

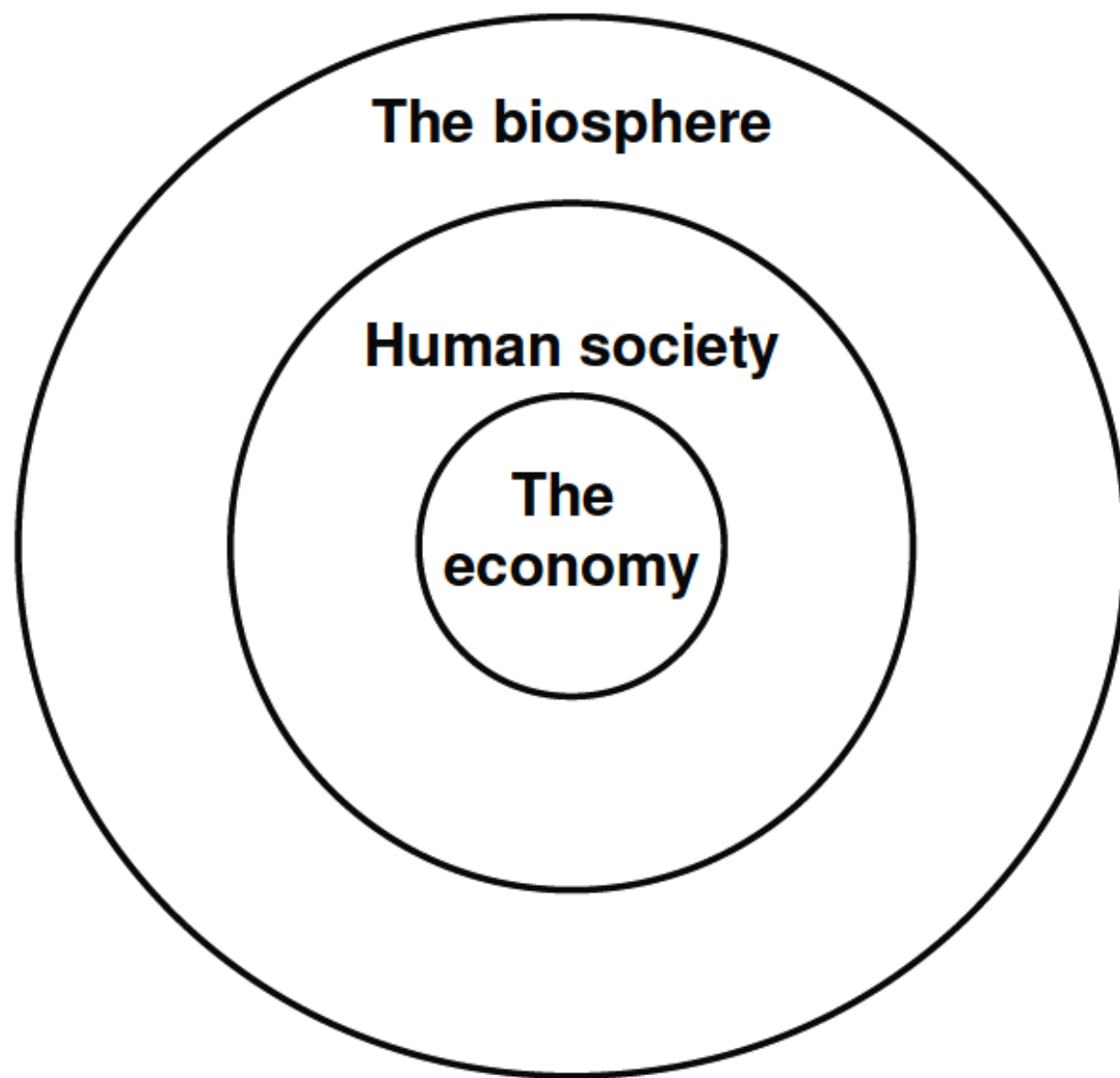
System Approaches to a Clean Environment

An aerial photograph of a city, likely Stockholm, Sweden, featuring a large body of water, a bridge, and a dense urban landscape with various buildings and greenery under a cloudy sky.

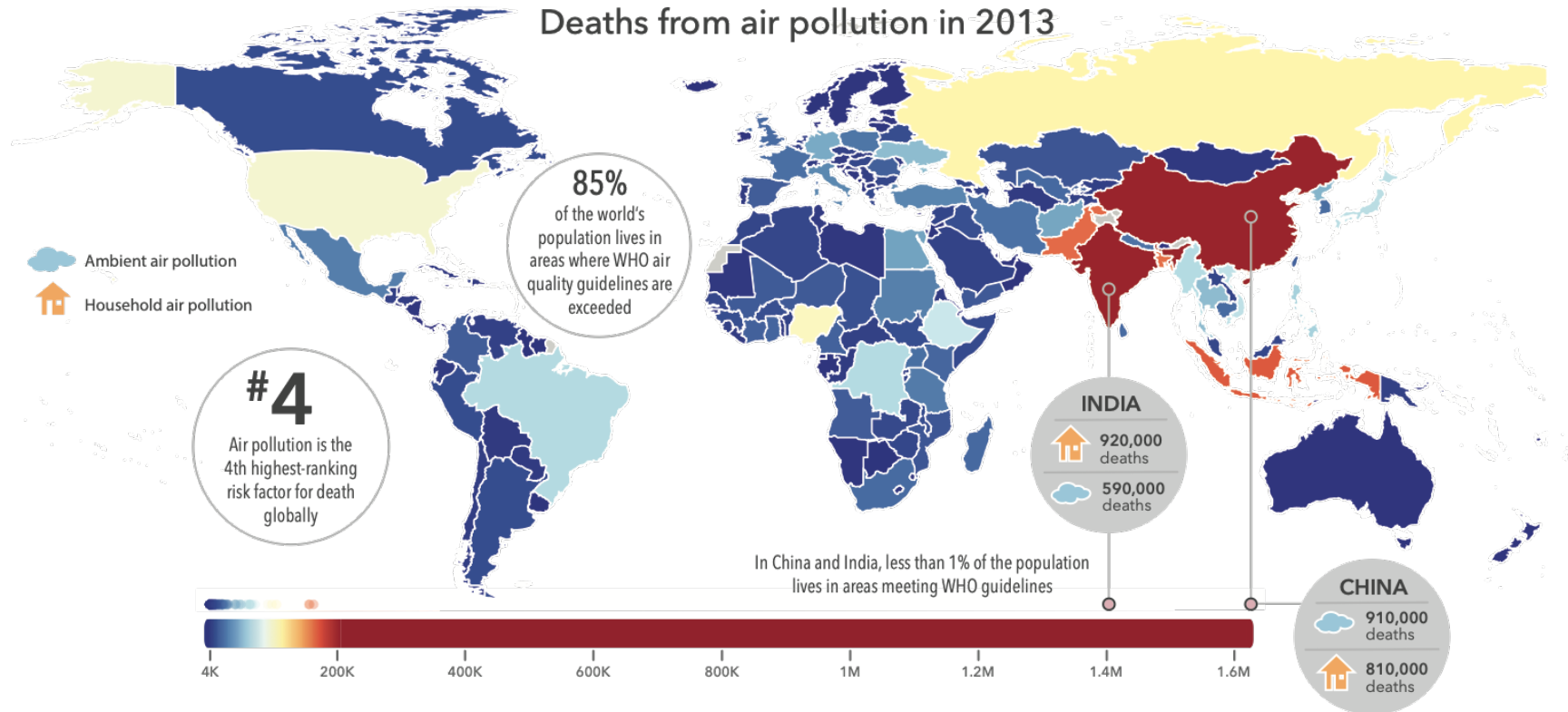
Daven Henze, University of Colorado
Mikael Nordlander, Vattenfall AB



Environment - More than just CO₂



Global Burden of Air Pollution

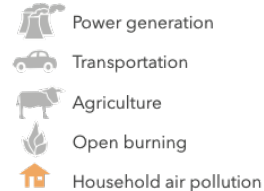


Air pollution was responsible for 5.5 million deaths in 2013

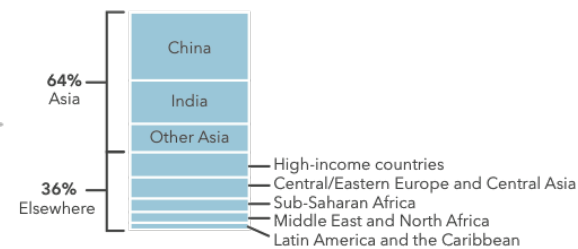
Household air pollution
 Caused by burning solid fuels for heating and cooking, including:



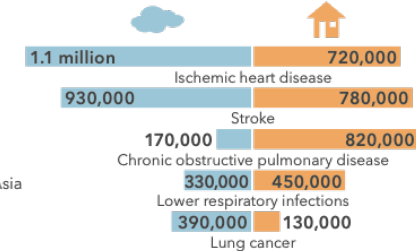
Ambient air pollution
 Caused by emissions from things like:



2.9 million deaths from ambient air pollution in 2013



10% of all deaths were from air pollution in 2013



Source:

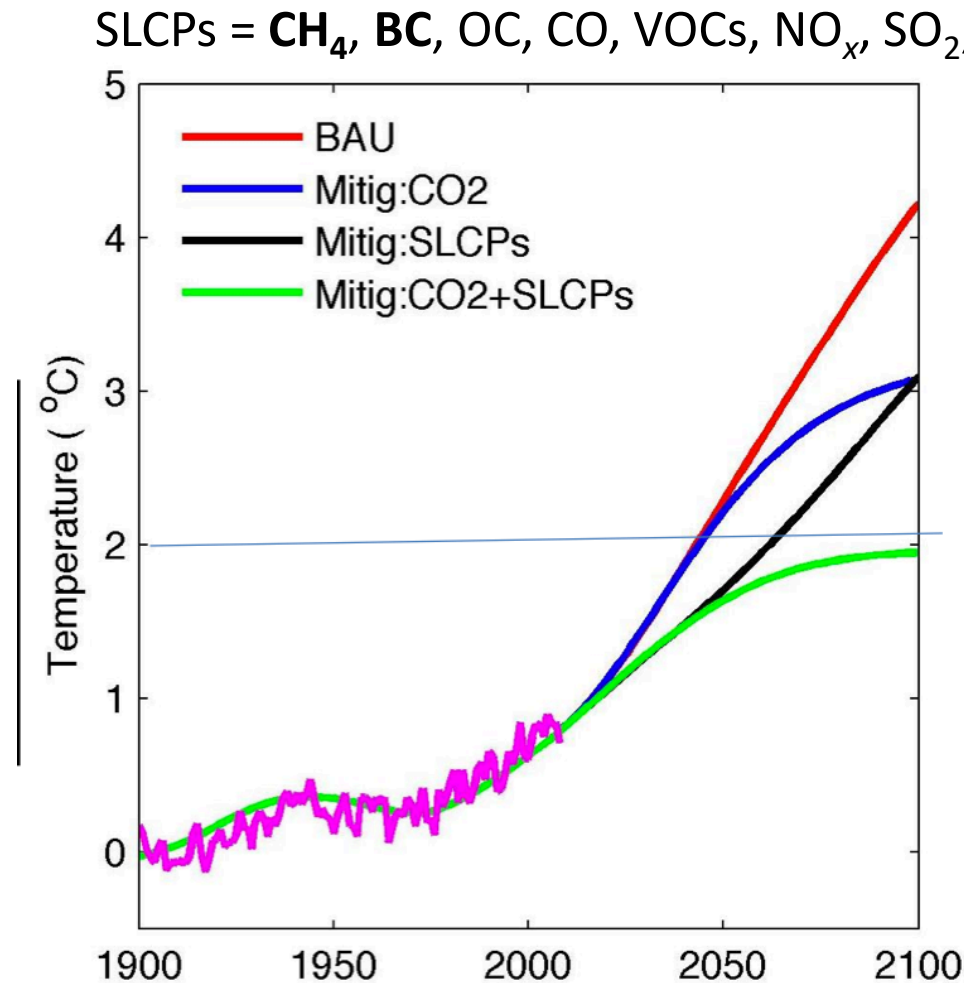
1. Forouzanfar MH, et al. Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2015 Dec 5;386(10010):2287-323.

2. Brauer M, et al. Ambient air pollution exposure estimation for the Global Burden of Disease 2013. *Environmental Science & Technology*. 2016 Jan 5;50(1):79-88.



W UNIVERSITY of WASHINGTON

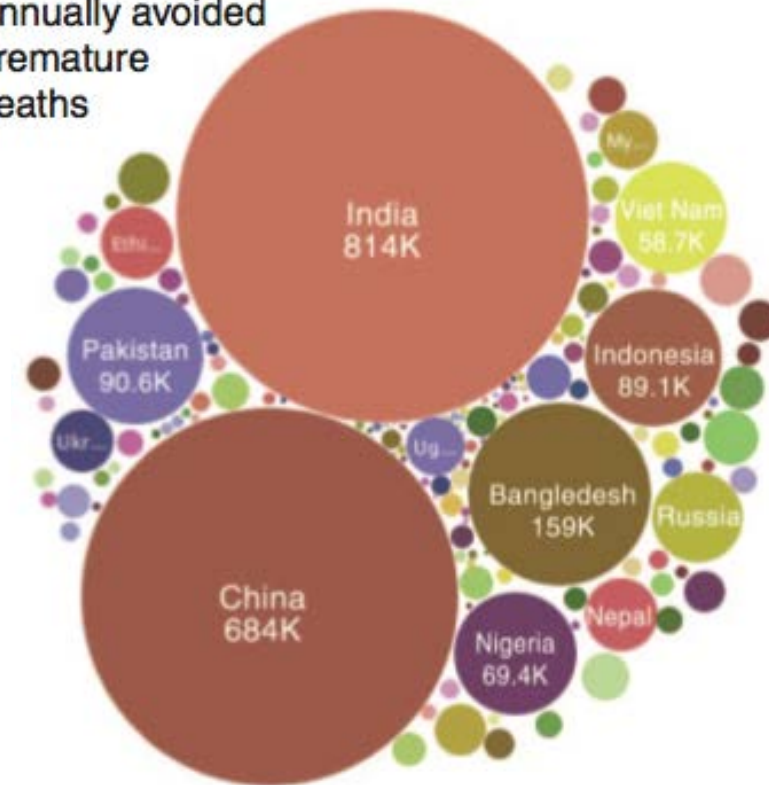
Solutions for addressing climate and air pollution are coupled: CO₂ and air pollutants are co-emitted, and both affect climate



Ramanathan and Xu, 2010; Hu et al., 2013

Ramanathan and Carmichael, 2008

Annually avoided
premature
deaths



UNEP 2011; Shindell et al., 2012

Analyzing the environment

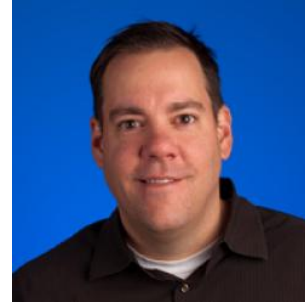
– about as multidisciplinary as it gets...



System approaches to a clean environment



Stefan Schönberger
Boston Consulting Group
The Economic Case for Combating Climate Change



Steve Davis
Associate Professor, UC Irvine
Net-zero emissions energy systems



Malin Strand
Policy Strategist, Fossil Free Sweden
Swedish roadmaps for fossil free competitiveness



Noelle Eckley Selin
Associate Professor, MIT
Toxic Air Pollution as a Sustainability Challenge