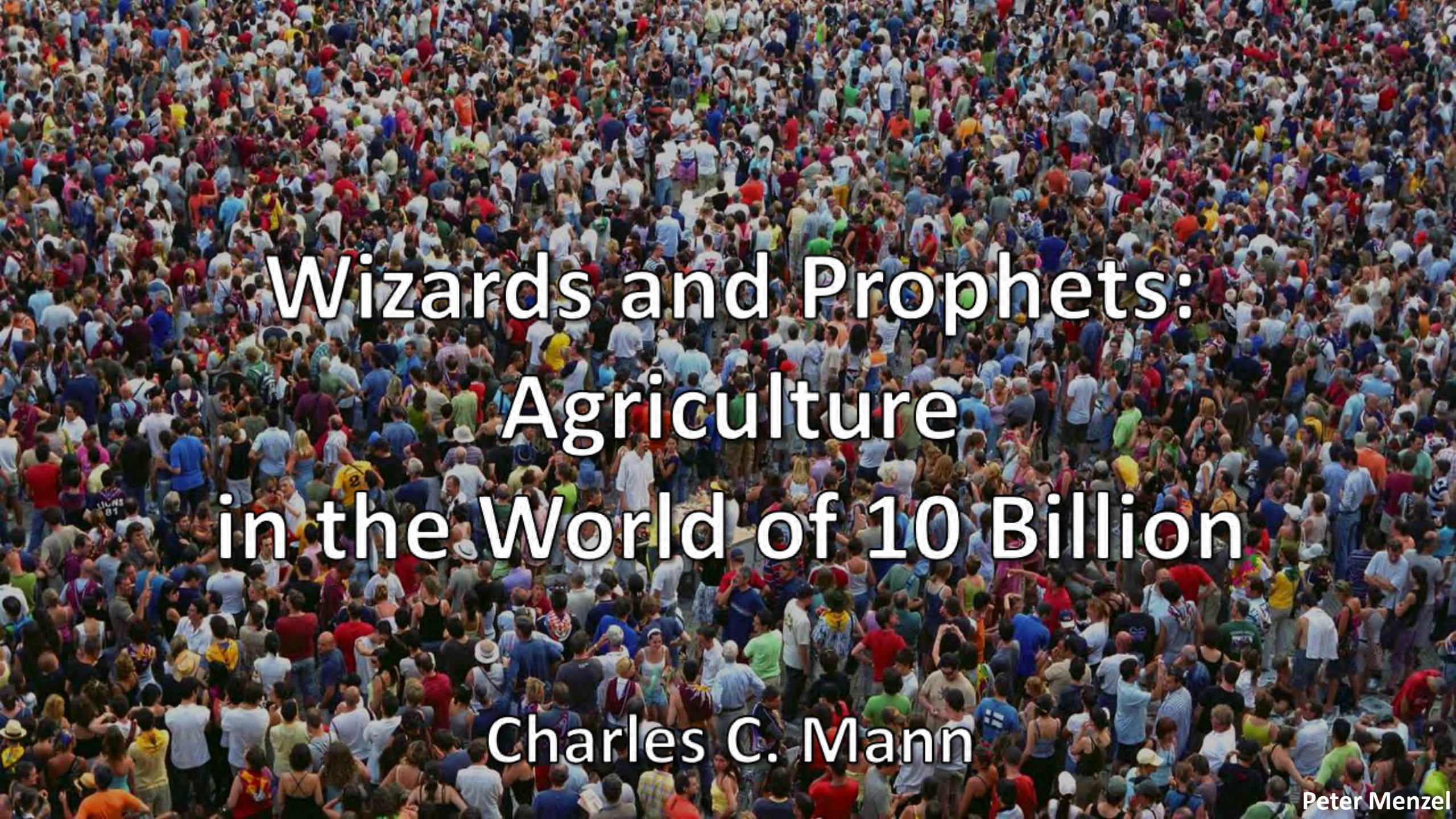


Wizards and Prophets: Agriculture in the World of 10 Billion

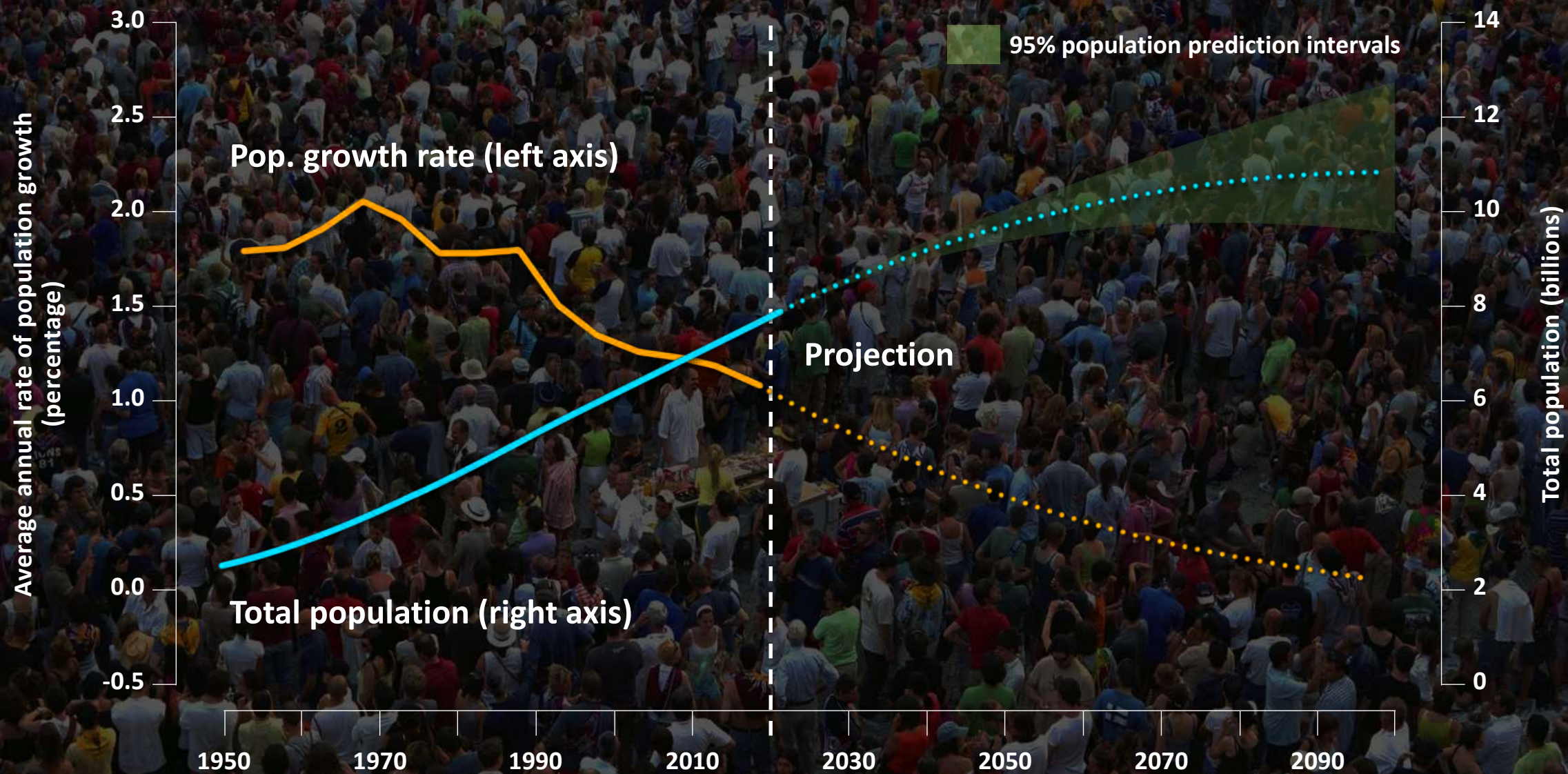
Charles C. Mann



Wizards and Prophets: Agriculture in the World of 10 Billion

Charles C. Mann

U.N. global population projections



Global per-capita income, 1870-2016





Global per-capita income, 1870-2016

FOUR GREAT CHALLENGES:

1) Food

2) Water

3) Energy

4) Climate



FOUR GREAT CHALLENGES:

1) Food

2) Water

3) Energy

4) Climate

...and agriculture is key to all of them!

2. Water

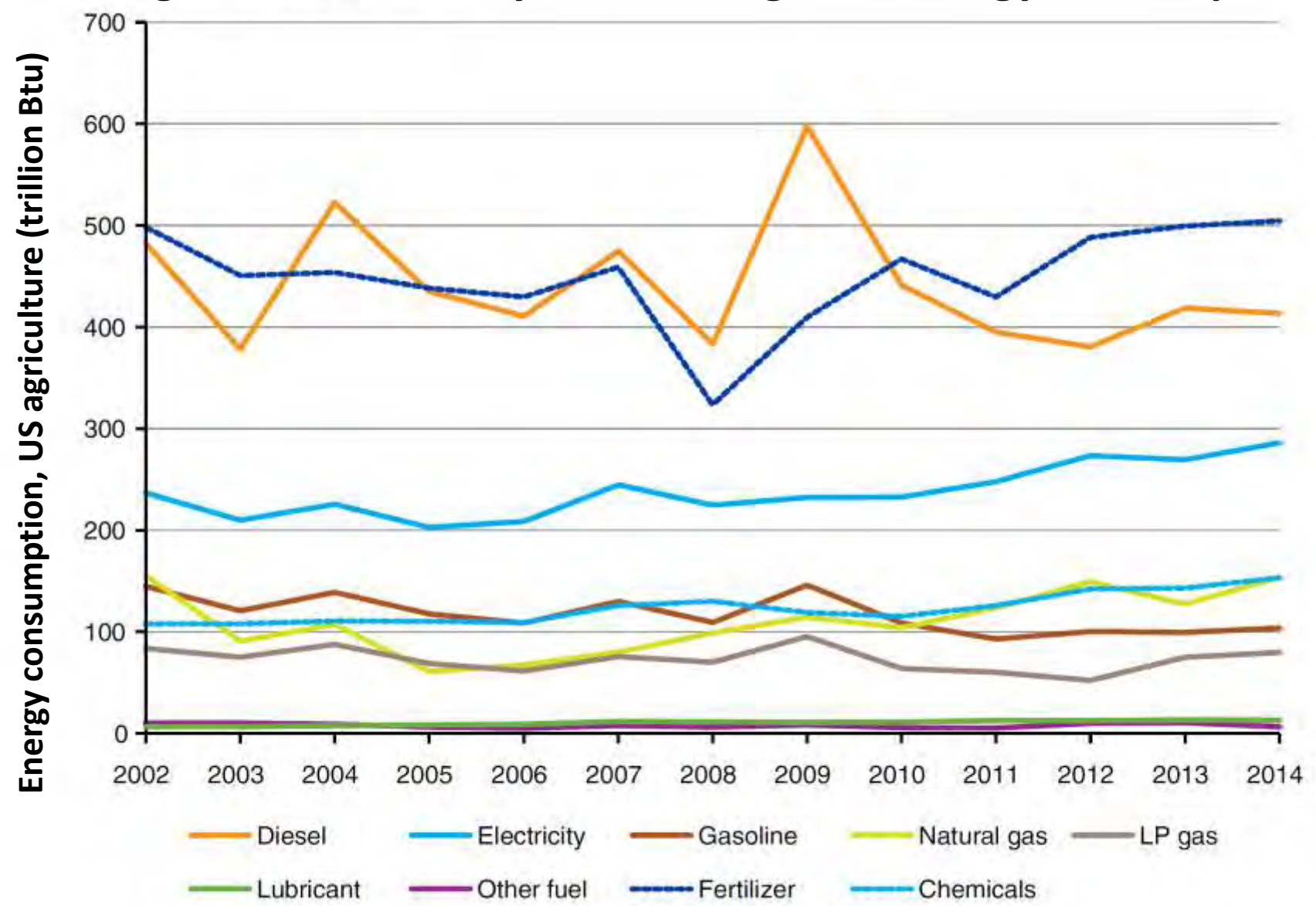
“Agriculture... makes use of 70 percent of all water withdrawn from aquifers, streams and lakes.” -- FAO 2019



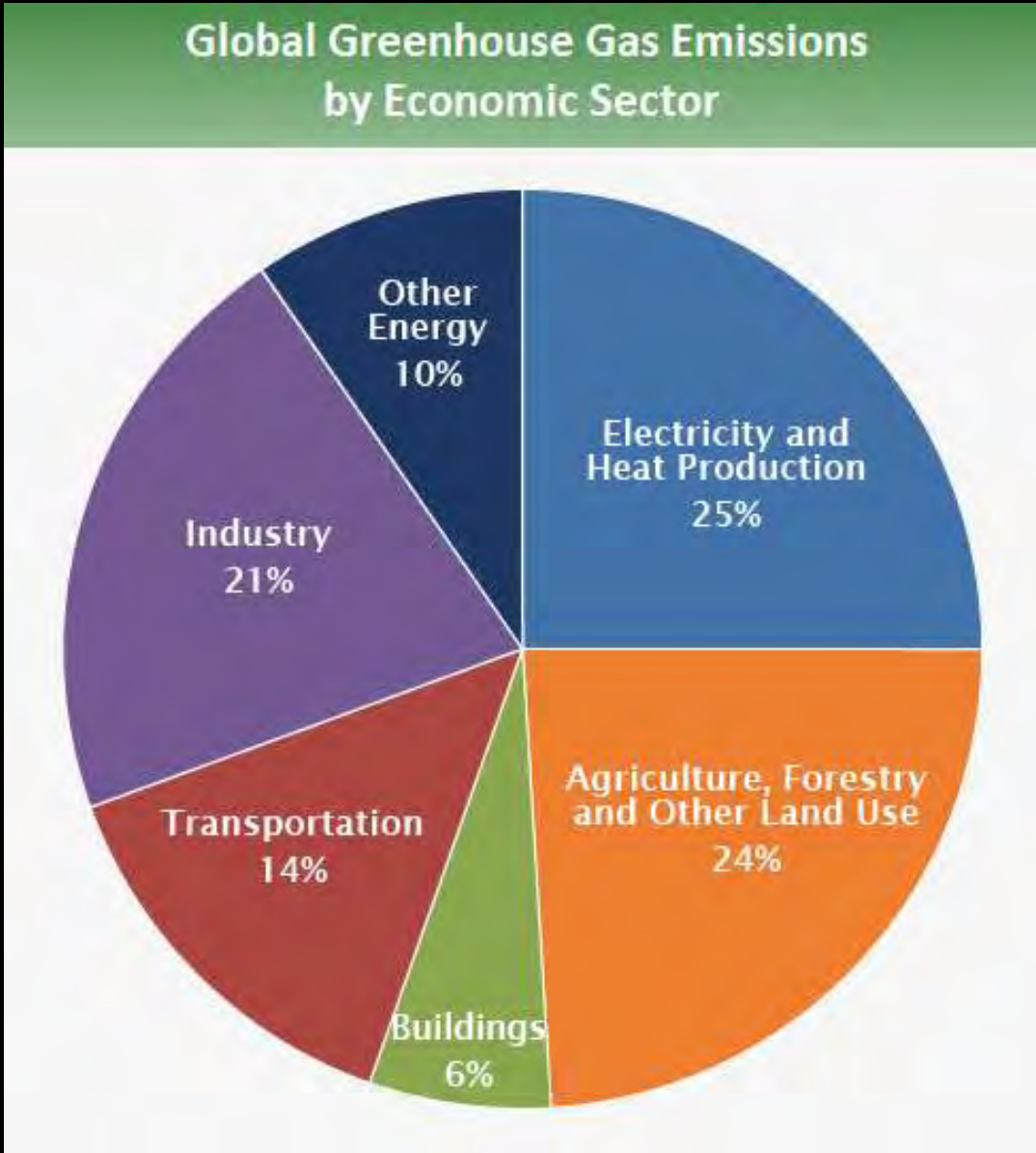
Summer irrigation, Arizona cotton: 6-8"/ac/month

3. Energy

Agriculture/forestry — 15-20% global energy consumption

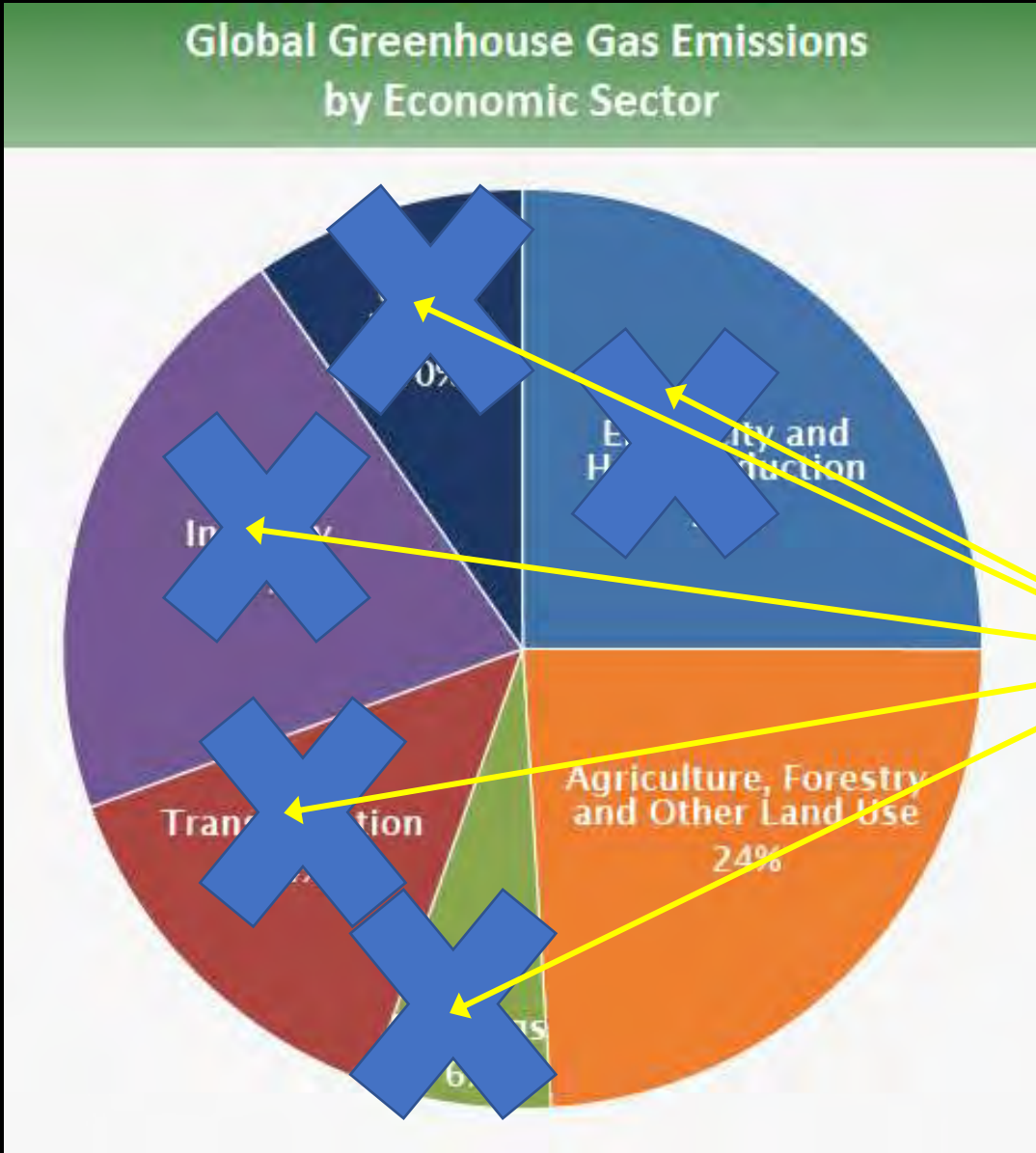


4. Climate



IPCC (2014)

4. Climate

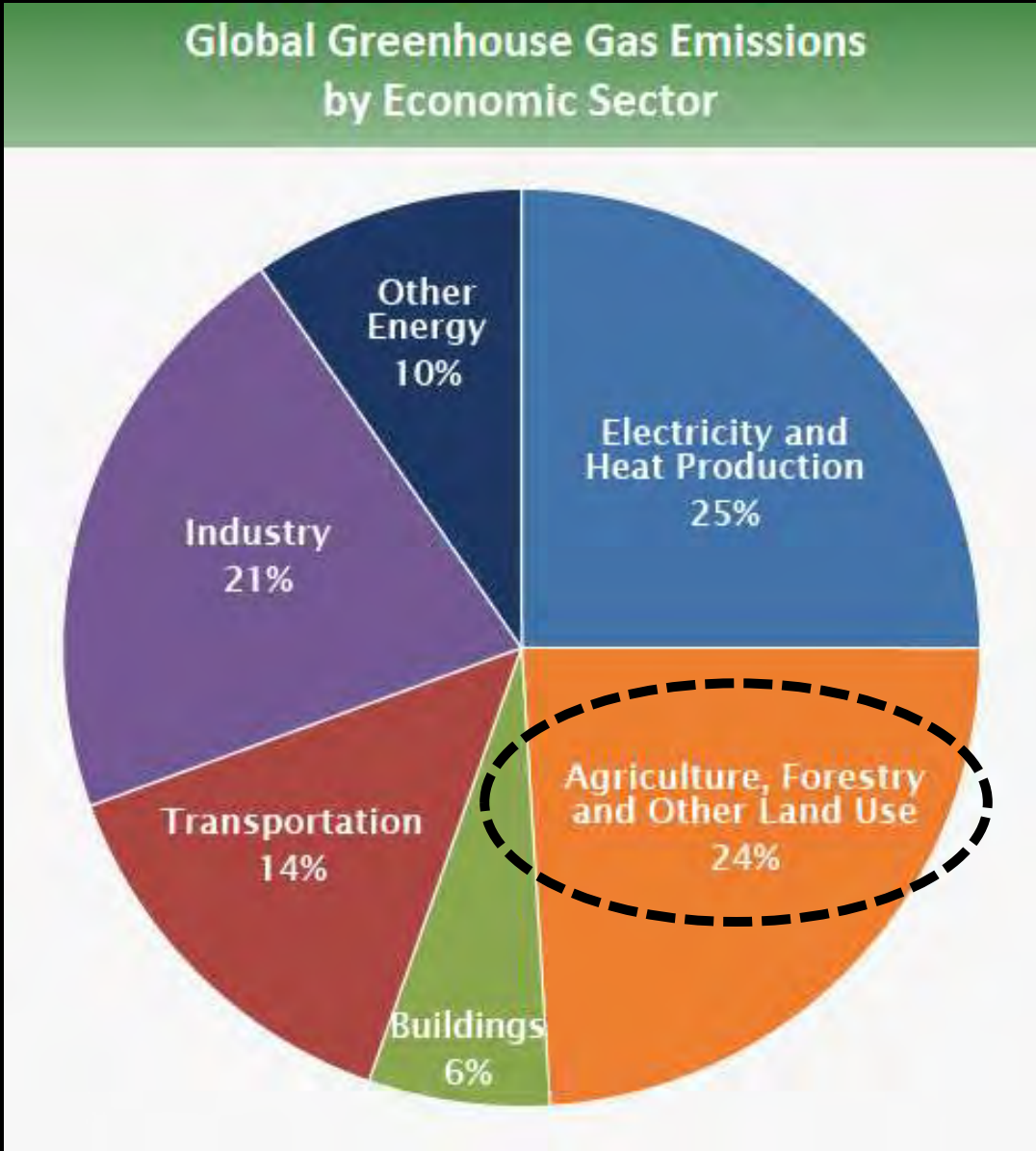


We know what to do for most emissions:
electrify everything and provide
electricity with carbon-free sources.



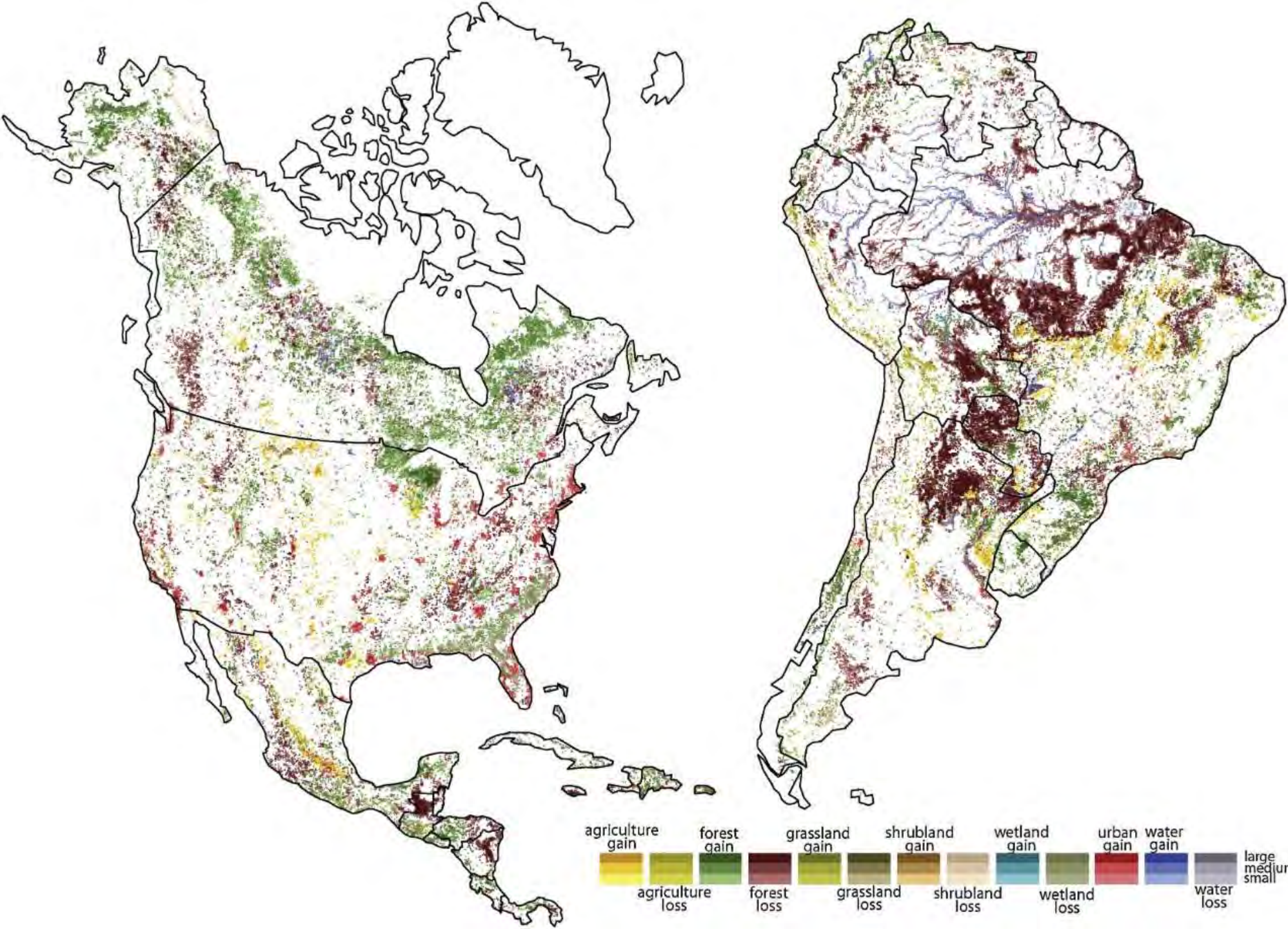
IPCC (2014)

4. Climate



But we don't have a clear path
for land use —
and the whole effort fails without one.

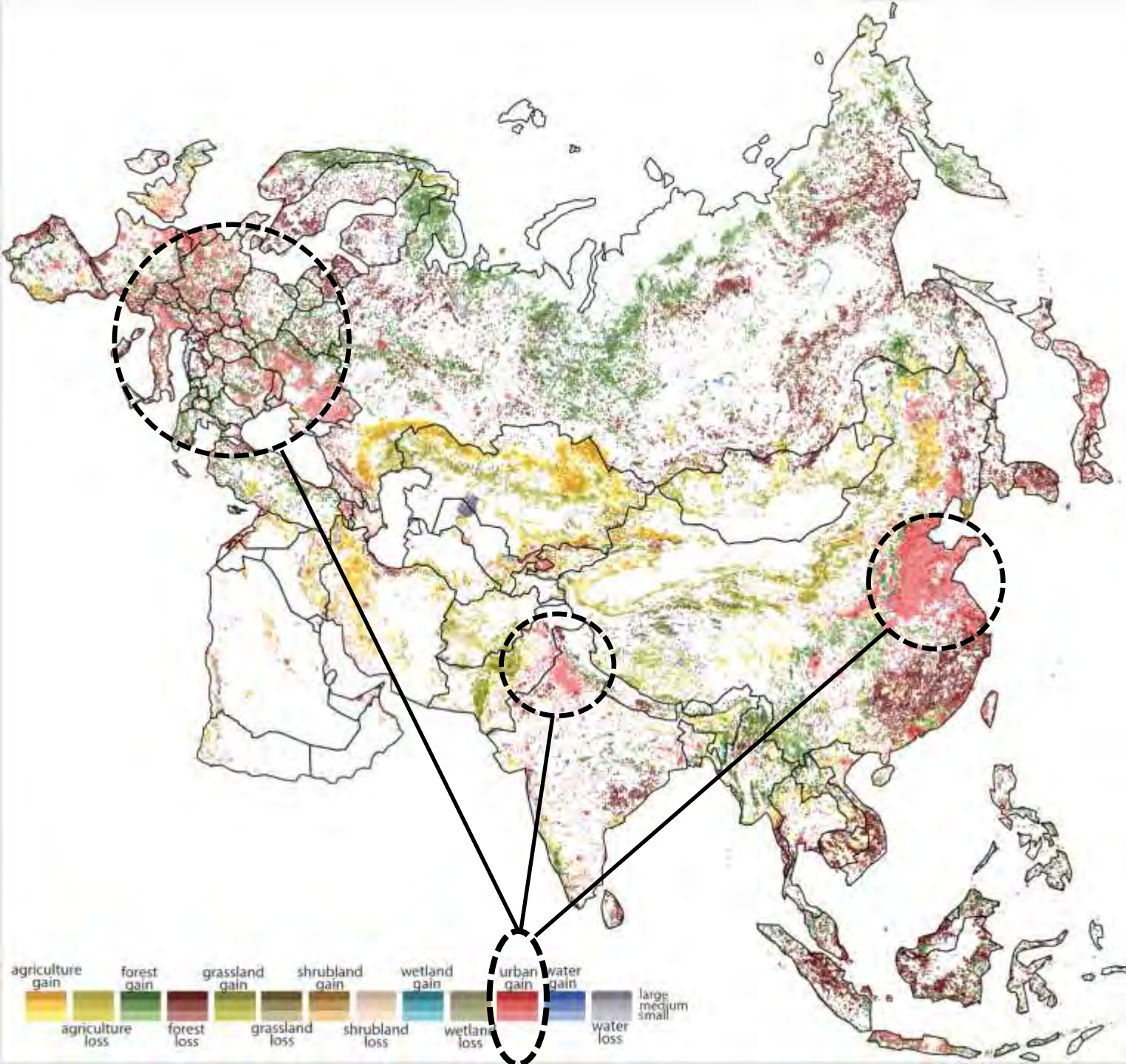
IPCC (2014)



Between 1992 and 2015, 22% of earth's landmass "experienced significant landscape change"

“Dominant land cover transitions were forest
→ agriculture”

Reasons vary, but often
expansion of agriculture
into forest driven by
loss of existing farmland
to housing, industry,
parks, solar farms, etc.





Des Moines Register, 1944

Answer #1:
Wizards
Norman Borlaug
(1914-2009)



Denver Public Library, 1939

Answer #2:
Prophets
William Vogt
(1902-1968)

The Green Revolution “package”

- Hybrid seeds—disease-resistant, short-strawed (semi-dwarf), photoperiod-insensitive
- Fertilizer—high-intensity, N-heavy, made in factories via energy-intensive Haber-Bosch process
- Irrigation—necessary to control water in most cases



The Wizard's credo:
Be smart and make more!
That way everyone can
win!

Science and technology,
properly applied, can let us
produce our way out of our
dilemmas.





Denver Public Library. 1939

Answer #2:
Prophets
William Vogt
(1902-1968)

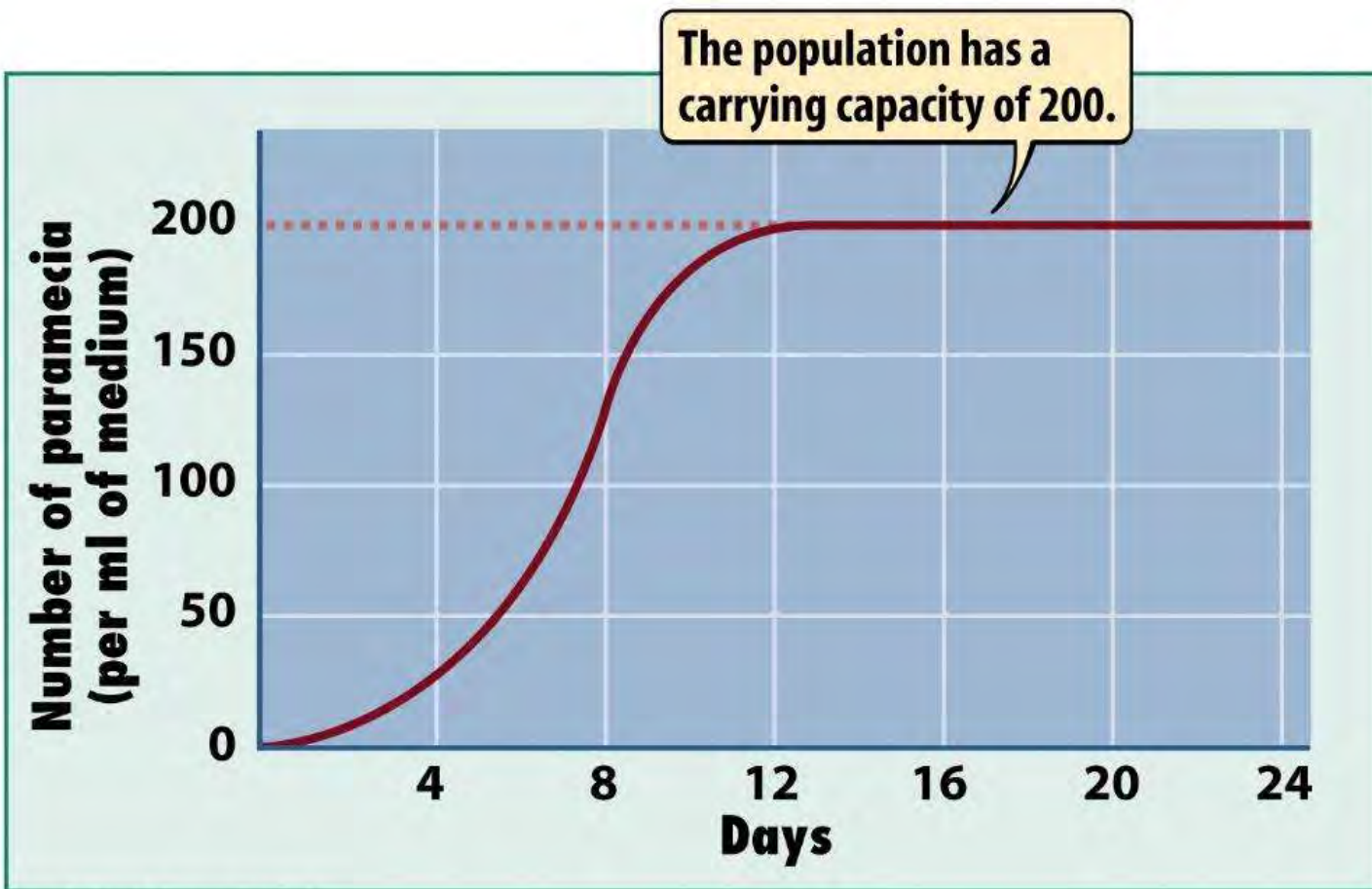
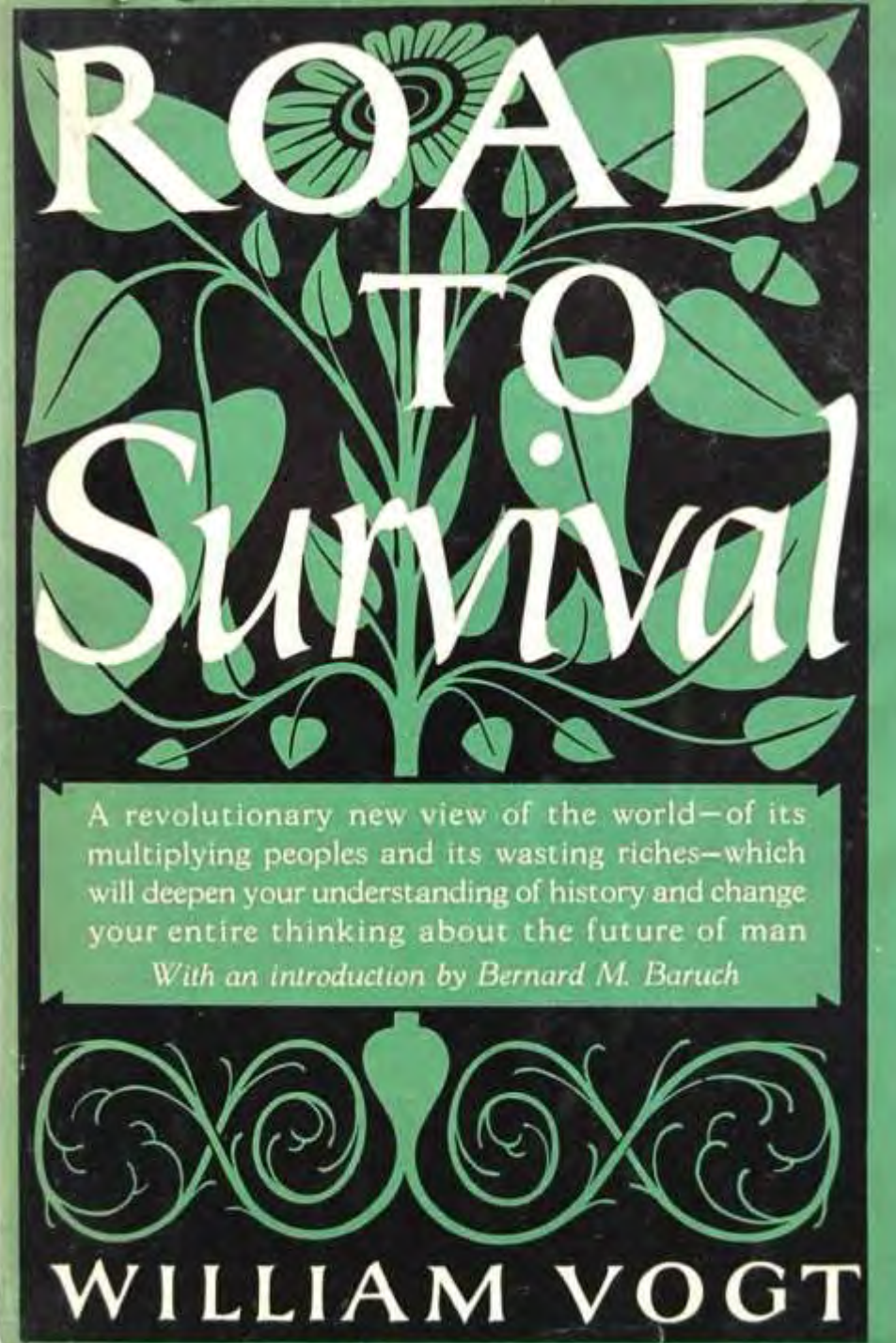


Figure 34-6 part 1 Discover Biology 3/e
© 2006 W. W. Norton & Company, Inc.

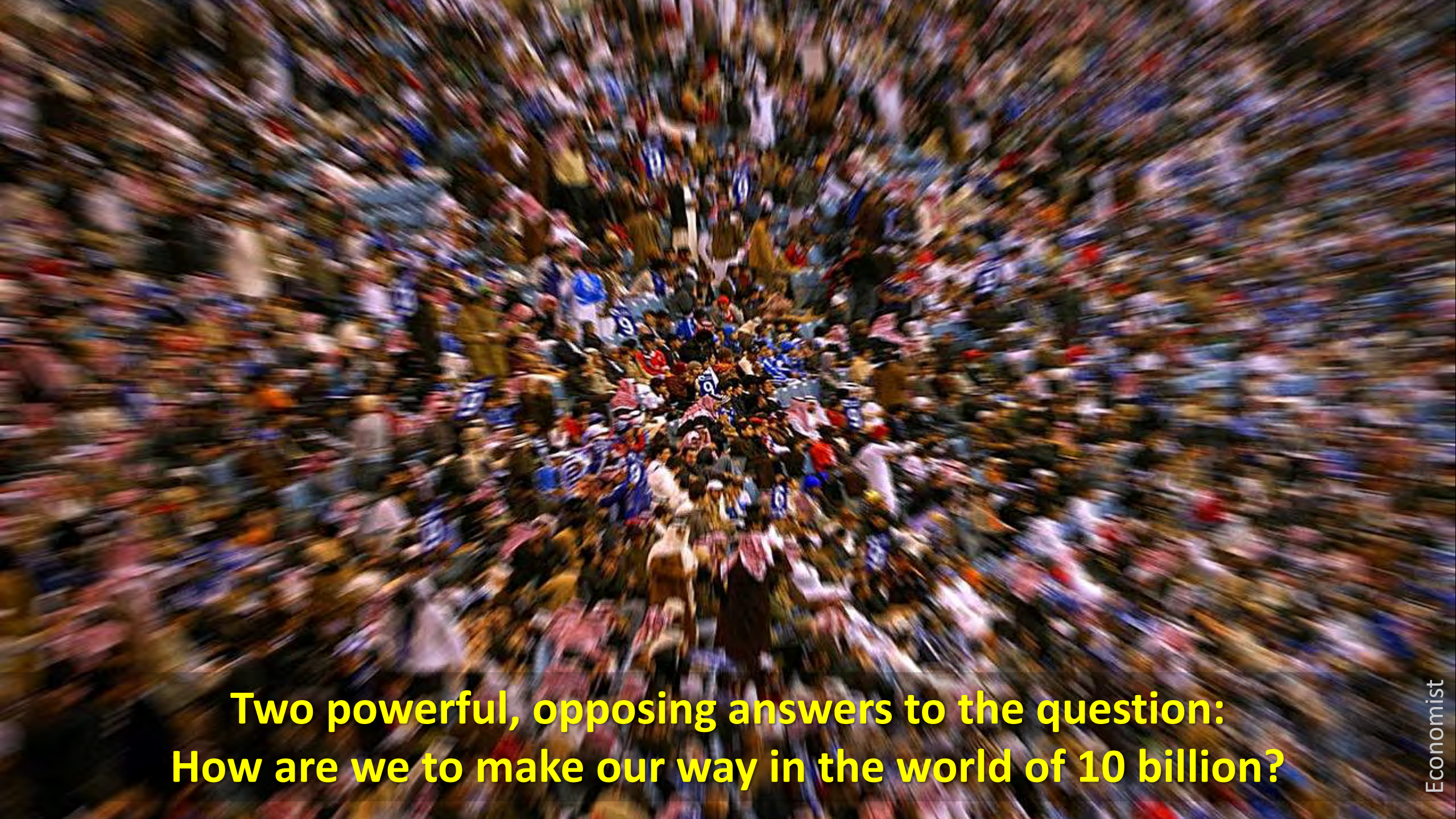
“Carrying capacity” —
the foundational idea
of the environmental
movement



The Prophet's credo:
Use less and conserve!
Otherwise everyone will
lose!

The world is governed by
fundamental ecological
processes with limits
that we transgress to our
peril.





**Two powerful, opposing answers to the question:
How are we to make our way in the world of 10 billion?**

