



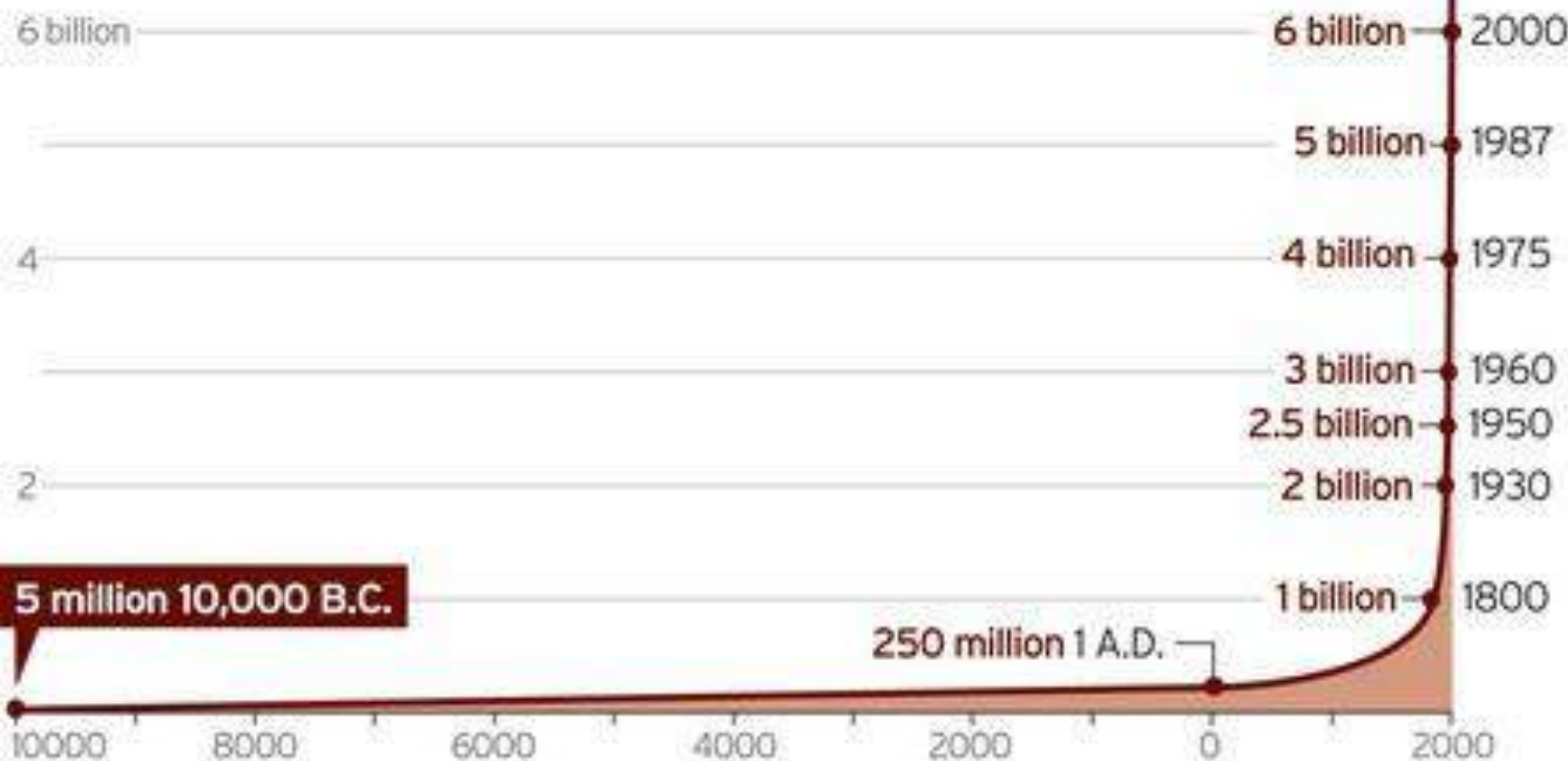
# CLIMATE CHANGE, AGRICULTURE AND FOOD SECURITY



*Riccardo Valentini*  
*University of Tuscia - CMCC*

# World population growth

Fertility rates are declining, the United Nations says, but not fast enough to stop population growth. The U.N.'s medium-level projection is for the world's population to reach 9.2 billion by 2050 but still more than 3 billion higher since the turn of the century. Population activists say that's too much for the world to handle.

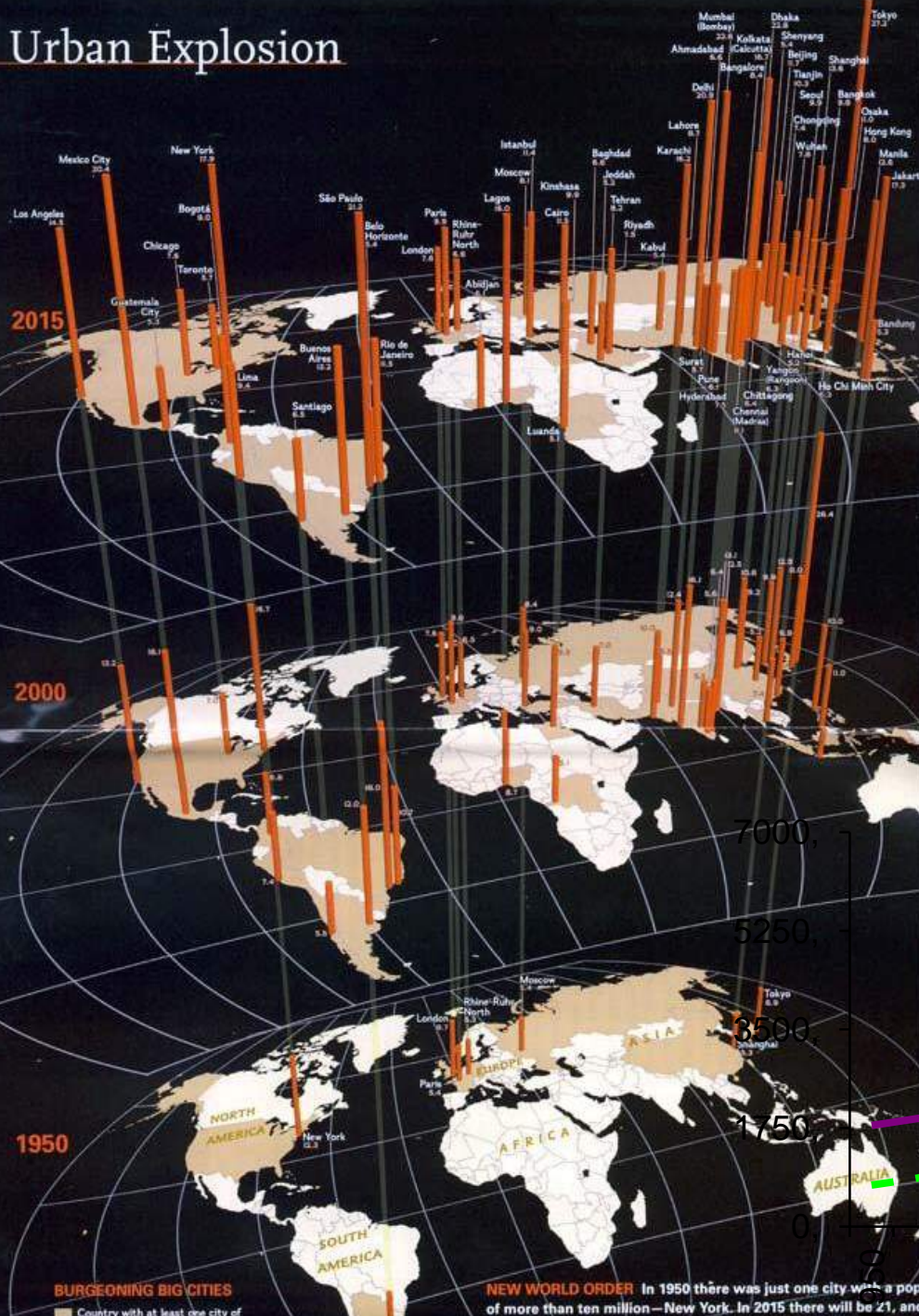


Sources: United Nations; Sustainable Scale Project; World Resources Institute; NationMaster.com

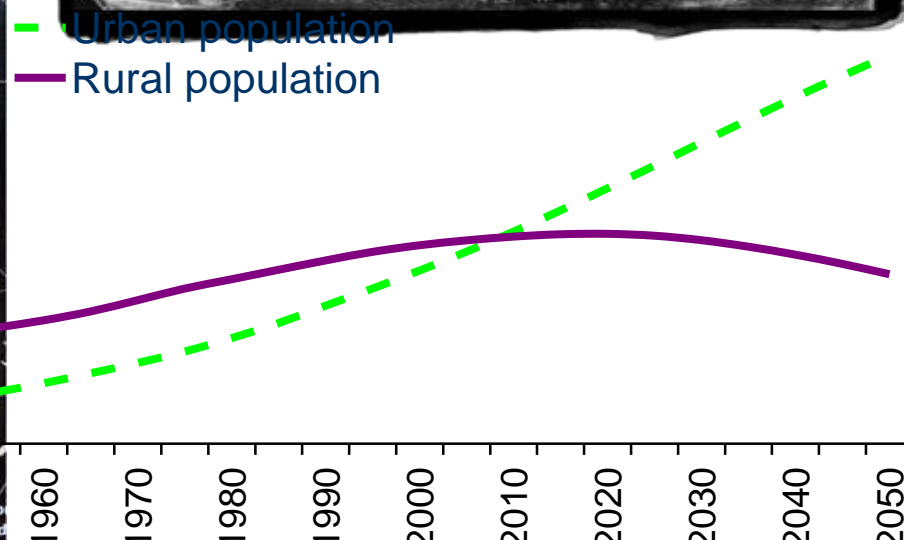
\* Projection



# Urban Explosion



# THE URBAN HUMAN





# CONVERSIONE TERRA





CI SARA' ABBASTANZA CIBO?

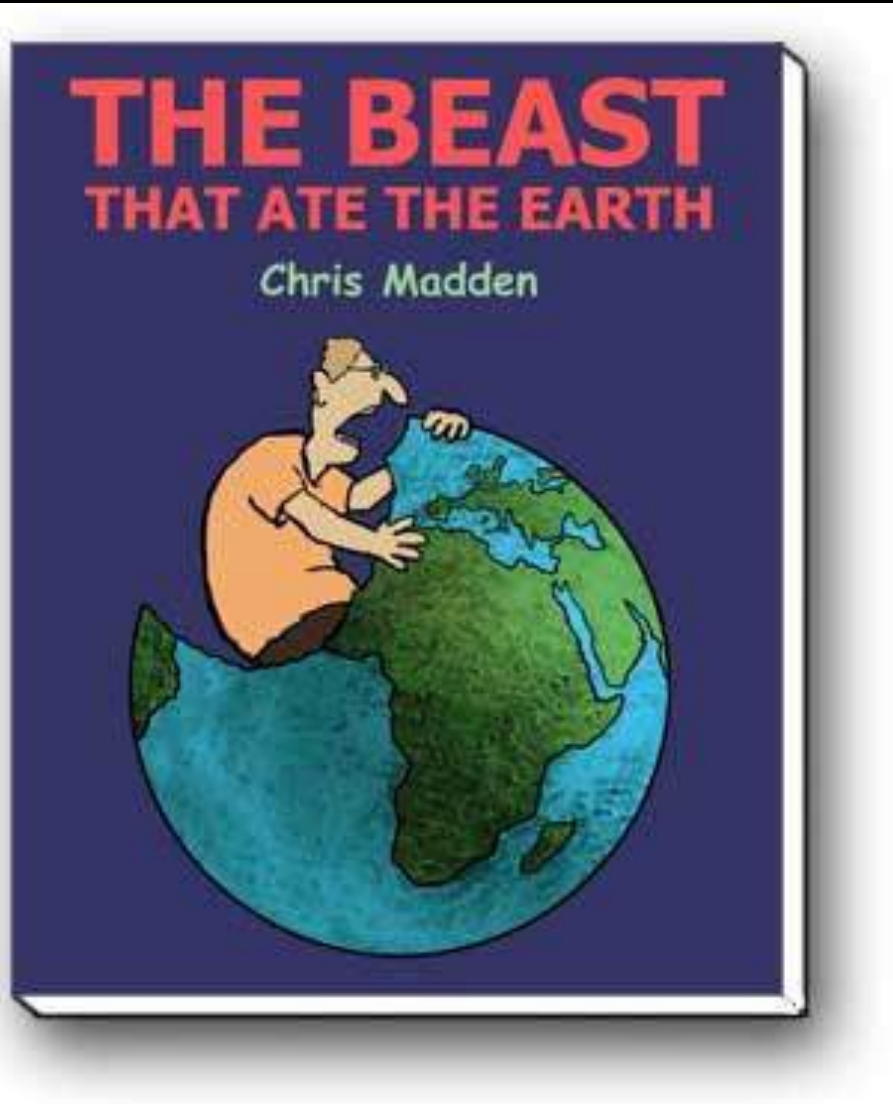




# Cambiamenti Climatici



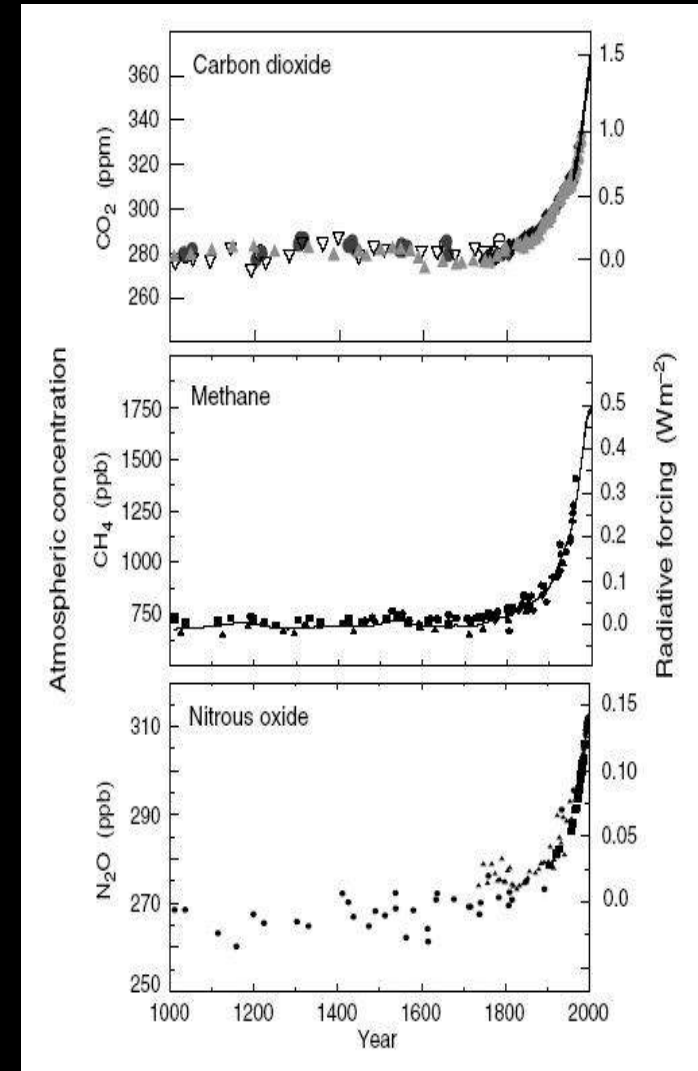
# Benvenuti nell' antropocene.....



$\text{CO}_2$

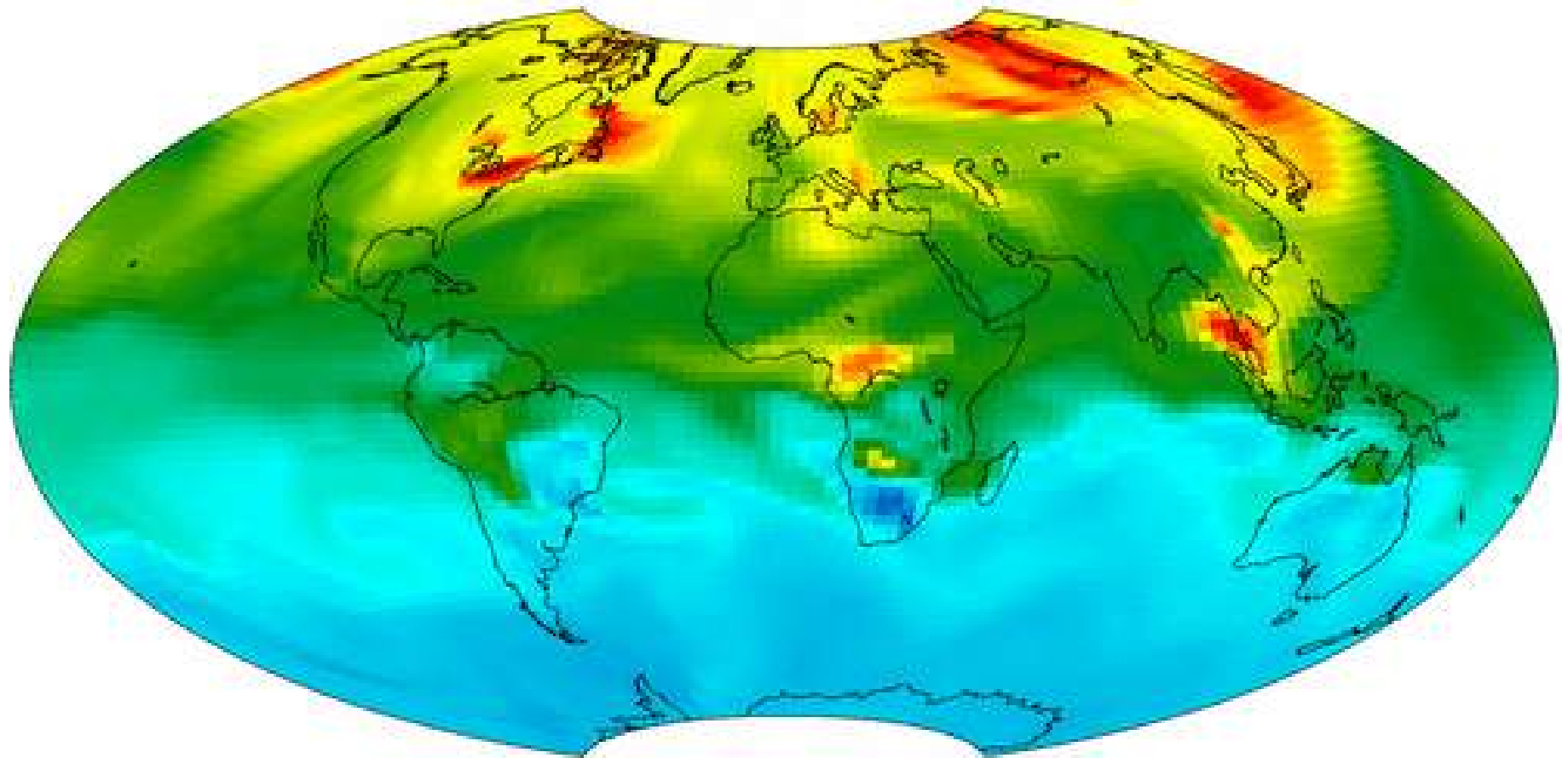
$\text{CH}_4$

$\text{N}_2\text{O}$



# CarbonTracker free troposphere CO<sub>2</sub>

2008-Jan-01



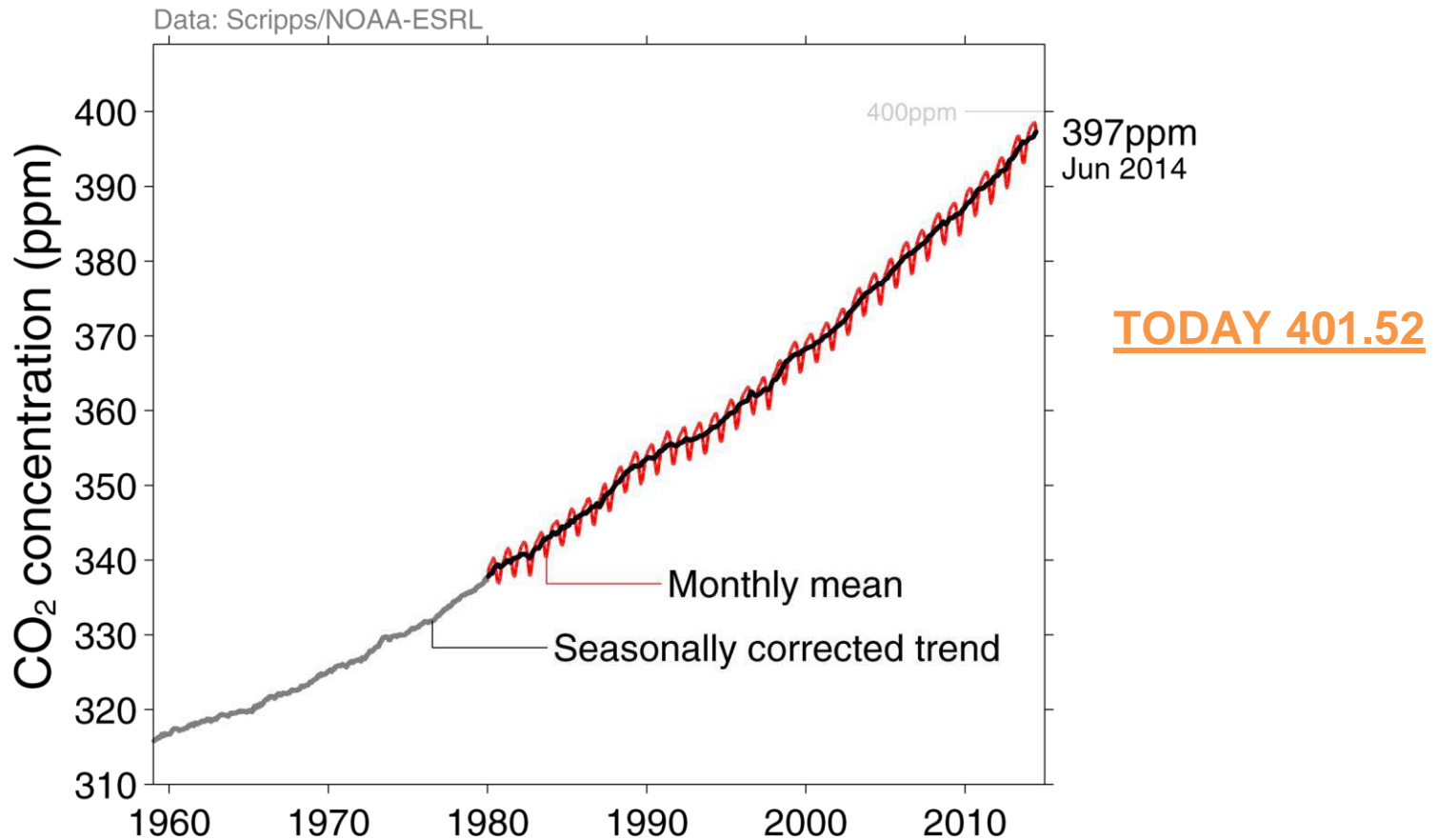
NOAA Earth System Research Laboratory  
CarbonTracker CT2009 release





# Atmospheric Concentration

The global CO<sub>2</sub> concentration increased from ~277ppm in 1750 to 395ppm in 2013 (up 43%)  
 Mauna Loa registered the first daily measurements above 400ppm in May 2013



Globally averaged surface atmospheric CO<sub>2</sub> concentration

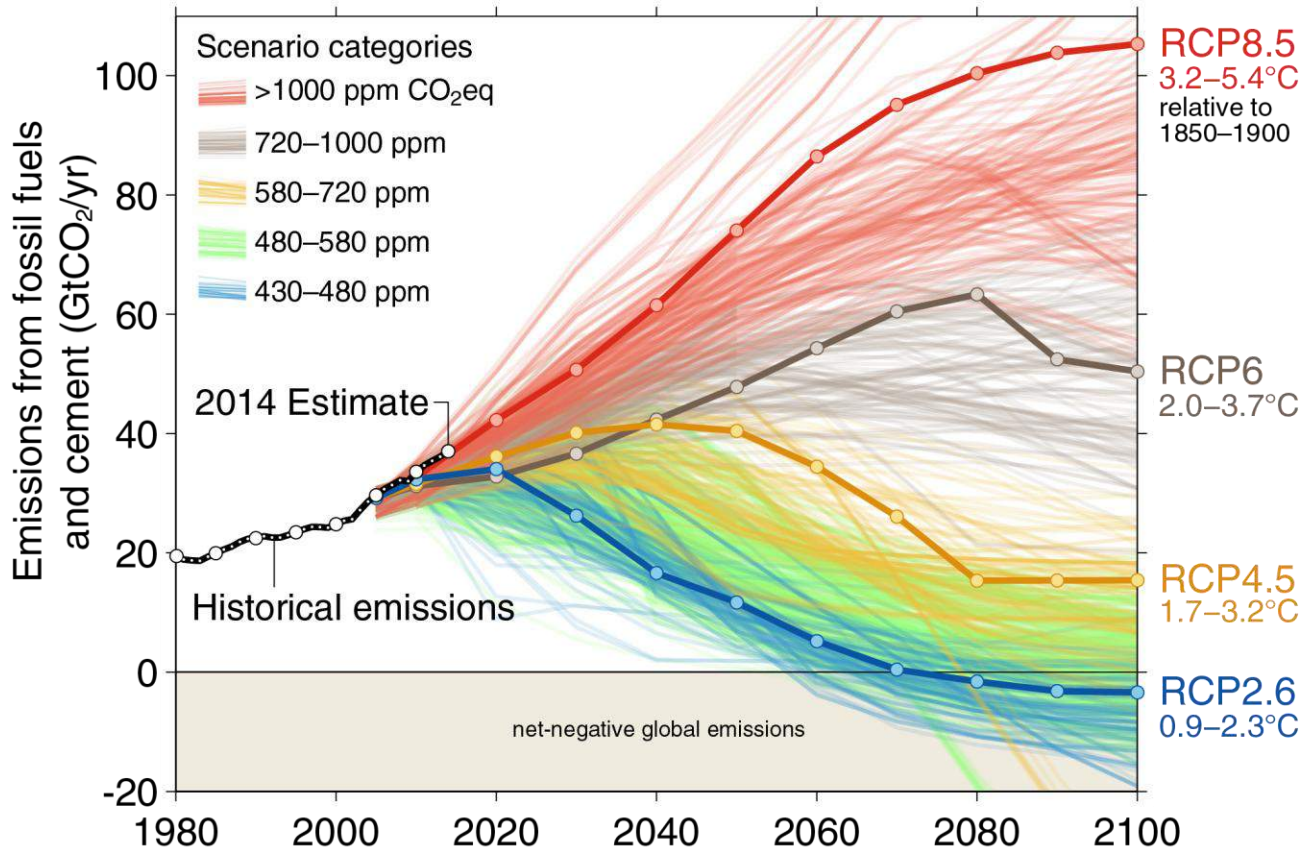
Data from: NOAA-ESRL after 1980; the Scripps Institution of Oceanography before 1980 (harmonised to recent data by adding 0.542ppm)

Source: [NOAA-ESRL](#); [Scripps Institution of Oceanography](#); [Global Carbon Budget 2014](#)

# Observed Emissions and Emissions Scenarios

Emissions are on track for 3.2–5.4°C “likely” increase in temperature above pre-industrial  
 Large and sustained mitigation is required to keep below 2°C

Data: CDIAC/GCP/IPCC/Fuss et al 2014



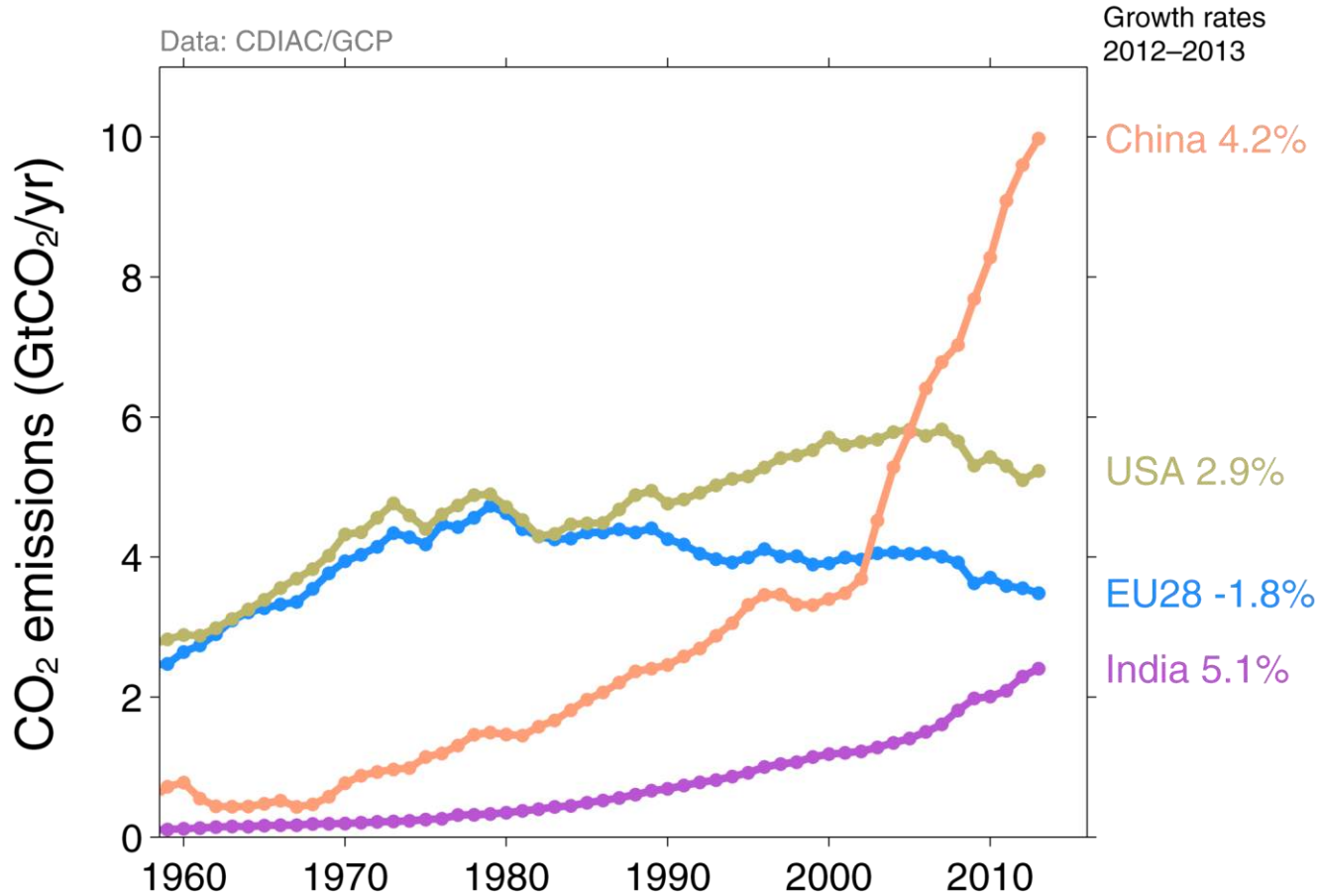
Over 1000 scenarios from the IPCC Fifth Assessment Report are shown

Source: [Fuss et al 2014](#); [CDIAC](#); [Global Carbon Budget 2014](#)



# Top Fossil Fuel Emitters (Absolute)

The top four emitters in 2013 covered 58% of global emissions  
 China (28%), United States (14%), EU28 (10%), India (7%)



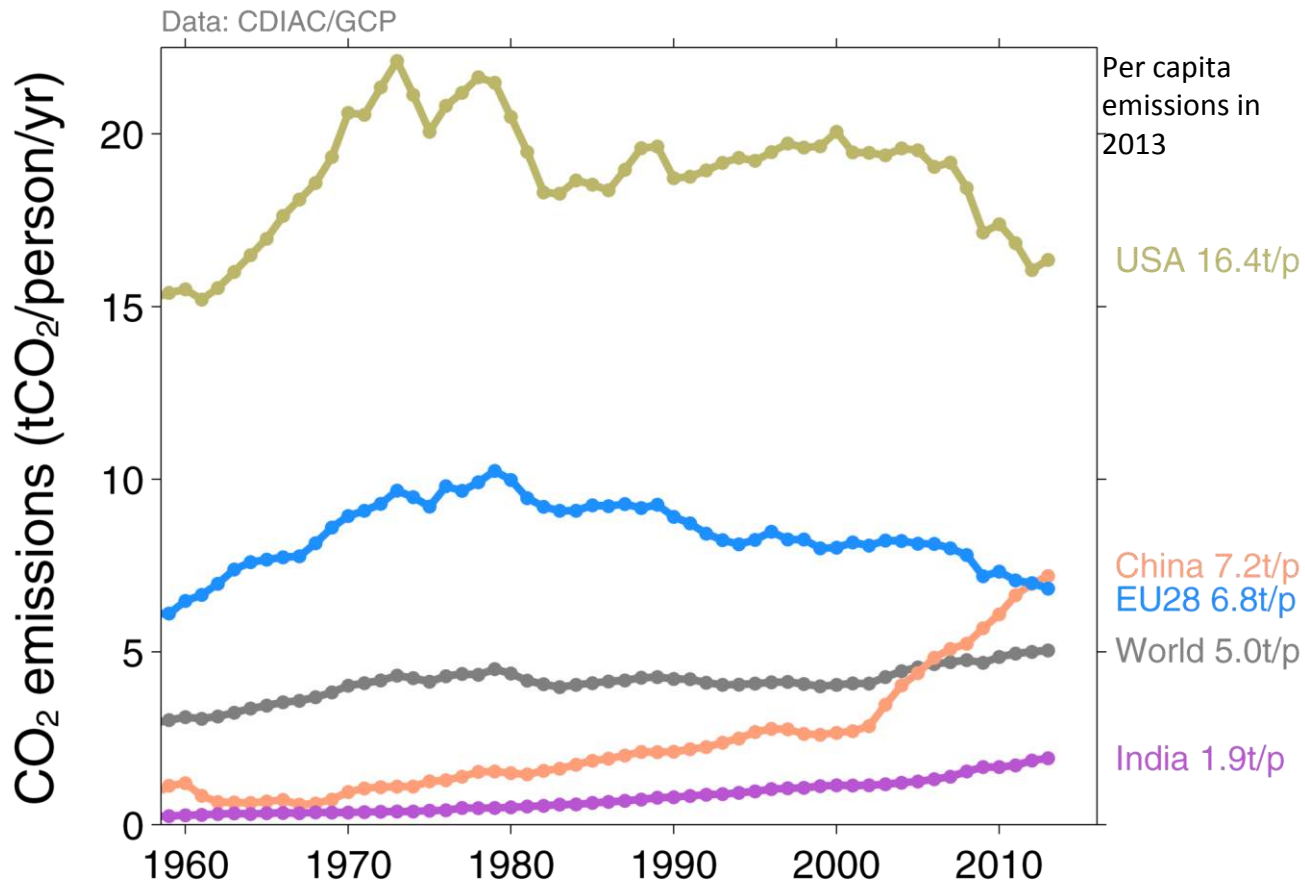
Bunkers fuel used for international transport is 3% of global emissions

Statistical differences between the global estimates and sum of national totals is 3% of global emissions

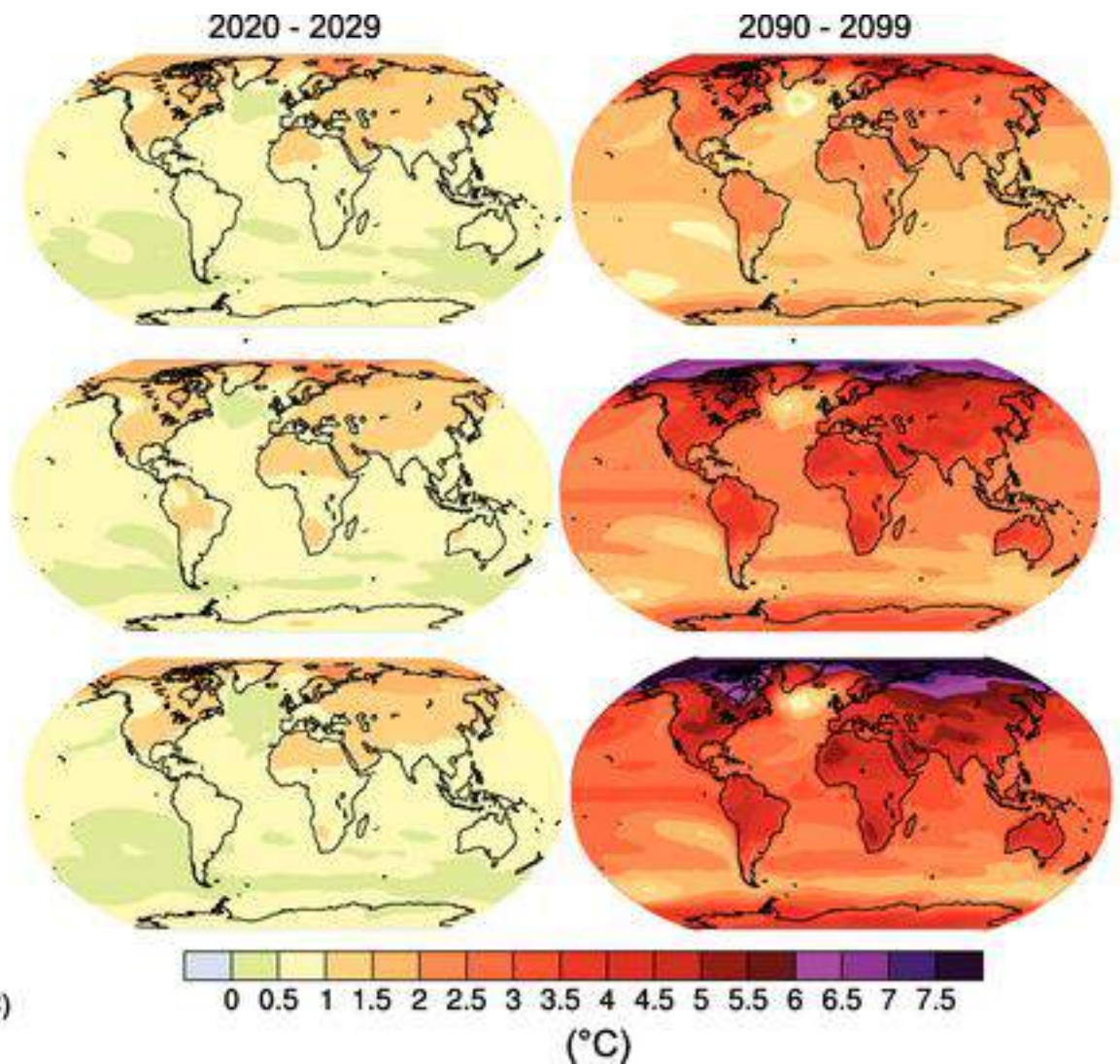
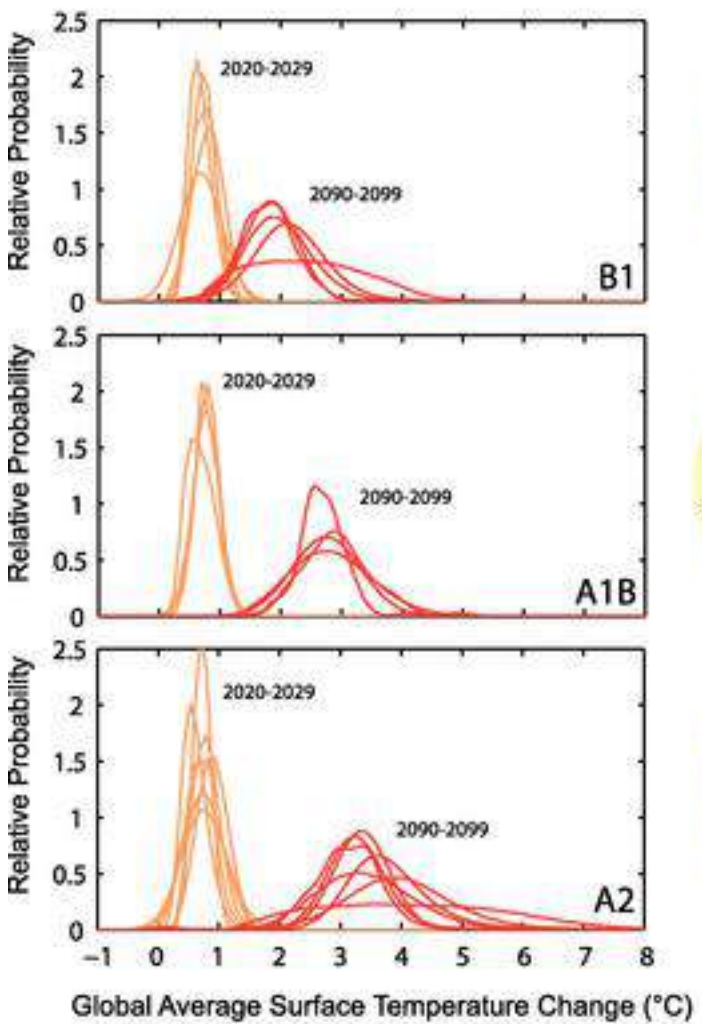
Source: [CDIAC](#); [Le Quéré et al 2014](#); [Global Carbon Budget 2014](#)

# Top Fossil Fuel Emitters (Per Capita)

China's per capita emissions have passed the EU28 and are 45% above the global average

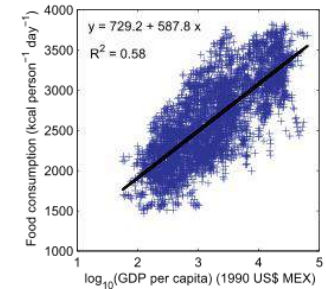
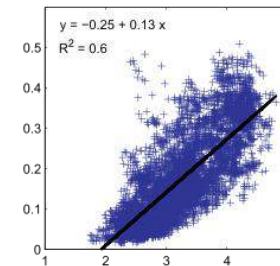
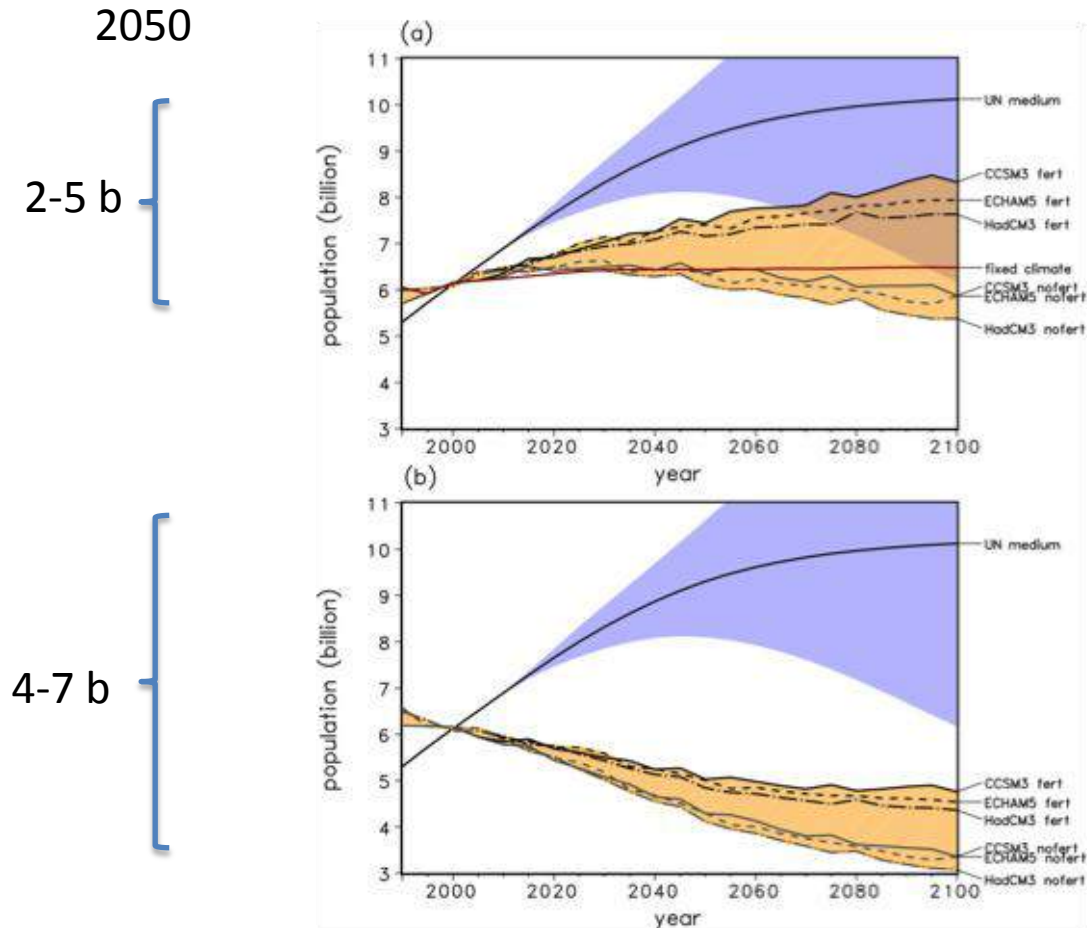






©IPCC, 2007: WG1-AR4

# Proiezioni sui fabbisogni di cibo



**Fig. 5.** 5-year running means of  $K_c$  estimates from 1990 to 2100 (orange corridor) under different GCM-climate forcing (CCSM3, ECHAM5, HadCM3) and different  $\text{CO}_2$  fertilization effect (fert: maximal  $\text{CO}_2$  fertilization; nofert:  $\text{CO}_2$  levels of 2000) based on caloric demands of 2000 (a) and changing caloric demands (b). The blue corridor indicates the low and high fertility variant boundaries of the population projections of the United Nations (2011) with the medium fertility variant highlighted as black solid line. The red line in panel (a) indicates  $K_c$  under constant yields and per capita demands of the year 2000. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)



## DIE OF HUNGER OR OBESITY?

Today, worldwide, for every malnourished person, there are two people who are obese or overweight.

# 1

TODAY  
IN THE  
WORLD

UNDERNOURISHED PEOPLE  
**868**  
million

OBESSE OR OVERWEIGHT PEOPLE  
**1.5**  
billion



FOR EVERY UNDERNOURISHED  
PERSON, THERE ARE TWO WHO  
ARE OBESSE OR OVERWEIGHT



DEATHS  
EVERY YEAR  
WORLDWIDE FROM:



LACK  
OF FOOD  
**36**  
million

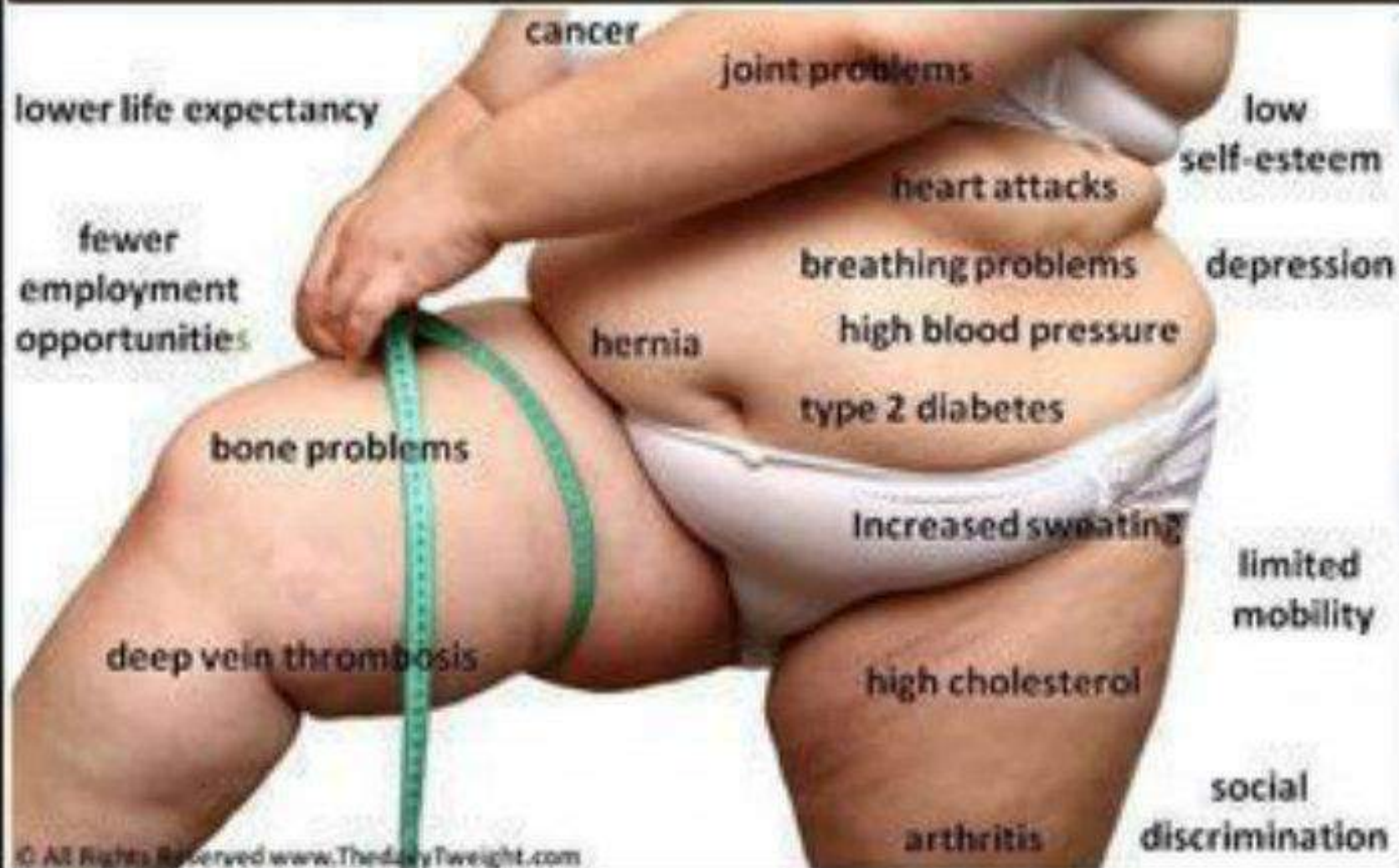


TOO MUCH  
FOOD  
**29**  
million



# YOU MIGHT LOVE YOUR WEIGHT BUT DO YOUR WEIGHT LOVE YOU???

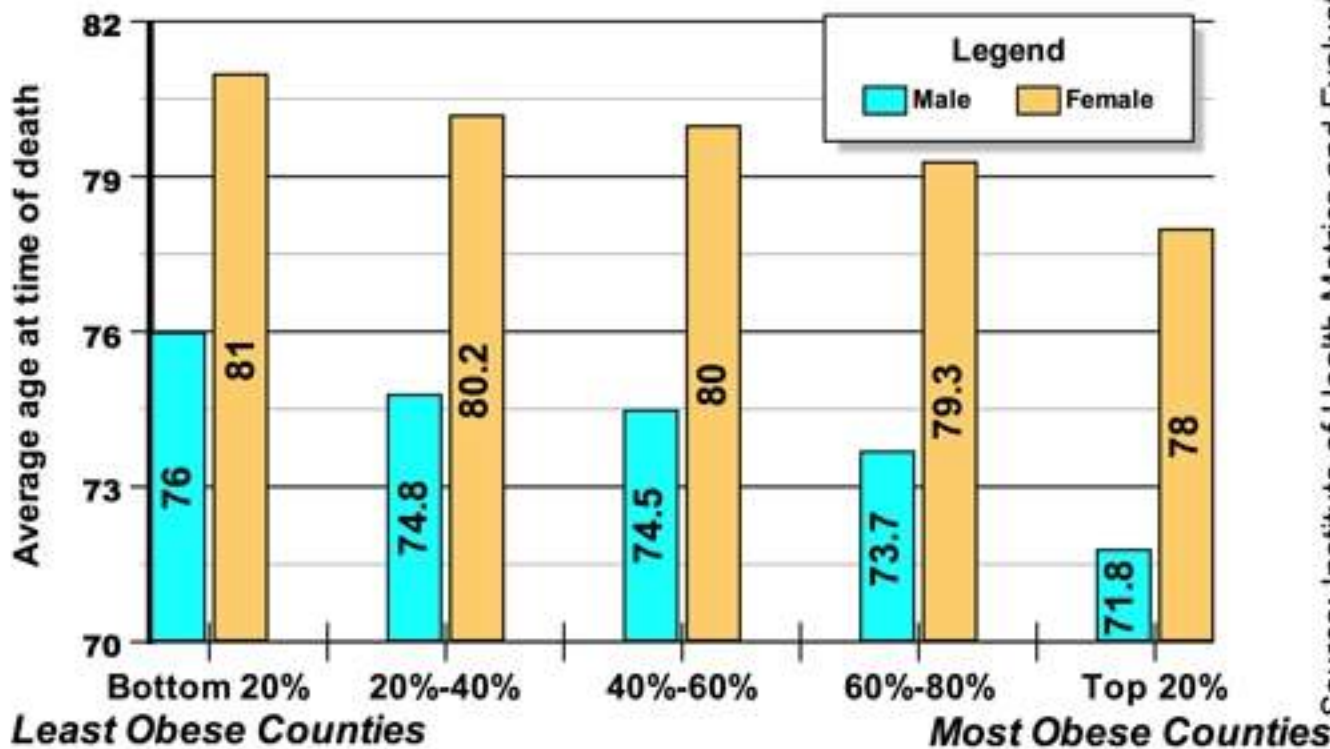
## The Negative Effects of Obesity on Your Health and Your life





# Live Expectancy: Obesity

*As obesity rates in counties increase, life expectancy declines*



This chart shows the average longevity for people according to county. Counties are ranked according to obesity, from the least obese on the left to the most obese on the right. As obesity rates increase, longevity declines.

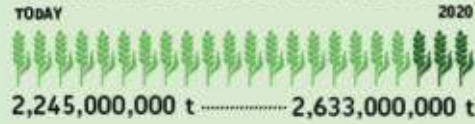
Source: Institute of Health Metrics and Evaluation

## FEED PEOPLE, ANIMALS, OR CARS?

One-third of all food production worldwide is destined for feeding livestock. In addition, a growing share of agricultural land is used for the production of biofuel. As a result, we are choosing to feed automobiles instead of people.

\* allocation of the use of grains as a percentage between animal food, human food, and the production of biofuel

## GRAIN PRODUCTION IN THE WORLD AND ITS USE\*



## POPULATION



## FILIPE FORTES PRESENTS:



# The China Diet

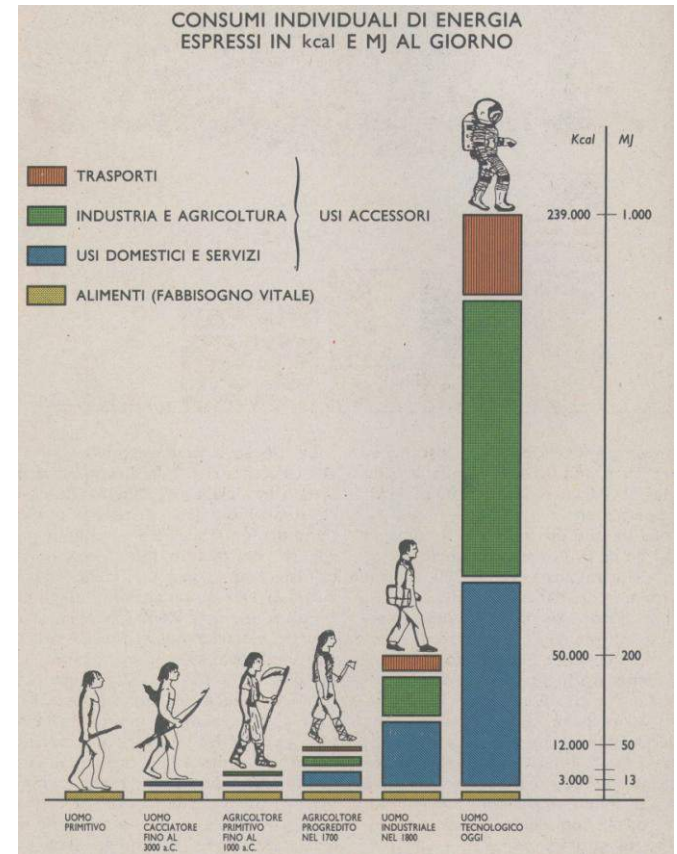
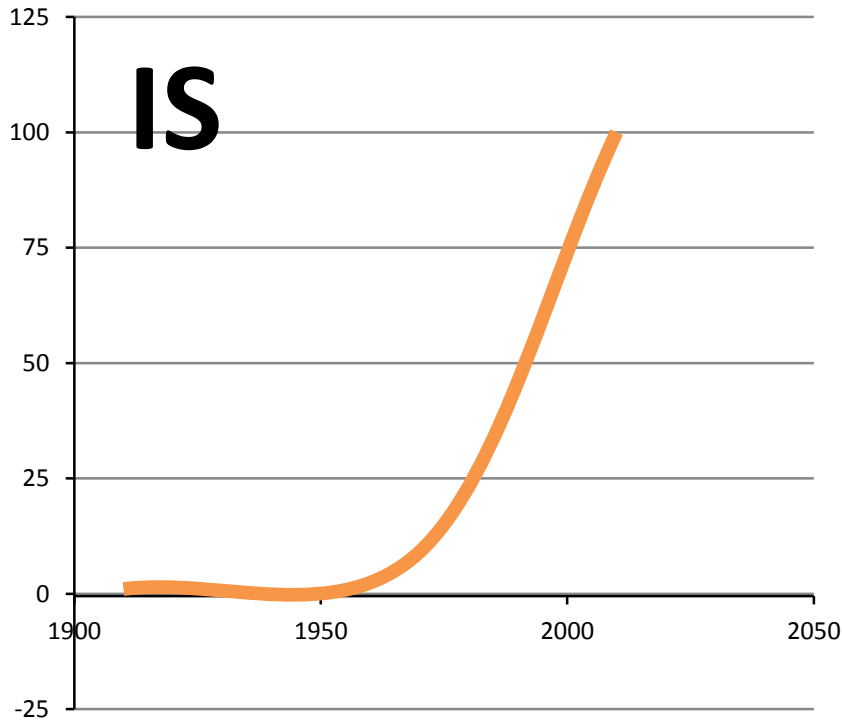




# EMISSIONI



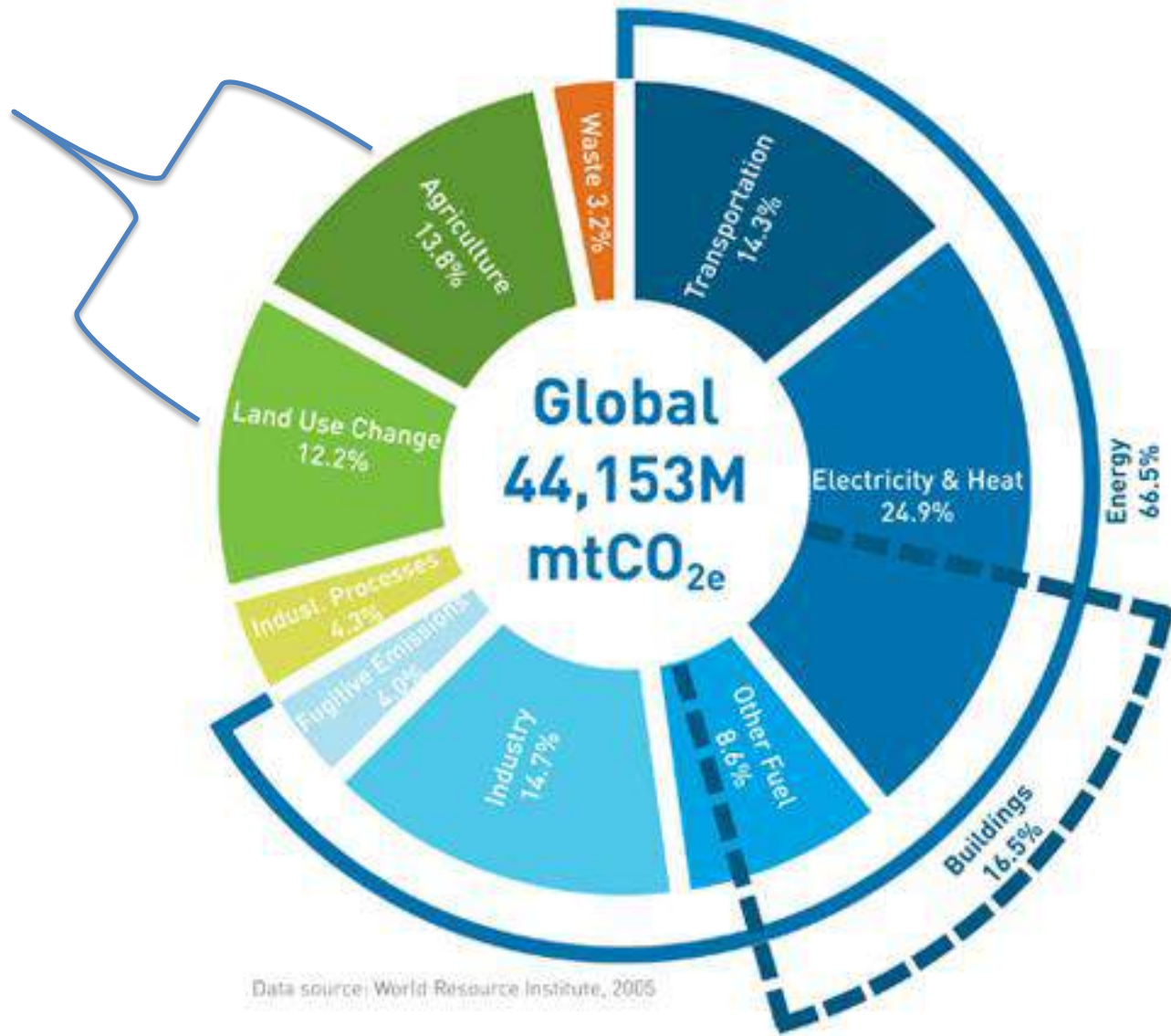
$$IS = \frac{\text{Energy consumed to produce food}}{\text{Energy content of food}}$$





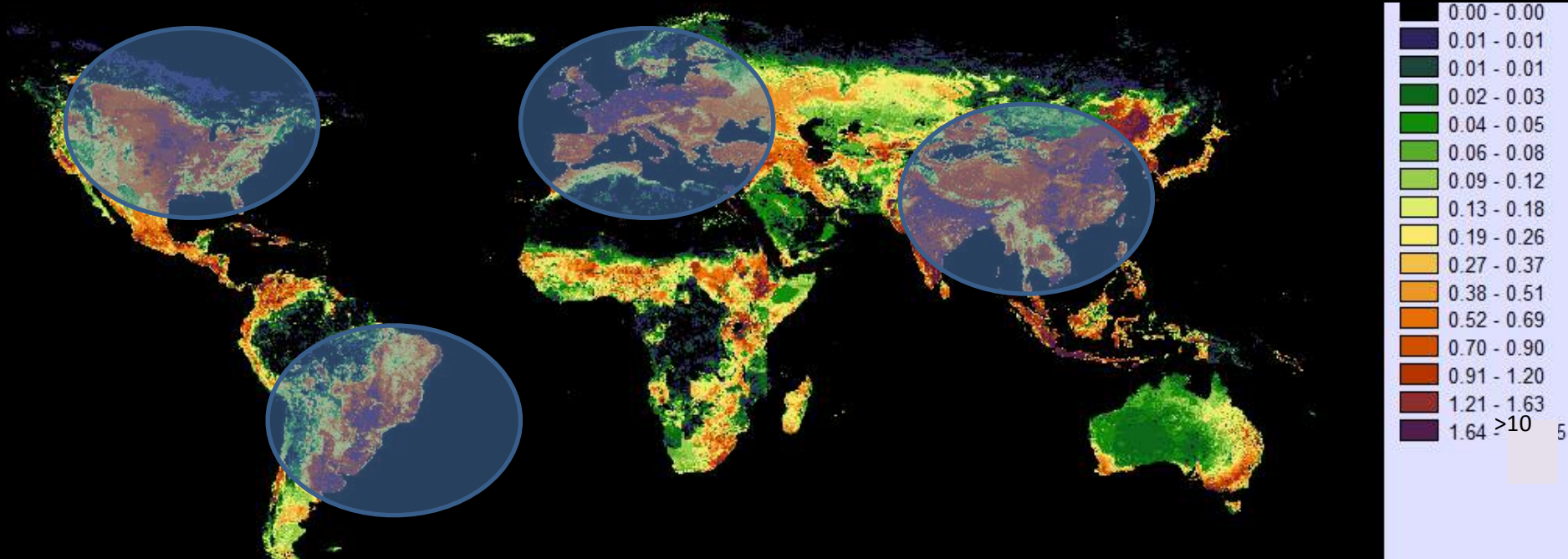
# Global Greenhouse Gas Emissions per Sector

26%



Data source: World Resource Institute, 2005

# Distribuzione globale emissioni N<sub>2</sub>O (kg N/ha yr<sup>-1</sup>)

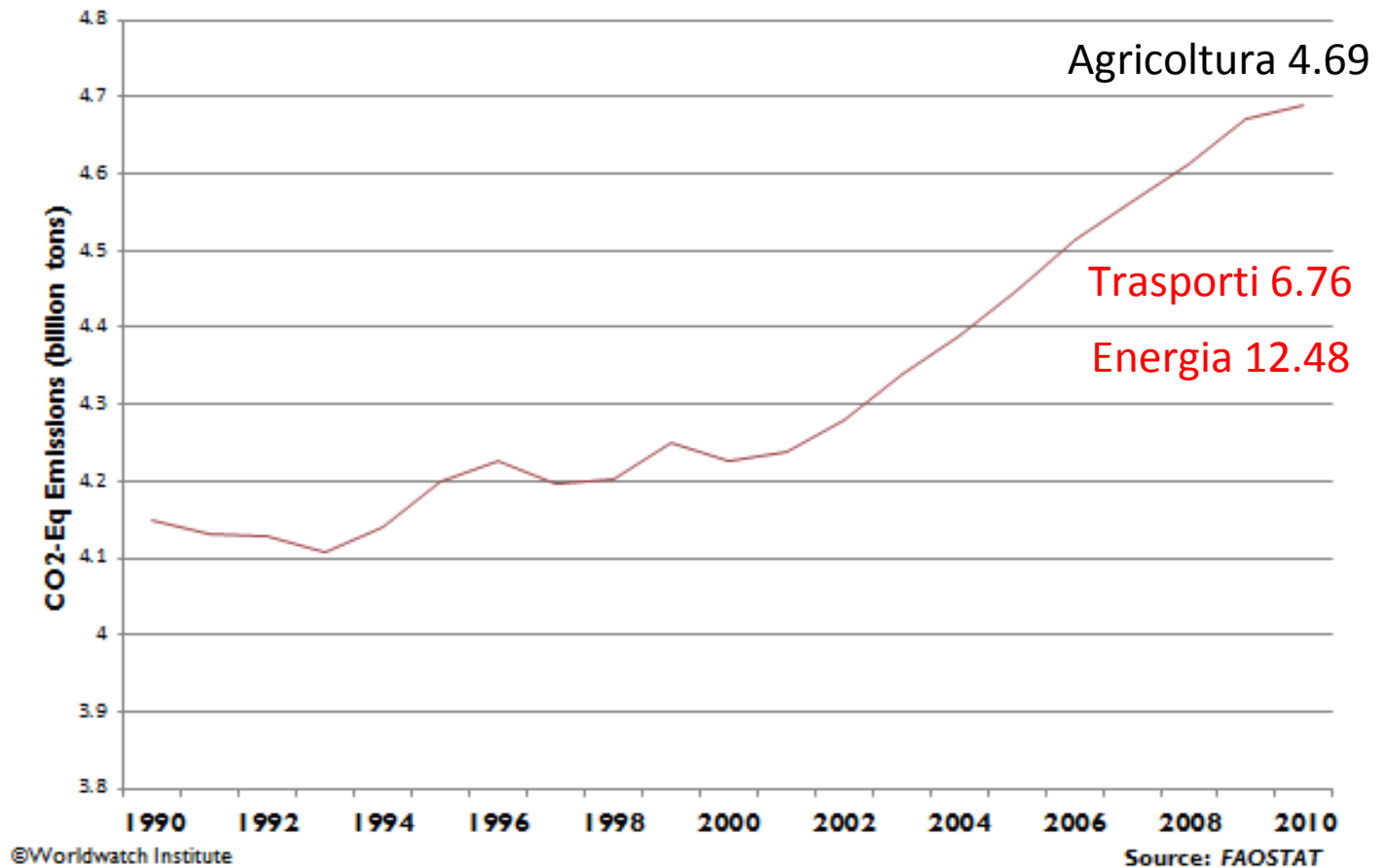


Castaldi et al 2015



# Emissioni di gas serra dall'agricoltura

Figure 1. | Global Emissions from Agriculture, 1990-2010



# The Greenhouse gas balance of Italian agro-industry (1778 kg CO<sub>2</sub>eq/year per capita)

<b>Settore</b>	<b>Mt CO<sub>2</sub> eq</b>
<b>Agriculture production</b>	<b>47,1</b>
<b>Enteric fermentation</b>	<b>11,6</b>
<b>Manure and waste</b>	<b>6,9</b>
<b>Transport</b>	<b>19,8</b>
<b>Industrial transformation</b>	<b>5,5</b>
<b>Packaging</b>	<b>13,1</b>
<b>TOTAL</b>	<b>104,0</b>

<sup>[1]</sup> Con il termine emissioni della produzione agricola si intendono tutte le emissioni di gas serra in seguito alle lavorazioni, irrigazione, concimazioni etc. fino al confine dell'azienda (*Farm gate*)

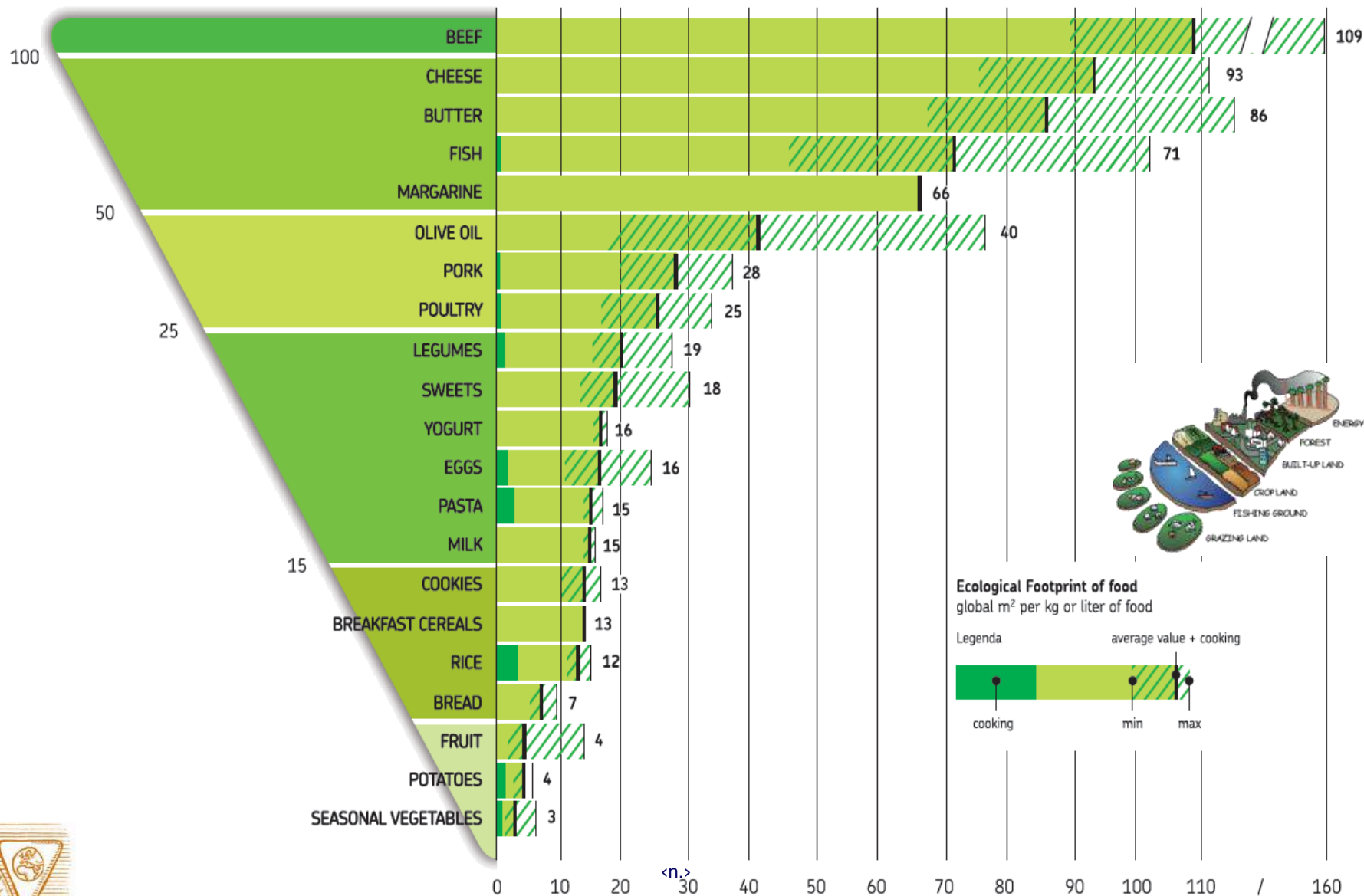
<sup>[2]</sup> Escluse foraggere

<sup>[3]</sup> Dato elaborato da NIR (ISPRA,2009)

<sup>[4]</sup> Dato elaborato da NIR (ISPRA,2009)



# Environmental Pyramid: Ecological Footprint



# The impact of dietary habits – “rich-meat” menu

This menu is also balanced from a nutritional point of view but it is based on a consumption, albeit modest, of red meat

MEAT MENU

2140 TOTAL KCALORIES

42 GLOBAL m<sup>2</sup>



PROTEIN  
**15%**



FATS  
**25%**



CARBOHYDRATES  
**60%**

## Breakfast

1 cup of low-fat milk  
4 cookies

3 global m<sup>2</sup>

## Snack

1 portion low-fat yogurt

2 global m<sup>2</sup>

## Mid-morning snack

1 portion of fruit (200 g)

1 global m<sup>2</sup>

## Dinner

1 portion of vegetable soup/pasta with peas  
1 grilled beef steak (150 g)  
1 slice of bread

20 global m<sup>2</sup>

## Lunch

1 portion of cheese pizza, mixed green salad

16 global m<sup>2</sup>





## The impact of dietary habits – “vegetarian” menu

This is an example of vegetarian daily menu, balanced from a nutritional standpoint, includes a diet rich in vegetable protein and low in animal fat



PROTEIN

14%



FATS

30%



CARBOHYDRATES

56%

### Breakfast

- 1 portion of fruit (200 g)
- 4 rusks

1 global m<sup>2</sup>

### Mid-morning snack

- 1 portion low-fat yogurt
- 1 fruit

3 global m<sup>2</sup>

### Lunch

- 1 portion of pasta with fennel
- 1 portion of squash and leek quiche

4 global m<sup>2</sup>

### Snack

- 1 portion low-fat yogurt
- 1 packet of unsalted crackers

1 global m<sup>2</sup>





### Dinner

- 1 portion of vegetables: steamed green beans (200 g) and potatoes (400 g) with grated cheese (40 g)

7 global m<sup>2</sup>



# Ecological Footprint's variations depending on Food choices

WEEKLY DIET	WEEKLY IMPACT [GLOBAL m <sup>2</sup> ]	AVERAGE DAILY IMPACT [GLOBAL m <sup>2</sup> ]
<p>7 TIMES "MEAT" MENU</p> 	294	42
<p>5 TIMES "VEGETARIAN" MENU + 2 TIMES "MEAT" MENU</p>  	164	23
<p>7 TIMES "VEGETARIAN" MENU</p> 	116	16

Taking the example of a week's worth of food, imagining to have **three different diets** on the basis of how many times a vegetarian menu is eaten and how many times the menu is based on meat.

**Limiting animal protein to just twice a week**, in line with the recommendations of nutritionists, **it is possible to "save" up to 20 square global meters per day.**

Source: BCFN elaboration of data from the Ecological Footprint Network.





## FEED WASTE OR FEED THE HUNGRY?

Every year worldwide, 1.3 billion tons of perfectly edible food are wasted, while 868 million people suffer from hunger.

# 3

1/3 OF GLOBAL FOOD PRODUCTION

=

1.3 OF FOOD ARE WASTED  
billion tons

ENDS UP IN THE GARBAGE EACH YEAR



4 TIMES  
WHAT IT WOULD TAKE TO FEED THE 868 MILLION PEOPLE WHO ARE HUNGRY



### THE PLANET'S BALANCE IS NEGATIVE

Today, what is consumed is greater than what we are able to regenerate.  
For our current lifestyle, we will need 1.5 planets, and in 40 years we will need 3

TODAY



1.5 planets



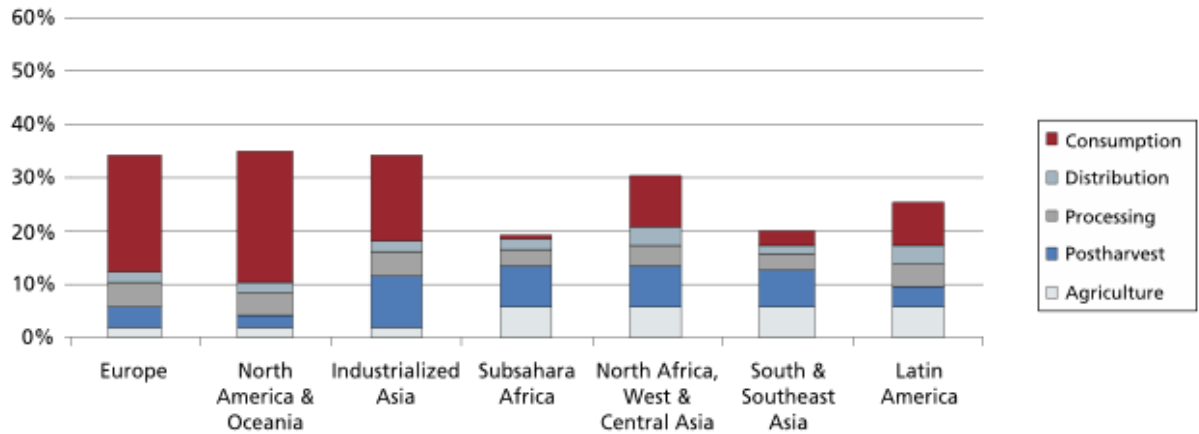
2050



3 planets



Food losses - Cereals



**1226 milioni di m<sup>3</sup> l'anno di acqua**, pari al 2,5% dell'intera portata annua del fiume Po;

**24,5 milioni di tonnellate CO<sub>2</sub> l'anno**, di cui 14,3 riferibili ai soli sprechi in casa. L'assorbimento della sola CO<sub>2</sub> sprecata da noi consumatori richiede un quarto della superficie boschiva italiana;

**5%** delle emissioni di gas serra dell'Europa (EU28)

**36% dell'azoto aggiunto con i fertilizzanti viene perso** che contribuisce al peggioramento delle qualità delle acque determinando impatti anche sulla flora e fauna degli ecosistemi idrici.



# BIG versus SMART Agriculture





# IL PAESAGGIO RURALE COME ELEMENTO DI EQUILIBRIO







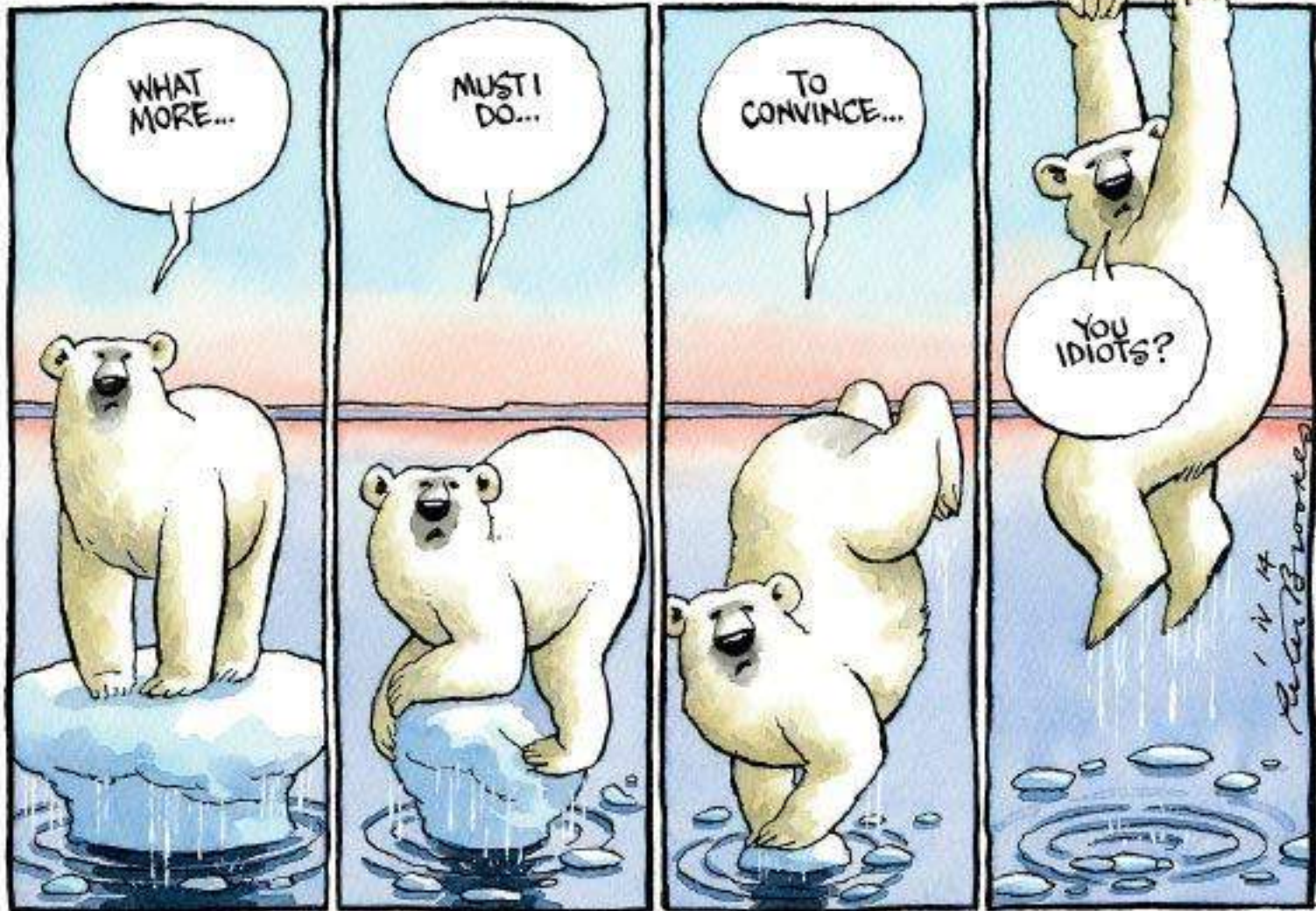
MILANO 2015  
1 MAY • 31 OCTOBER

FEEDING THE PLANET  
ENERGY FOR LIFE

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3. Lotta allo spreco alimentare
4. Educazione alimentare a tutti i livelli



Thanks !