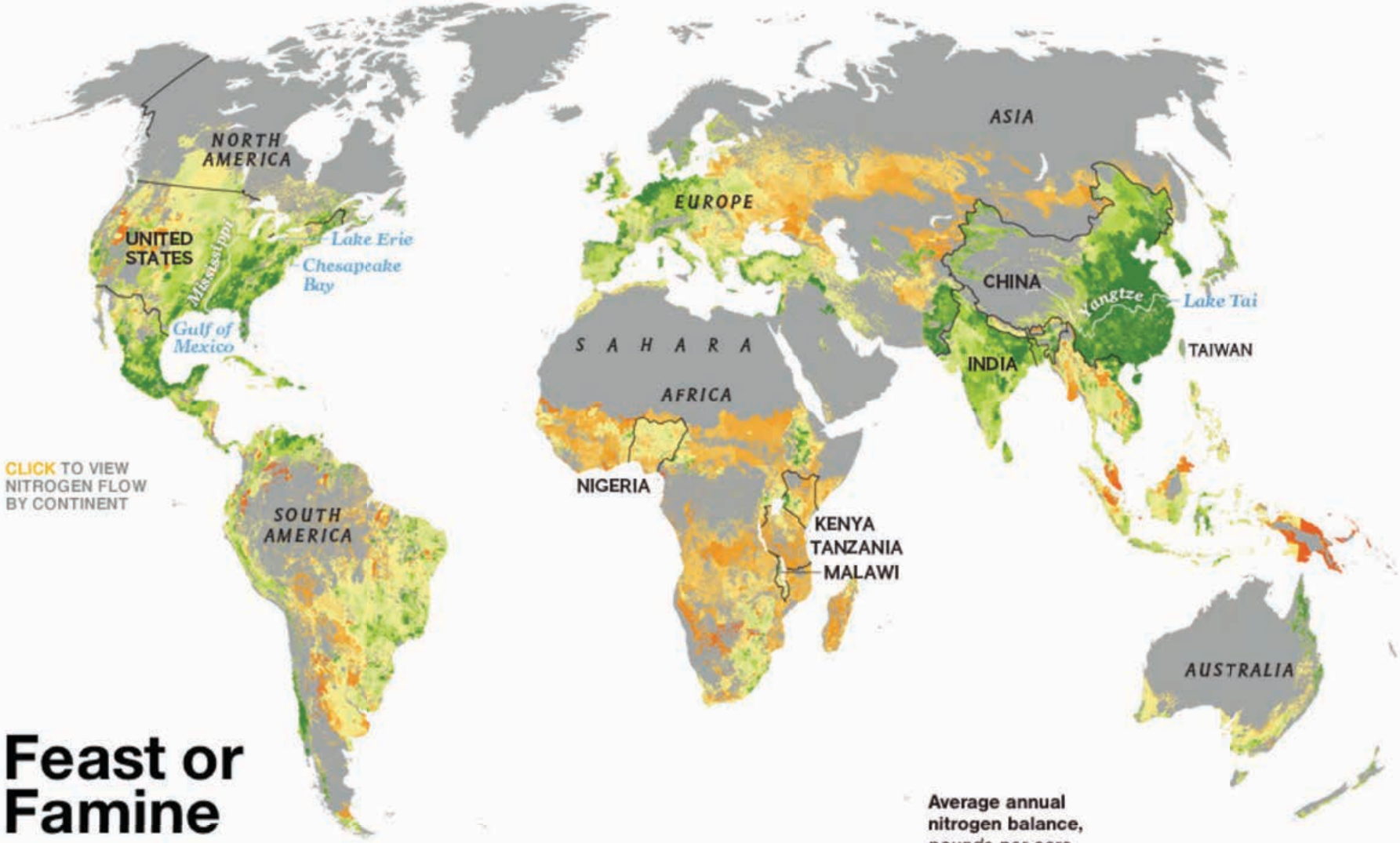


Fig. 2. Leverage points to reduce agriculture's effect on climate, water quality, and water consumption. The majority of global environmental effects of agriculture are in a few countries, driven by a few commodities. All nutrient and irrigation values are relative to the 17 major crops in this study. Figures S1 to S3 provide maps of N_2O emissions, nutrient input and excess, and water consumption, respectively. Irrigation consumption is relative only to precipitation-limited areas.

West et al., Science 2014



Feast or Famine

Nearly half the people on the planet wouldn't be alive if not for the abundant food made possible by nitrogen fertilizer. Yet its benefits have not reached everyone. In sub-Saharan Africa, where 239 million people go hungry in a year, crops fail as soil is stripped of nutrients, and farmers can't afford to buy fertilizer. Elsewhere overuse pollutes waterways and releases greenhouse gases.

Average annual nitrogen balance, *pounds per acre*

Deficiency — Excess

-200 0 220

Little or no cropland

Zero means the crop used exactly the amount of nitrogen applied. The ideal range varies due to local conditions.

JEROME N. COOKSON AND LAWSON PARKER, NGM STAFF
SOURCE: PAUL C. WEST, INSTITUTE ON THE ENVIRONMENT, UNIVERSITY OF MINNESOTA

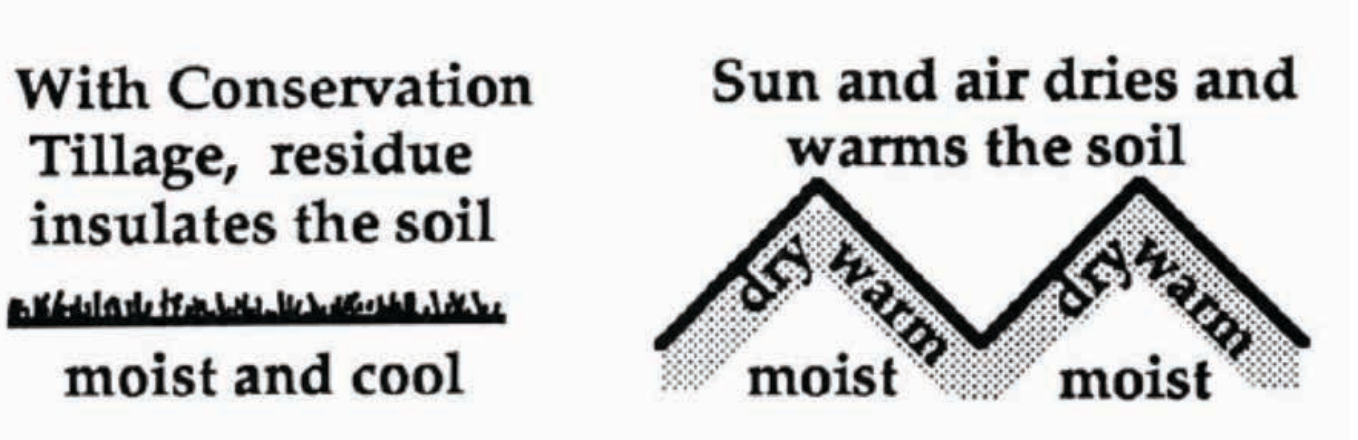
Answer…Precision farming

About 80% of nutrients are needed during boll formation stage

Answer…

Sustainable Farming

Conservation agriculture
Optimize fertilizer use
Legume crops
Bio-fertilisers & Manures
Residue recycling




Thank
you