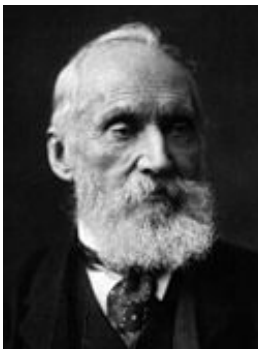Benoit Delaveau, MS, BEAP, CEM (aka Prof. Ben)
benoit.delaveau@sjsu.edu
Office hours sign-up here: calendly.com/benoit-delaveau

ENVS 119 - Energy & the Environment
09 - Carbon Footprint & Climate Change

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science."
William Thomson (Lord Kelvin)

Climate change History

- **1800** Global population 1B
- **1930** Global population 2B
- **1938** Guy Calendar show temperatures and CO2 concentration had risen
- **1958** Charles Davis start CO2 measurements at Mauna Loa at 315ppm
- **1972** First UN env. conference (nothing about CO2)
- **1987** Global population 5B
- **1988** IPCC (Int. Panel Climate Change) formed
- **1990** IPCC (1st assessment) +0.3-0.6C over last century
- **1995** IPCC (2nd) states "*a discernible human influence*" on the Earth's climate
- **1999** Global population 6B
- **2001** IPCC (3rd) "*new and stronger evidence*" humanity is the main cause
- **2005** Kyoto Protocol signed (-5% before 2012) US Senate declares it will not ratify the treaty
- **2007** IPCC (4rd) "*humanity emissions 90% likely to be the source of CC*"
- **2008** IPCC and Al Gore receive the Nobel Peace Prize "*for their efforts to build up…greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change*".
- **2008** Mauna Loa is at 380ppm
- **2009** China overtakes the US as the world's biggest GHG emitter
- **2011** Global population 7B
- **2013** Mauna Loa is at 400ppm
- **2015** first global agreement in Paris?

CO$_2$ equivalent = base unit for GHG

Name	Pre-industrial concentration (ppmv *)	Concentration in 1998 (ppmv)	Atmospheric lifetime (years)	Main human activity source	GWP **
Water vapour	1 to 3	1 to 3	a few days	-	-
Carbon dioxide (CO_2)	280	365	variable	fossil fuels, cement production, land use change	1
Methane (CH_4)	0,7	1,75	12	fossil fuels, rice paddies waste dumps, livestock	23
Nitrous oxide (N_2O)	0,27	0,31	114	fertilizers, combustion industrial processes	296
HFC 23 (CHF_3)	0	0,000014	260	electronics, refrigerants	12 000
HFC 134 a (CF_3CH_2F)	0	0,0000075	13,8	refrigerants	1 300
HFC 152 a (CH_3CHF_2)	0	0,0000005	1,4	industrial processes	120
Perfluoromethane (CF_4)	0,00004	0,00008	> 50 000	aluminium production	5 700
Perfluoroethane (C_2F_6)	0	0,000003	10 000	aluminium production	11 900
Sulphur hexafluoride (SF_6)	0	0,0000042	3 200	dielectric fluid	22 200

* ppmv = parts per million by volume, ** GWP = Global warming potential (for 100 year time horizon).
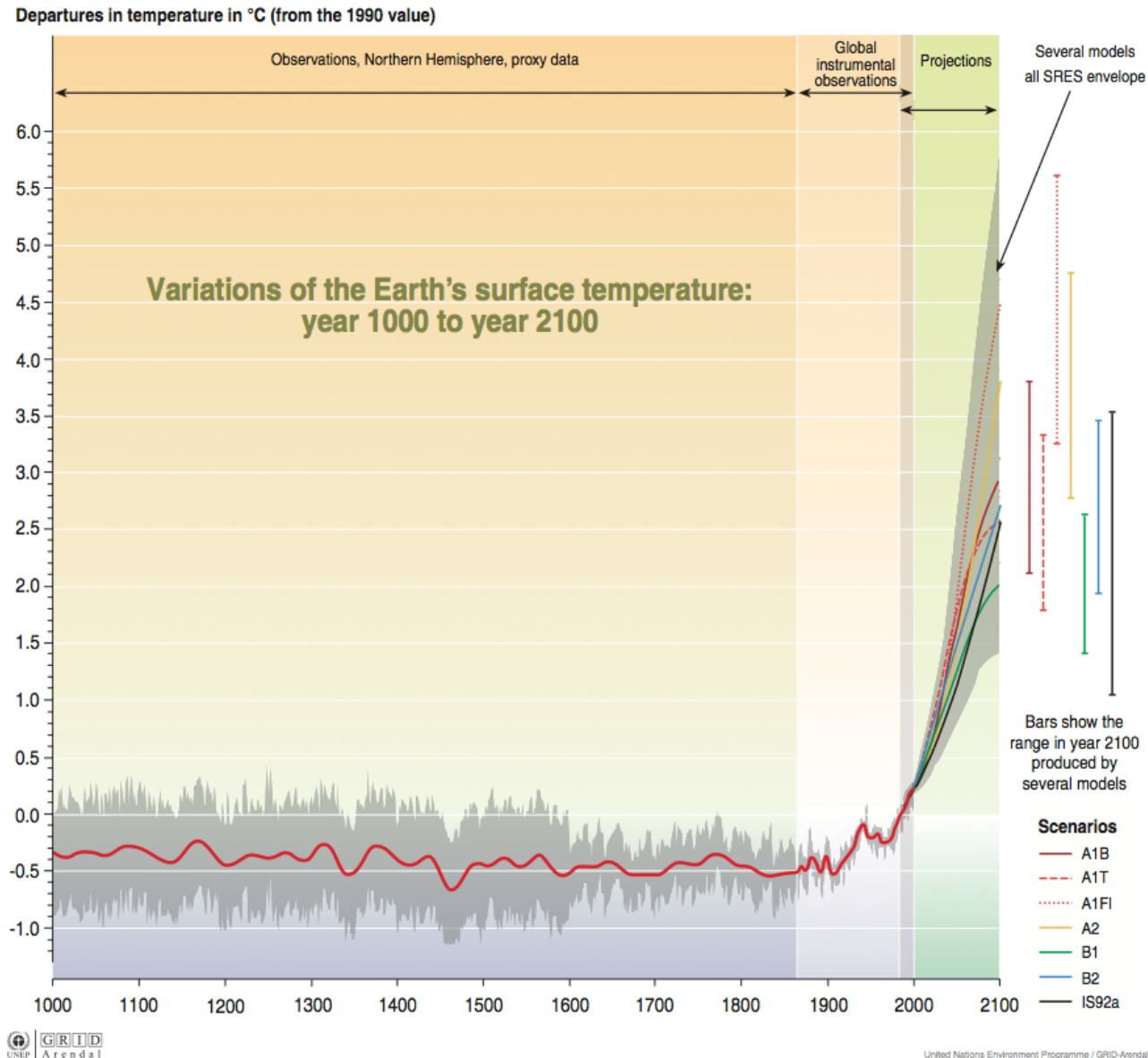
UNEP | GRID Arendal

Global Green House Gas Flowchart
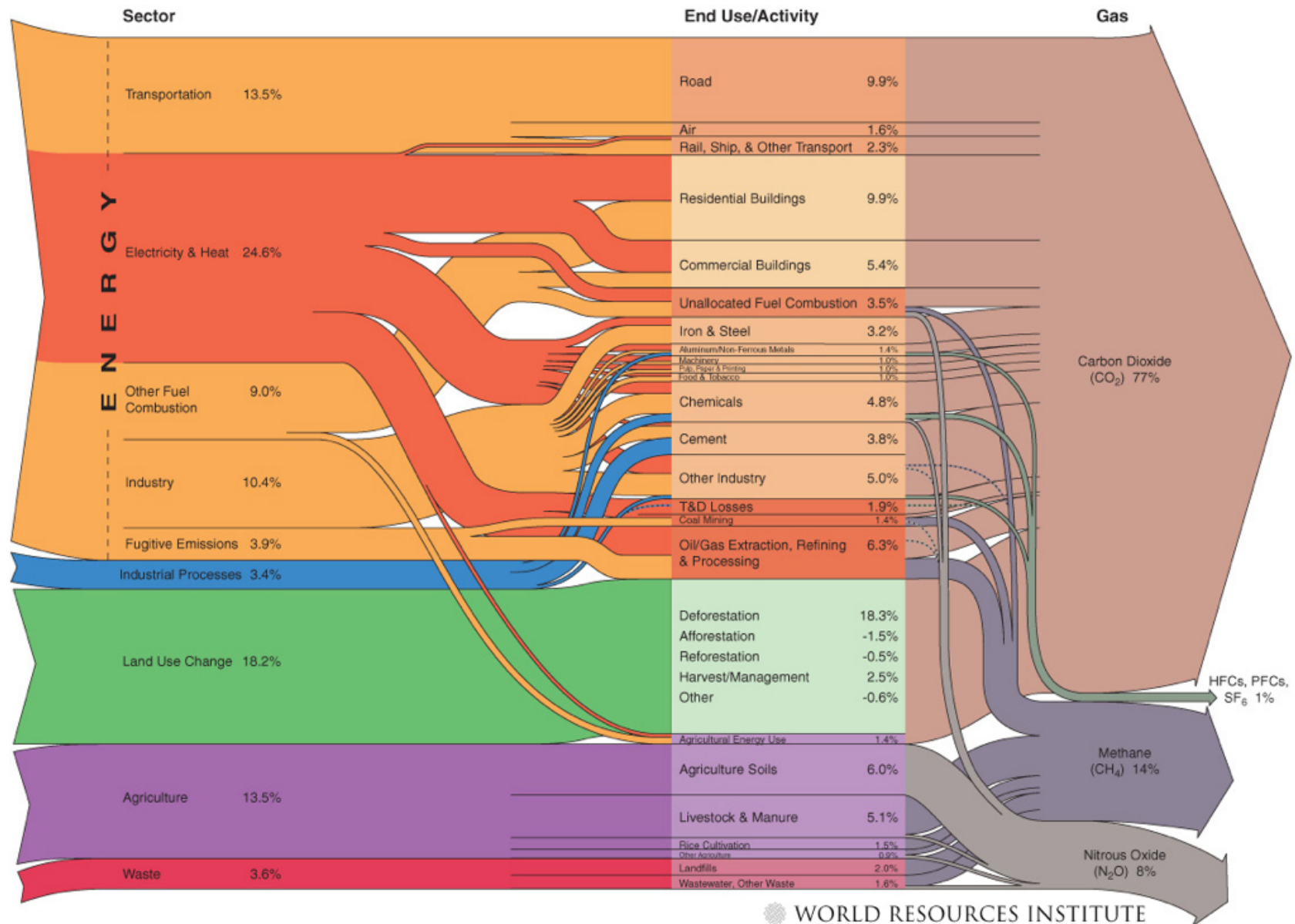
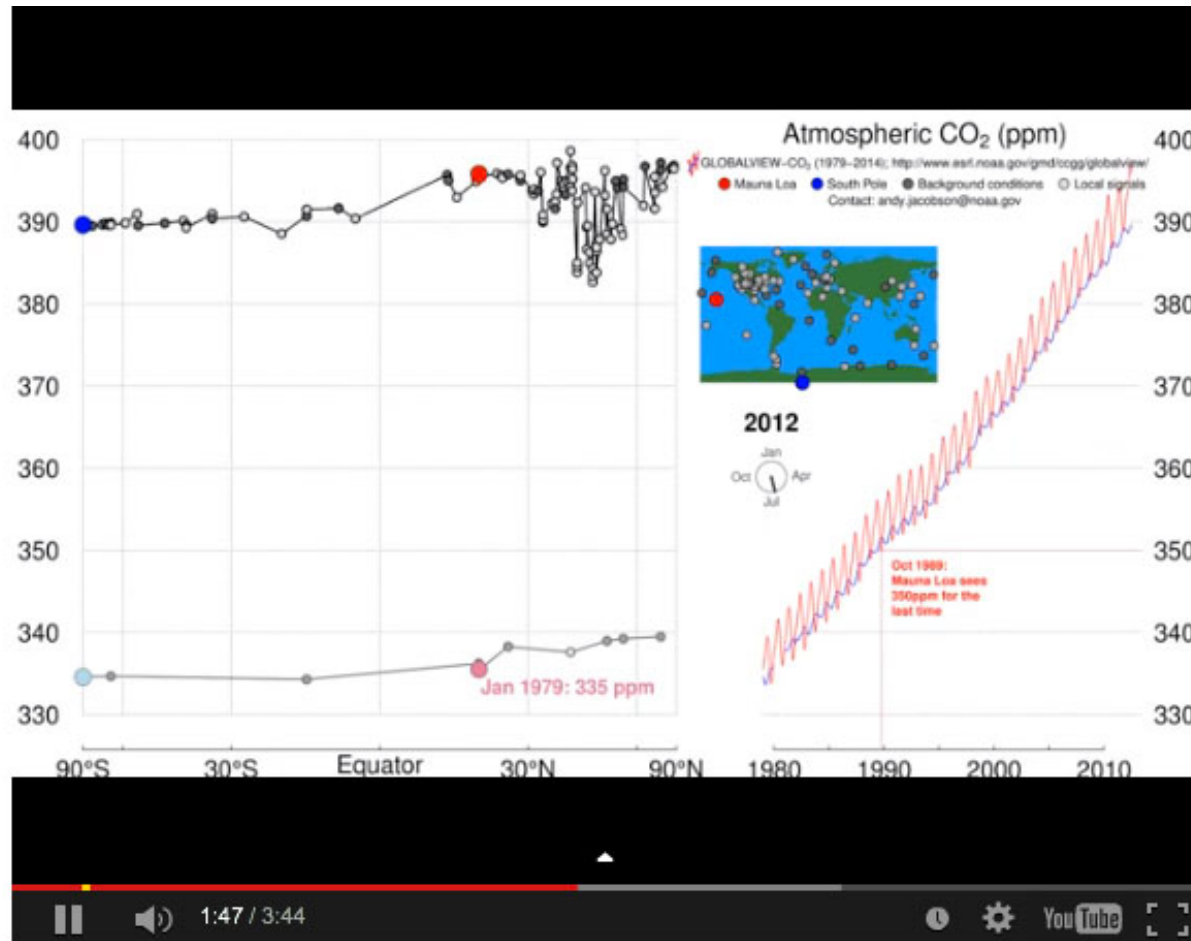# GHG and CO₂e Atmospheric concentration

Past and future CO2 atmospheric concentrations
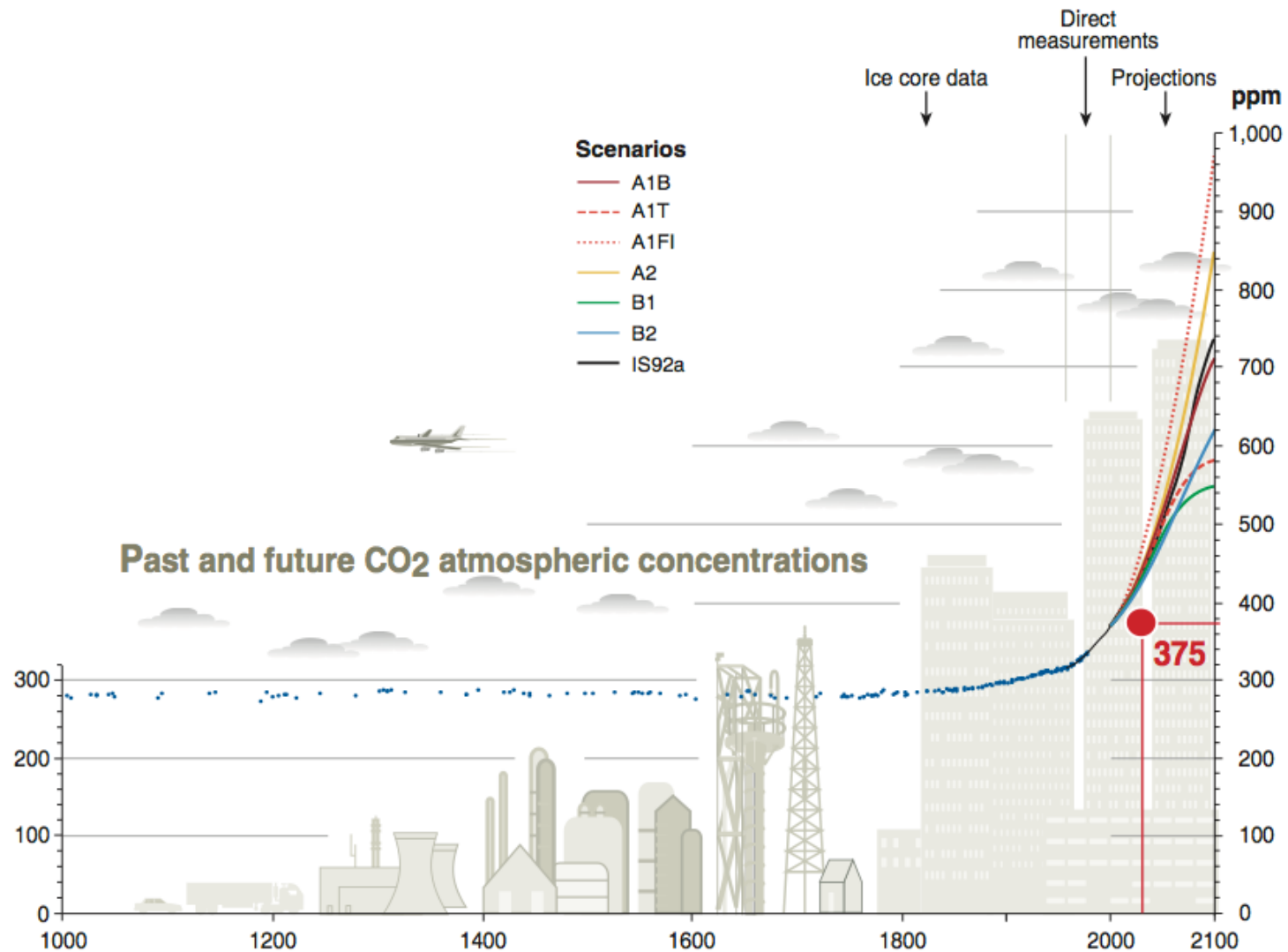
GHG and Climate Change

Measuring Atmospheric CO₂

Global Personal GHG Footprint

Personal Carbon Footprints: t CO_2e (2001)

Country	t CO_2e
USA	21.7
Canada	14.5
Australia	14.0
UK	11.7
Germany	11.2
France	9.3
Japan	8.6
Russia	7.8
Korea	6.5
Mexico	4.2
World	4.0
Brazil	3.2
China	1.7
India	1.4
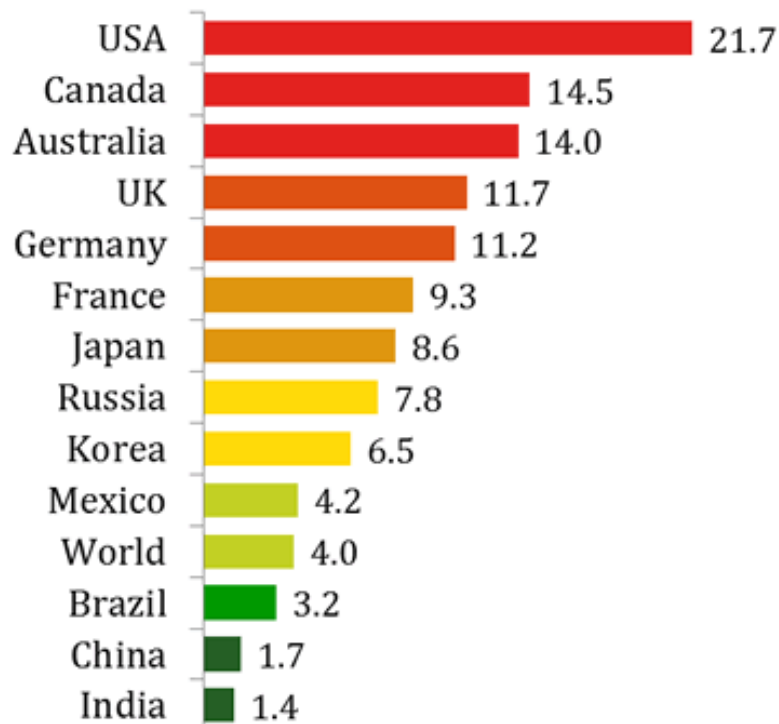
Note: The personal carbon footprint represents the combined emissions from personal consumption, inlcuding housing, travel, food, product and service emissions. It excludes capital, government and land use emissions.
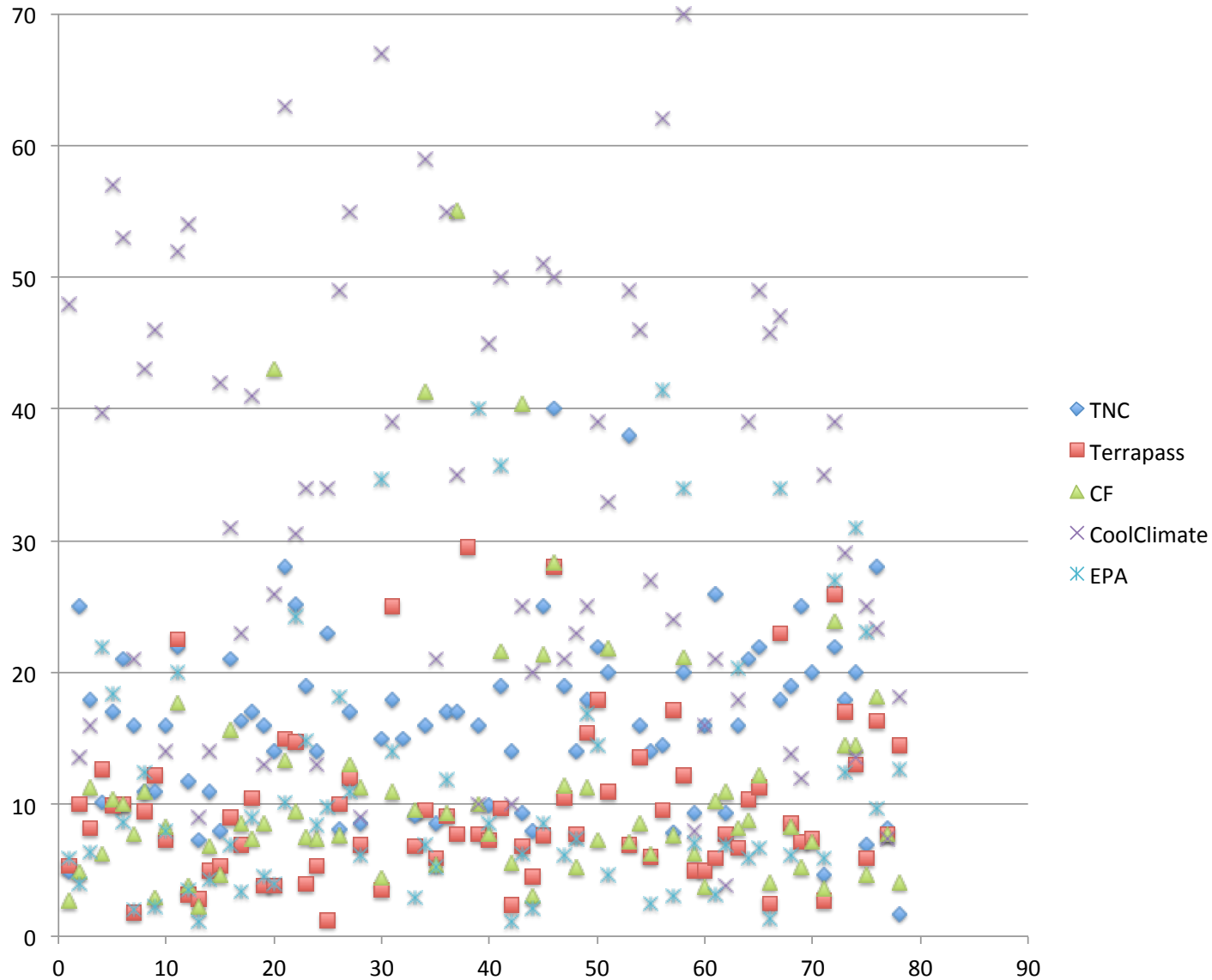
Sources: Hertwich & Peters 2009

Shrink That Footprint

Average U.S. Household GHG
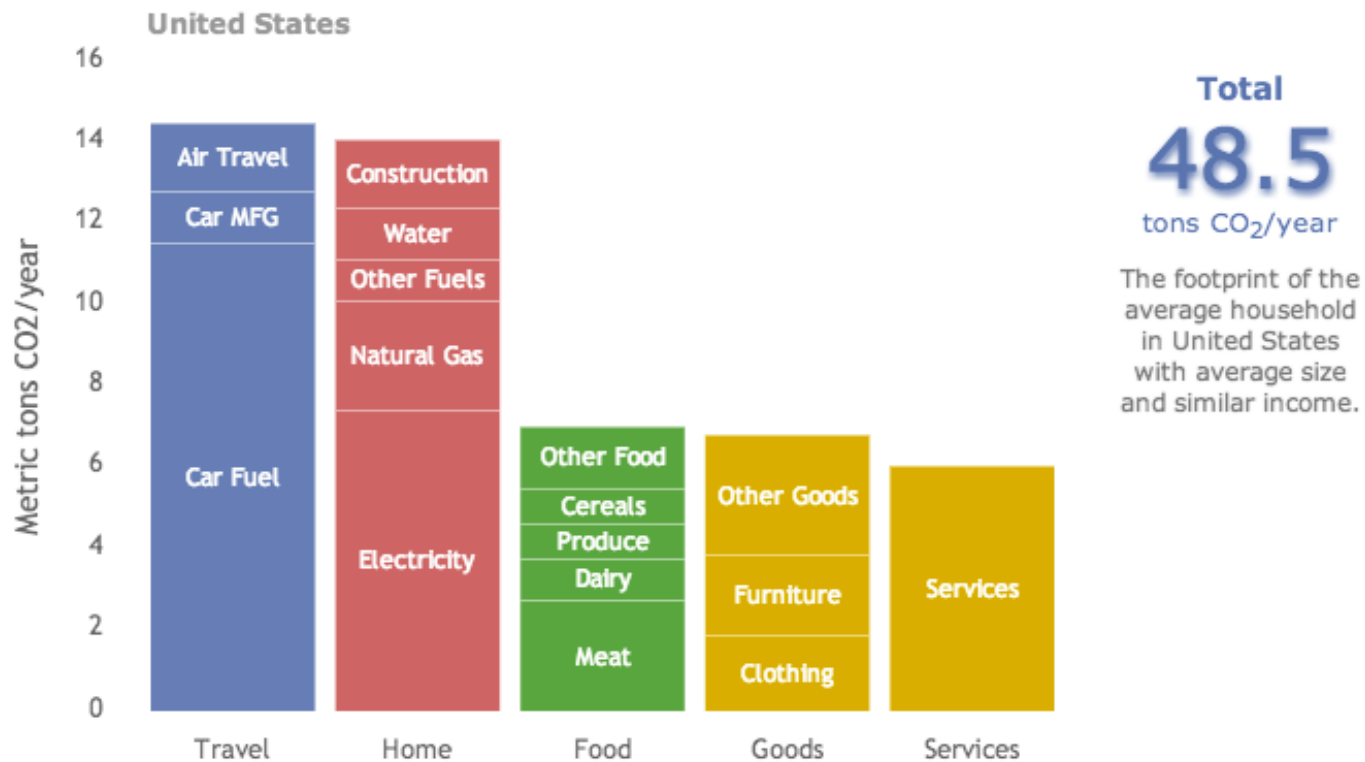
NRDC - http://switchboard.nrdc.org/blogs/kgrenfell/what_you_can_do_to_reduce_your.html

Assignment #3 - GHG calculator

ENVS/ENGR 119 - Lecture 09

Q/A

End