

UF/IFAS Extension

The Journey to Sustainability Begins with Education



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Your Food Choices and Carbon Footprint

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Outline

- What food choices are we talking about?
- Concepts of carbon footprint and food systems
- Carbon emissions information about food choices
- Food choice-based solutions

What Foods Are We Talking About?

- **“What The World Eats”**

<http://www.time.com/time/photogallery/0,29307,1626519,00.html>

- A photograph essay of diets from around the world
- Shows quantity consumed in 1 week by an average family
- Shows differences in food variety
 - Food groups
 - Food systems - e.g., extent of food processing, packaging, etc

What The World Eats

<http://www.time.com/time/photogallery/0,29307,1626519,00.html>



Italy

What The World Eats

<http://www.time.com/time/photogallery/0,29307,1626519,00.html>

Japan



What The World Eats

<http://www.time.com/time/photogallery/0,29307,1626519,00.html>

Chad



What The World Eats

<http://www.time.com/time/photogallery/0,29307,1626519,00.html>

Kuwait



What The World Eats

<http://www.time.com/time/photogallery/0,29307,1626519,00.html>



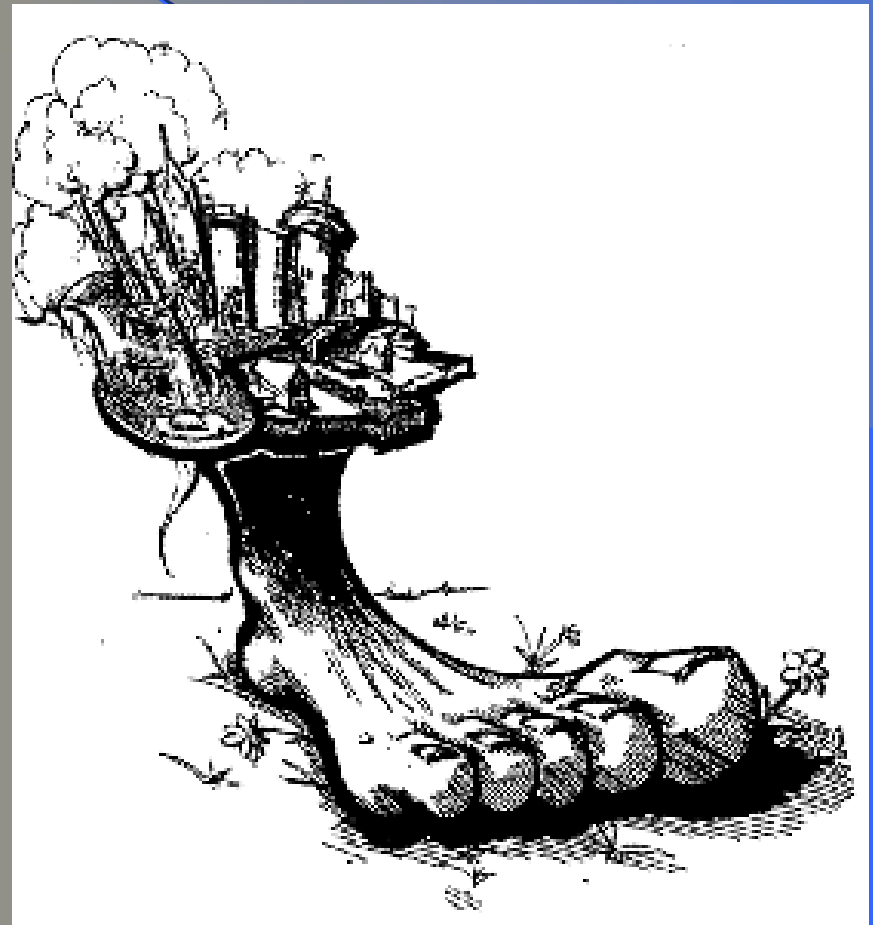
USA

What's the Beef? 📢

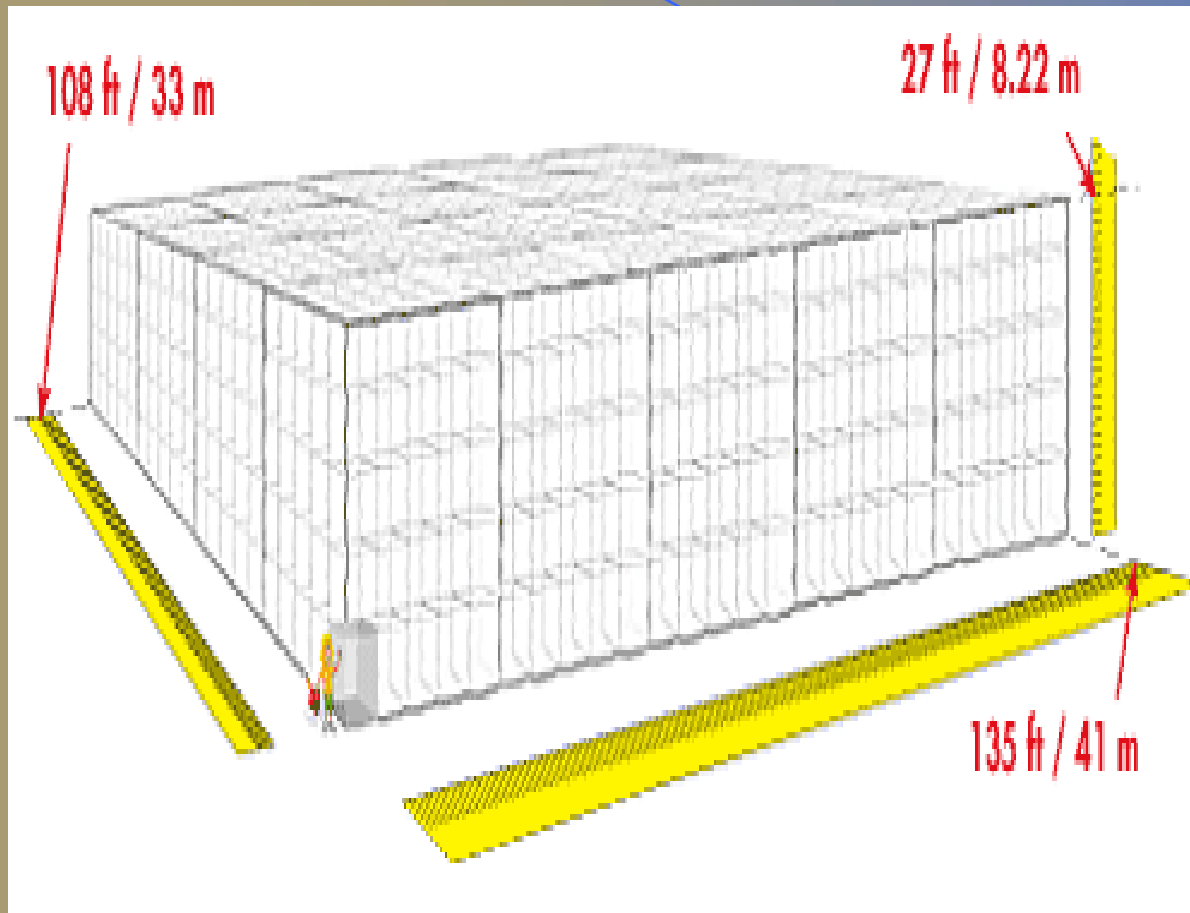
- **What is the problem with your food choices?**

Food Has A Carbon Footprint

- **What's a Carbon Footprint ?**
 - the amount of carbon dioxide - a potent greenhouse gas — that is given off from burning fossil fuels for lifestyle activities
 - becomes larger with increasing carbon emissions



Making Visible A Carbon Footprint



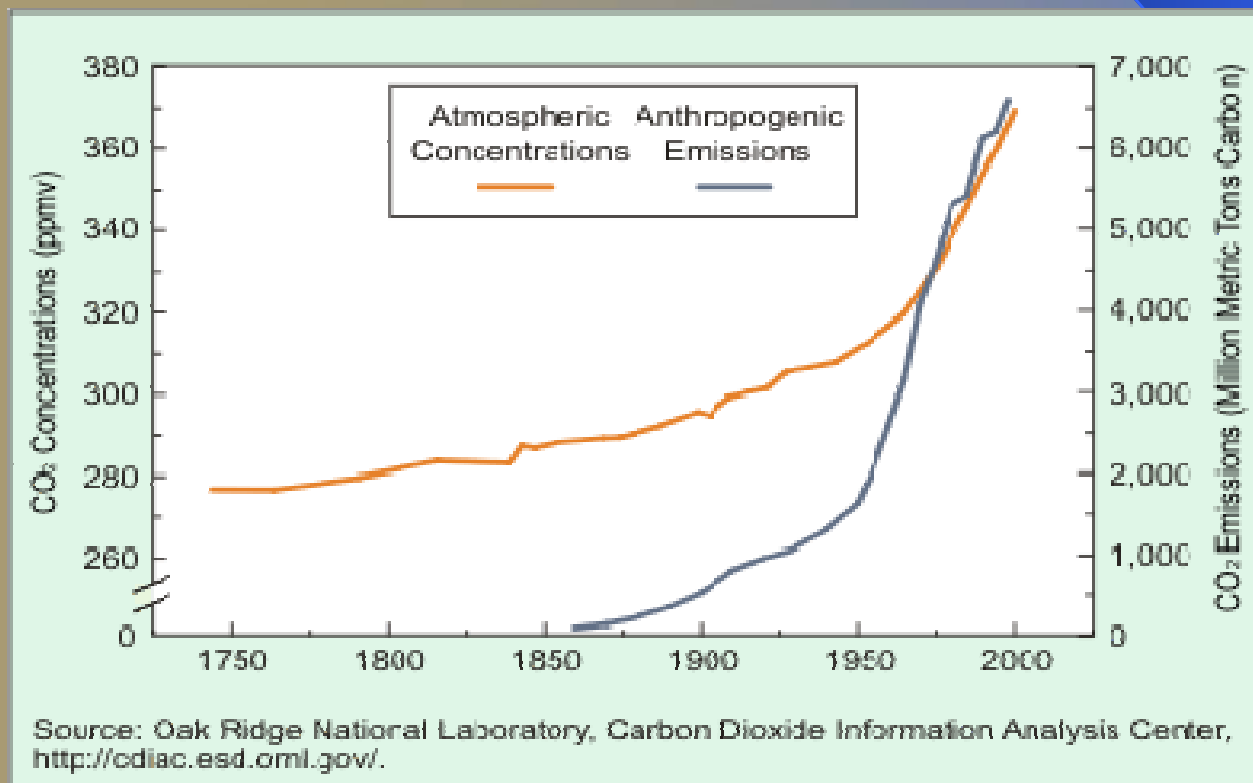
The carbon footprint for one person in the US is 22 tons of CO₂ per year.

Food Carbon Footprint

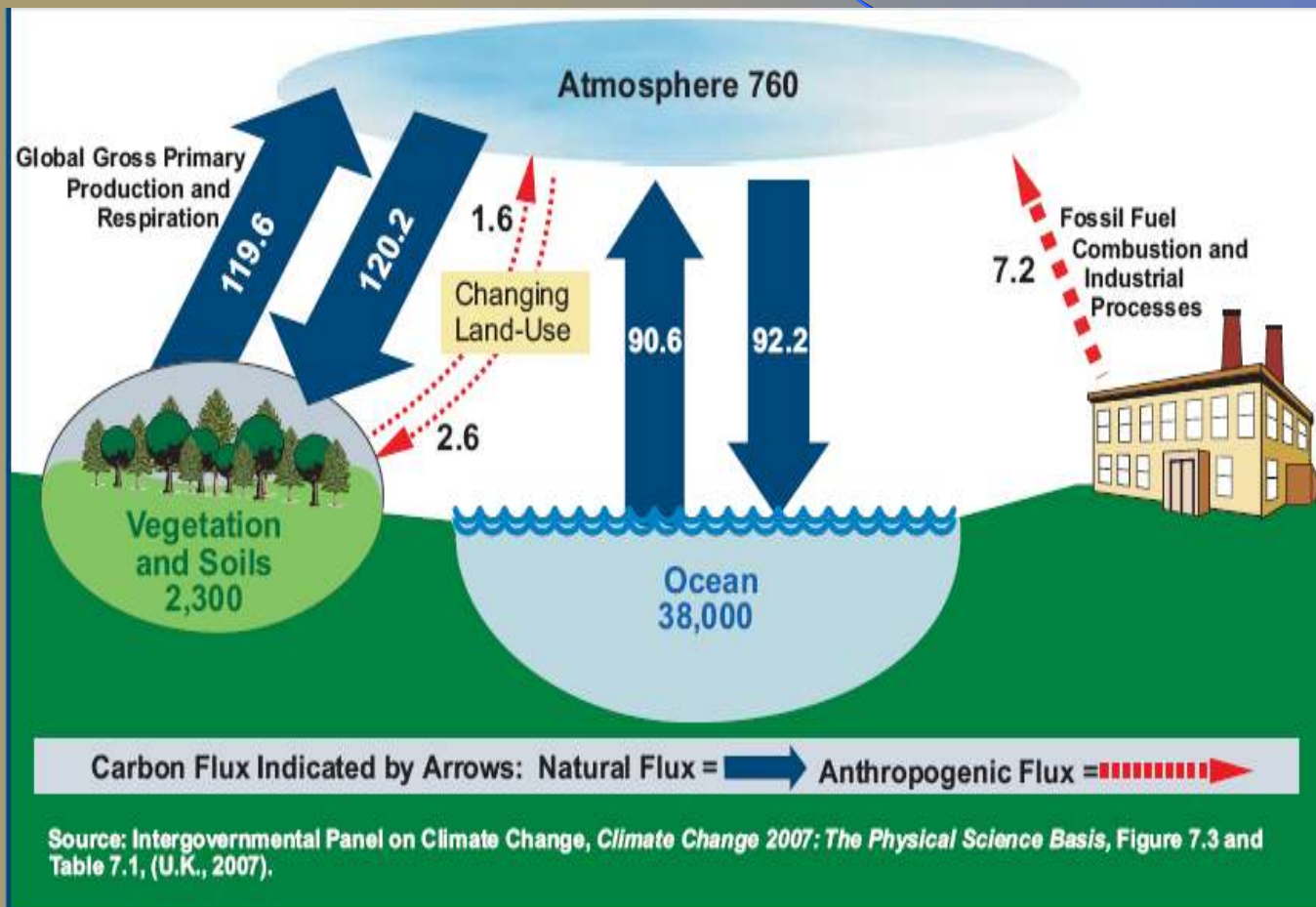
- **Food systems produce carbon emissions due to use of fossil fuels**
- **Food Carbon Footprint is part of the total carbon footprint of an individual, organization, and/or country**
- **Food choices are changing globally and impacting total carbon footprints**

What's The Story w/ Carbon Emissions?

- Carbon emissions are greatly increasing due to man-made causes and activities
- Increased carbon emissions have increased the atmospheric CO₂ concentration

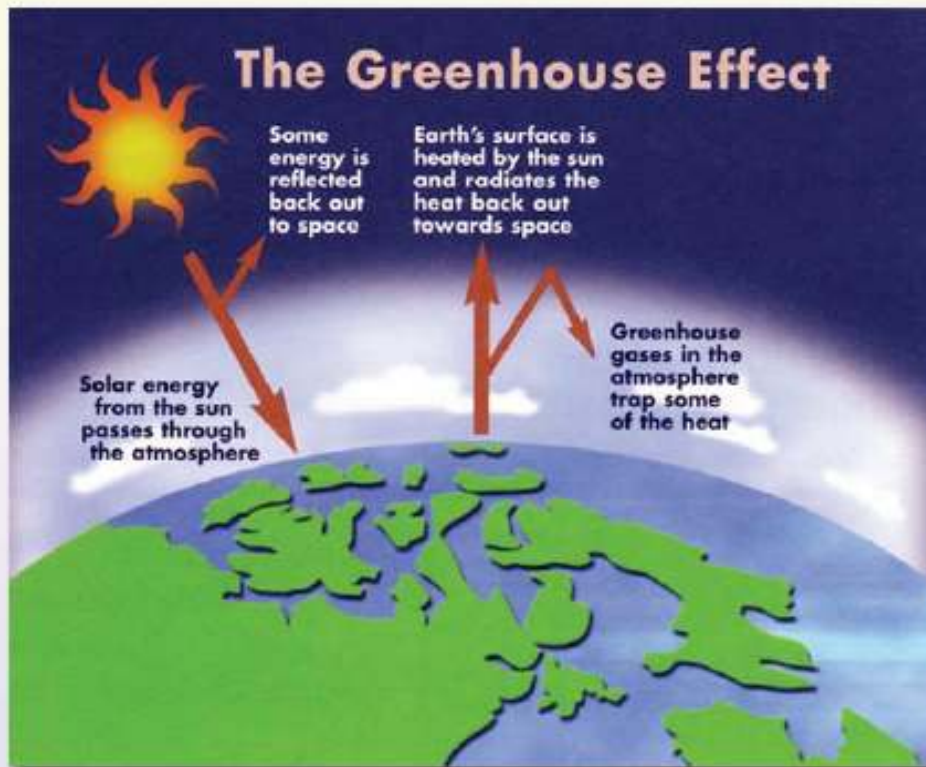


Carbon Cycle is Global

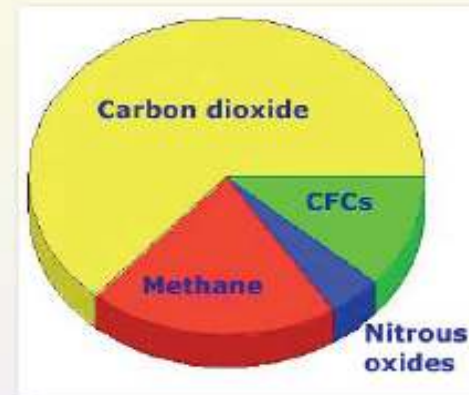


So what?

The problem: greenhouse gases absorb and radiate heat to the lower atmosphere.

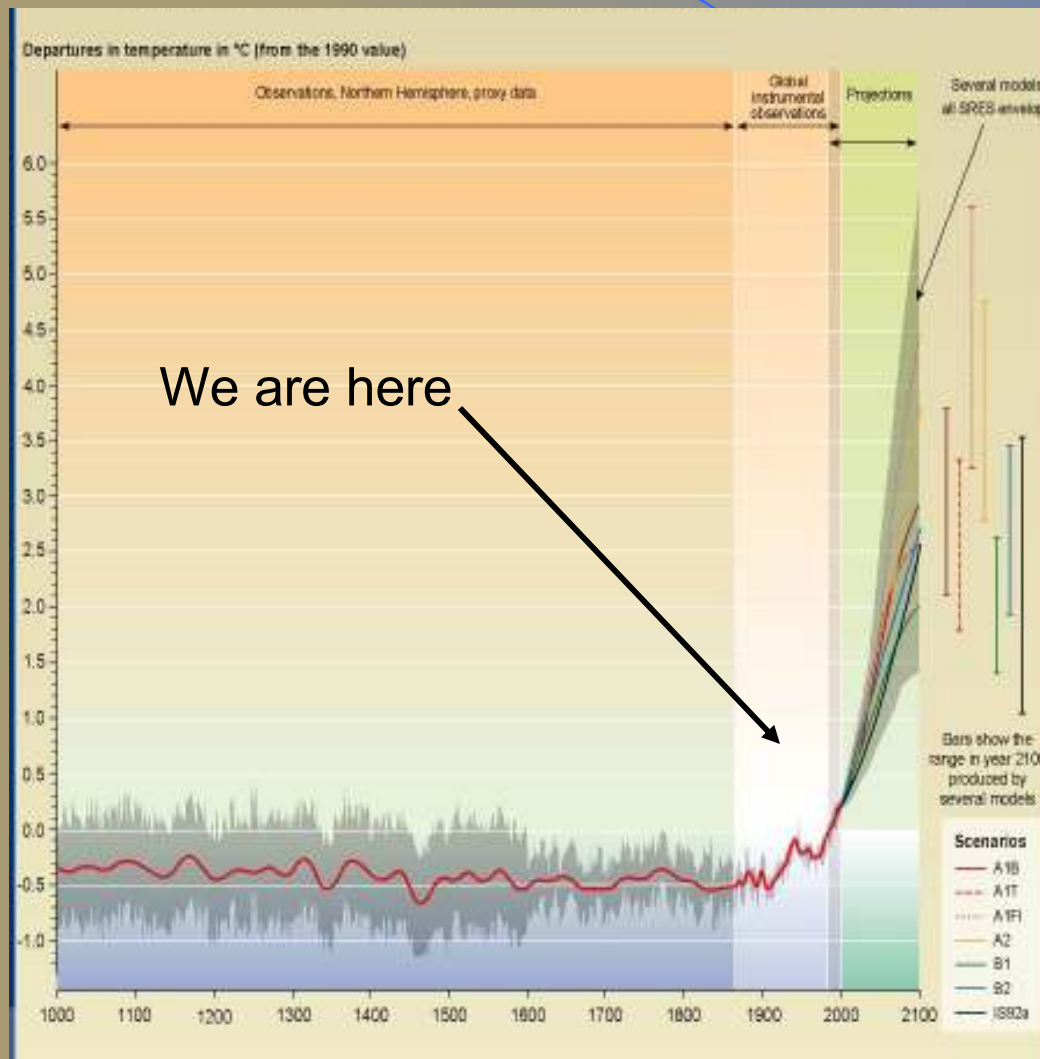


Relative importance



Greenhouse gases are higher now than in over 650,000 years

How Much Global Warming Do You Mean?



Temperatures are projected to rise an additional 2 – 5°C in the 21st Century

Global Warming vs. Climate Change

- **Global Warming**

- an increase in average global temperature as influenced by increased greenhouse gas concentrations without regard to other factors that may cause climate change

- **Climate Change**

- changes in the atmosphere over time scales ranging from weeks to decades to millions of years.

- vary by natural processes internal to the Earth (e.g., continental drift), external forces (e.g., solar energy), and human activities which affect global wind patterns, rainfall, and temperatures.

Who Says So ?

- The National Academies of Science of the International Community, including USA
- Intergovernmental Panel on Climate Change - IPCC

**Joint science academies' statement:
Global response to climate change**

Climate change is real
It is always been uncertain if a system as complex as the world's climate. However there is now strong evidence that significant global warming is occurring. The evidence comes from direct measurements of rising surface air temperatures and subsurface ocean temperatures and from phenomena such as increases in average global sea levels, retreating glaciers, and changes to many physical and biological systems. It is likely that most of the warming in recent decades can be attributed to human activities (IPCC, 2007). This warming has already led to changes in the Earth's climate.

The existence of greenhouse gases in the atmosphere vital to life on Earth – in their absence average temperatures would be about 30 centigrade degrees less than they are today. But human activities are now raising atmospheric concentrations of greenhouse gases – including carbon dioxide, methane, troposphere ozone, and nitrous oxide – to rise well above pre-industrial levels. Carbon dioxide levels have increased from 280 ppm in 1750 to over 370 ppm today – higher than any previous levels that can be reliably measured. In the last 400,000 years, increasing greenhouse gases are causing temperatures to rise, the Earth's surface warmed by approximately 0.6 centigrade degrees over the twentieth century. The Intergovernmental Panel on Climate Change (IPCC) projected that the average global surface temperature will continue to increase to between 1.4 centigrade degrees and 5.8 centigrade degrees above 1990 levels by 2100.

Reduce the causes of climate change
The scientific understanding of climate change is now sufficiently clear to justify nations taking action. It is vital that the international community take steps that they can take now, to contribute to substantial and long-term reduction in net global greenhouse gas emissions. Action taken now to reduce significantly the build-up of greenhouse gases in the atmosphere will lessen the magnitude and rate of climate change. As the United Nations Framework Convention on Climate Change (UNFCCC) negotiates, a lack of full scientific certainty about some aspects of climate change is not a reason for delaying an immediate response that will, at a reasonable cost, prevent dangerous anthropogenic interference with the climate system.

As nations and economies develop over the next 25 years, world primary energy demand is estimated to increase by almost 60%. Fossil fuels, which are responsible for the majority of carbon dioxide emissions produced by human activities, provide valuable resources for many nations and are projected to provide 85% of this demand (IEA 2006). Meeting the amount of this carbon dioxide reaching the atmosphere presents a huge challenge. There are many potentially cost-effective technological options that could contribute to stabilizing greenhouse gas concentrations. These are at various stages of research and development. However, barriers to their broad deployment still need to be overcome.

Carbon dioxide can remain in the atmosphere for many decades. Even with possible lowered emission rates we will be experiencing the impacts of climate change throughout the 21st century and beyond. Failure to implement significant reductions in net greenhouse gas emissions now would make the job that must be done in the future even more difficult.

Prepare for the consequences of climate change
Major parts of the climate system responsible to 21st century greenhouse gas emissions were still at today's levels, the climate would still adapt to the increased emissions of further changes in climate are therefore nations must prepare for them.

The projected changes in climate will lead to adverse effects on the regional level, water resources, agriculture, natural life human health. The larger and faster if climate, the more likely it is that other elements. Increasing temperatures on the frequency and severity of weather events and heavy rainfall. Increasing to lead to large scale effects such as melting sheets both major impacts on low-lying throughout the world. The IPCC estimates potential effects of sea level rise and from ocean warming are projected to range from sea level rise by between 0.1 between 1990 and 2100. In Bangladesh sea level rise would place about 6 million people at risk.

Developing nations that lack the infrastructure to respond to the impacts of climate change are particularly affected. It is clear that the poorest people are likely to suffer the most. Long-term global efforts to a prosperous and sustainable world may be hampered by changes in the climate.

The lack of observing and implementation to the consequences of climate change worldwide collaborative efforts from a range of experts, including physical and natural social scientists, medical scientists, the business leaders and economists.

**Designated authority -
The National Academies
of Science
&
The IPCC**

Krieger Academia Brasileira de Ciências, Brazil
EBuzig Académie des Sciences, France
Smith Accademia dei Lincei, Italy
Rott Royal Society, United Kingdom

Tim Platt Royal Society of Canada, Canada
Volker Hejny Deutsche Akademie der Naturforscher Leopoldina, Germany
Utsi Kuusisto Science Council of Japan, Japan
Bruce Albert National Academy of Sciences, United States of America

ZH Li Chinese Academy of Sciences, China
Rajaraman Indian National Science Academy, India
Y. A. Izrael Russian Academy of Sciences, Russia

June 2005

What does *this* Change in Climate mean?

“Many of the world's climate zones may disappear by 2100, leaving new ones in their place unlike any that exist today”

“..we are going to be seeing climates that certainly are completely outside the range of modern human experience..”

Source 2007 Articles: 26 March *Scientific American*; 27 March *Guardian*; 27 March IOL Reuters

So What?

- Climate change can affect world markets
 - Crop yields, prices, energy demand
- Potential for greater weather extremes
 - Drought, hurricanes, blizzards, floods
- Biodiversity
 - Changes in the range of plants and animals (can they move fast enough?)
- Sea level rise (lots of the world's population lives at low elevation)
- Health impacts (e.g., infectious diseases, heat-related illnesses, and accidents/injuries)

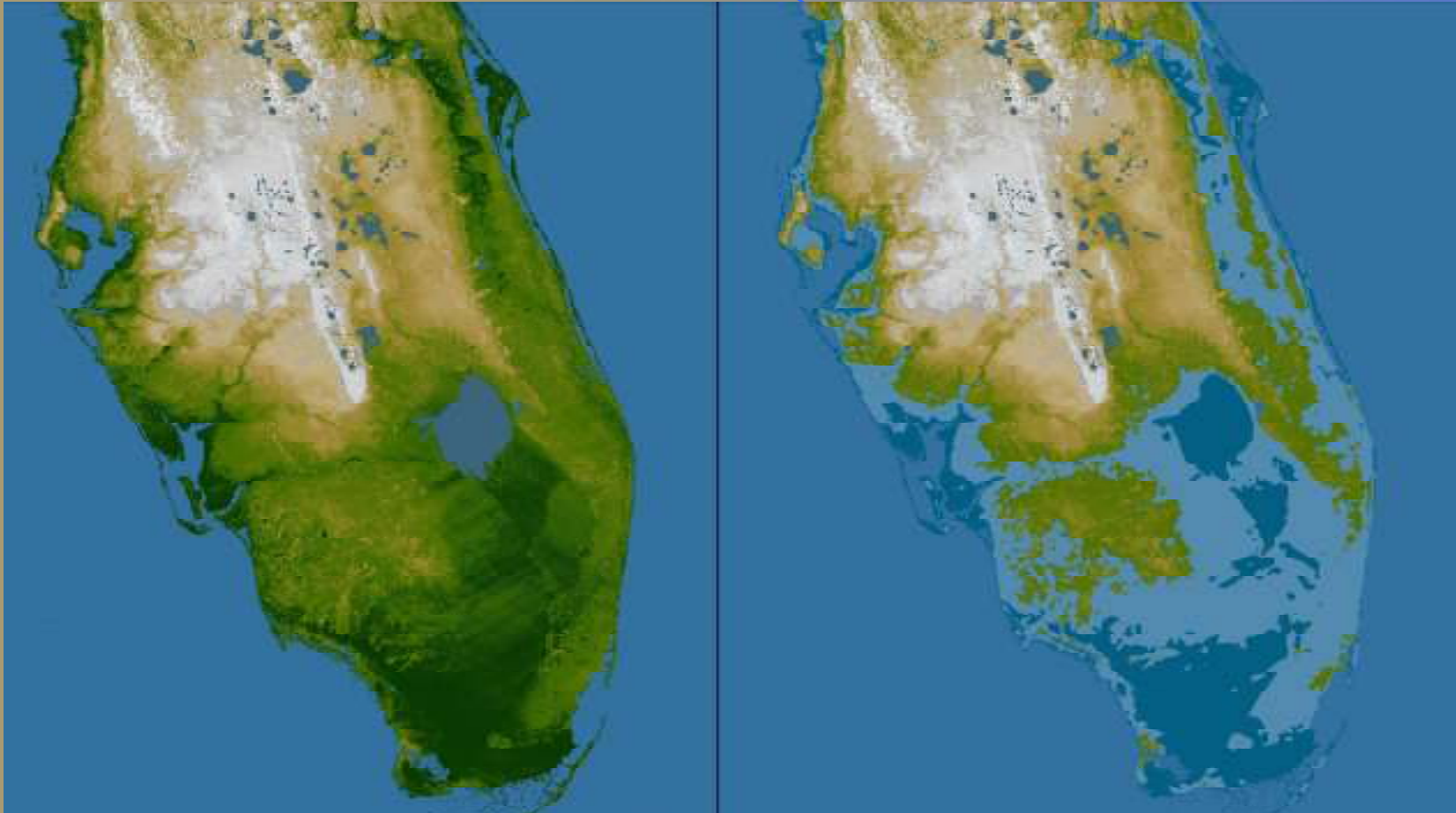
Projected Impacts on Florida Agriculture

- **Growing seasons changes due to reversal of summer-wet, winter-dry weather patterns**
- **New animal and plant disease vectors**
- **Increased “risk” of production**
- **Changes in food crops and production areas**

What Will Present Florida Agriculture Look Like With Climate Change?



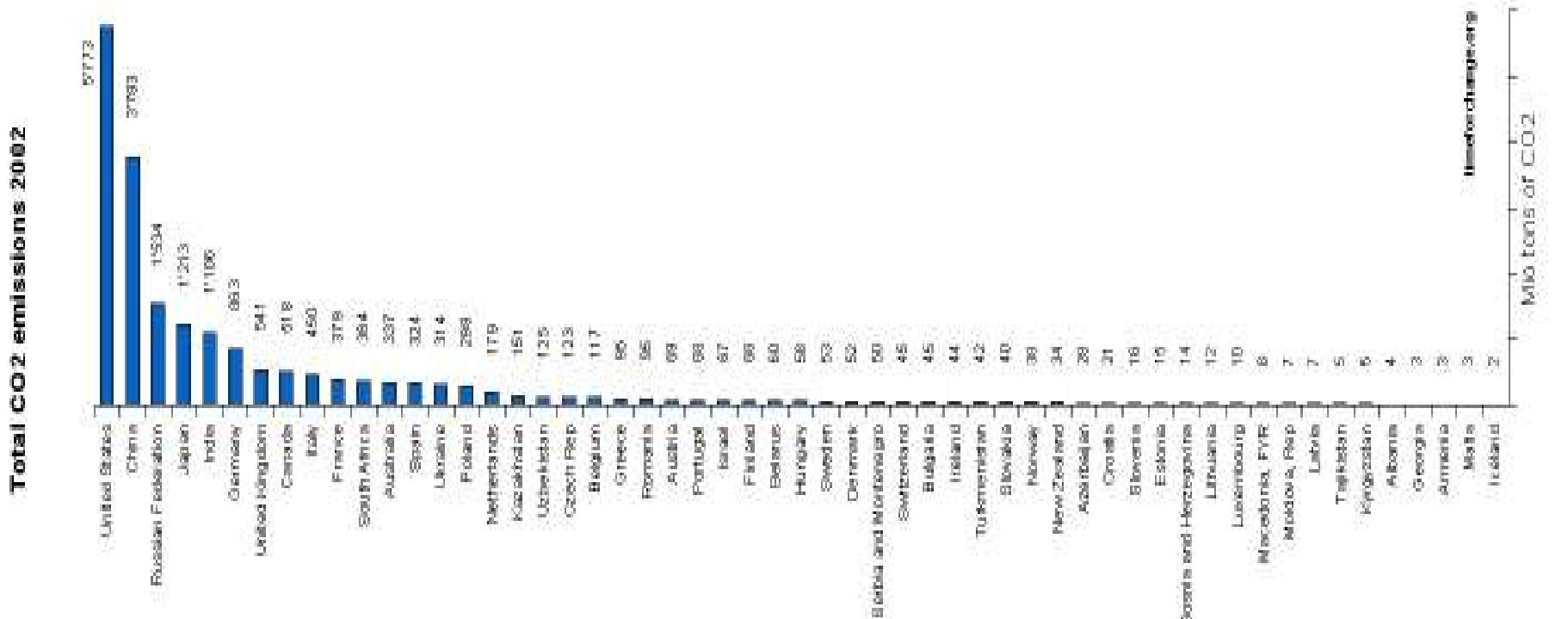
Sea Level Rises Impacts on Present Agricultural Areas



Expected sea level increase 21st Century: ~ 1.2 meter
Dark Blue Florida + 5 meter, unavoidable without action. Light Blue, Florida + 10 meter, avoidable with action

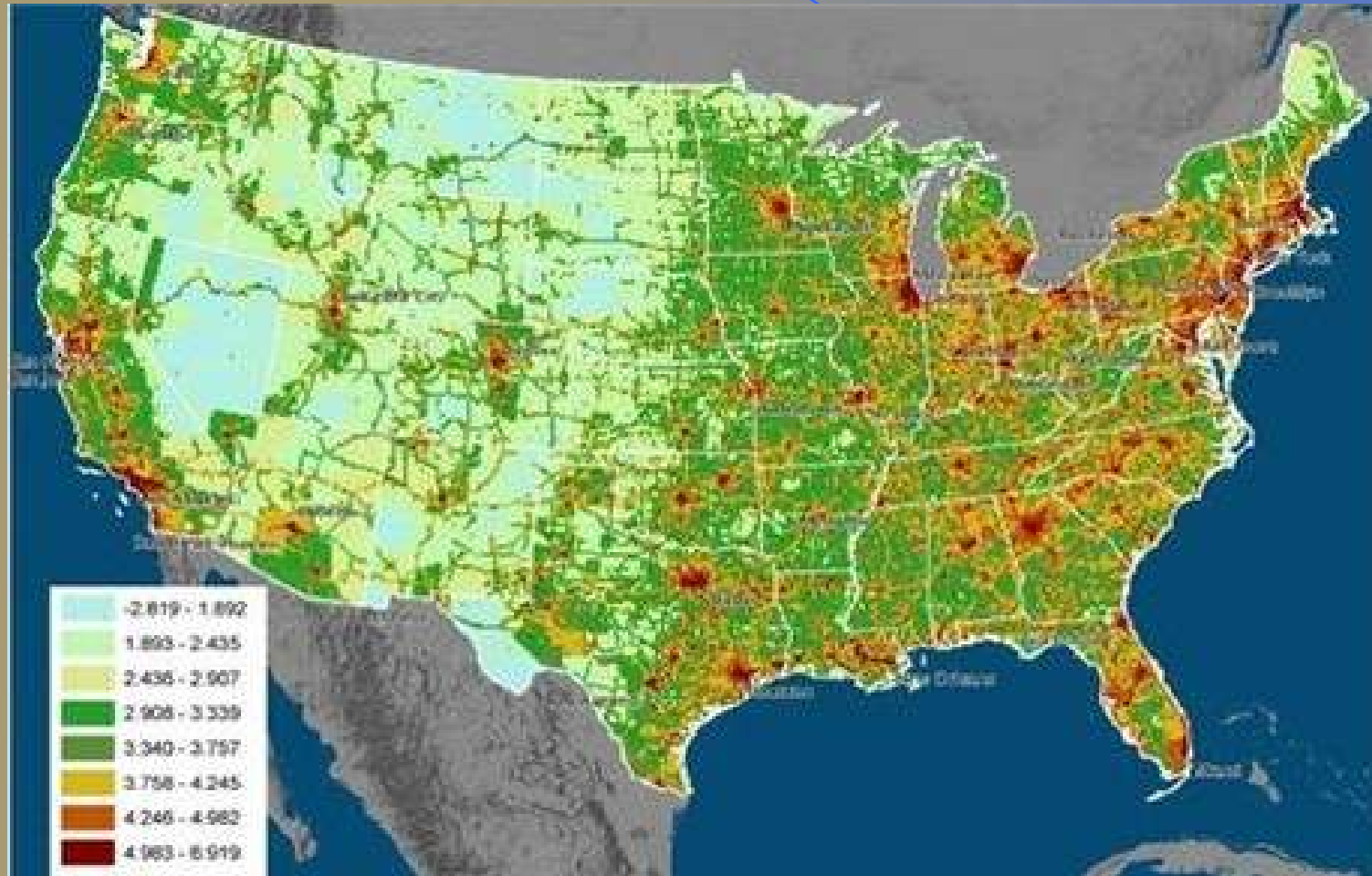
Total C Footprint by Country (2002)

- The USA carbon footprint is the highest in the world



World Resources Institute (WRI).
<http://www.wri.org/>

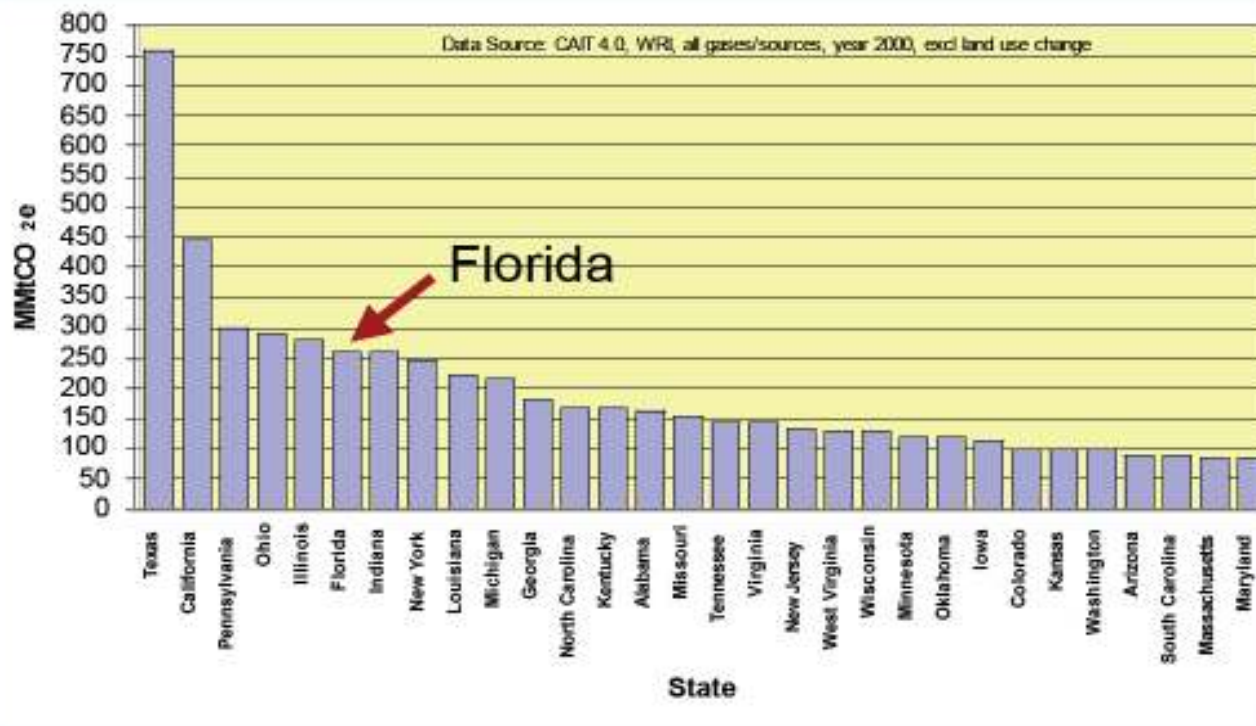
Map of Total C Emissions Inventories In the USA



<http://www.environmentalleader.com/2008/04/13/new-co2-maps-offer-unprecedented-detail/>

Florida's Relative Total C Footprint

Florida emissions among US states



Overall, Florida ranks 6th among the states in total CO₂ emissions

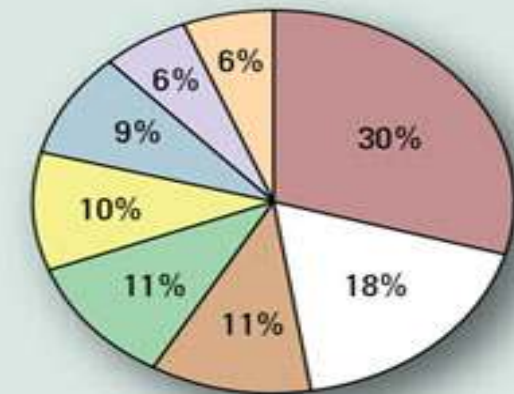
Sarasota County Food System Carbon Footprint Factors

- Number of miles your food travels from farm to plate
- Other factors:
 - how is your food produced?
 - what are your food category choices?

Statistics of Average U.S. Food Carbon Footprint Per Household

- **Amount**
 - 8.1 metric tons of greenhouse gases annually from food consumption choices
- **Sources**
 - Food industry
 - √ transportation - 11%
 - √ conventional production & harvesting - 83%
 - √ final delivery from producer to retail – 4%
 - Food types are different – see chart

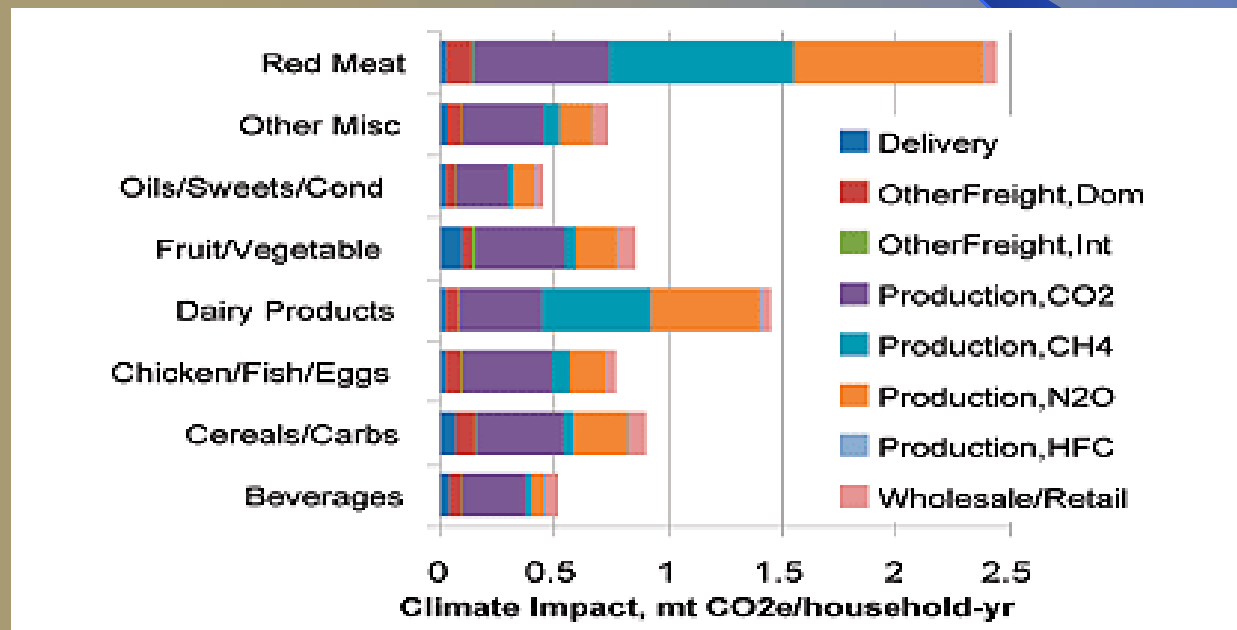
Greenhouse Gases from Food



Weber, C. and H. Matthews. 2008. Food-Miles and the Relative Climate Impacts of Food Choices in the United States *Environ. Sci. Technol.*, 42 (10): 3508–3513
<http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/2008/42/i10/abs/es702969f.html>

Food Carbon Footprint Analysis

Different Greenhouse Gases from Different Food Groups



Weber, C. and H. Matthews. 2008. Food-Miles and the Relative Climate Impacts of Food Choices in the United States *Environ. Sci. Technol.*, 42 (10): 3508–3513
<http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/2008/42/i10/abs/es702969f.html>

Statistics of Average U.S. Food Carbon Footprint Per Household

- What are the conclusions of the food carbon footprint facts from this report?
 - Are food miles the greatest factor?
 - No!
 - Purchasing local foods is only a partial solution.
 - What is the greatest factor?
 - How the food is produced!
 - Purchasing foods that are produced using sustainable and organic agriculture practices is a better solution.
- What's the best solution?
 - Purchase local, organic foods!
 - Choose food categories with reduced total footprints.

Food Carbon Footprint Analysis

How Is It Done?

- Calculated at the Food System Level
- In other words, the Analysis of the Who, What, Where, When, Why and How of Our Food Gets From the Farm to Our Plate



EarthFriends. 1995. The Whole Story of Food

Food Carbon Footprint Analysis

Cheese Example

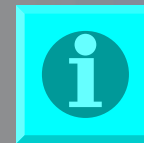
Calculate the carbon & equivalent gas emissions at each stage:

1. Factories manufacturing fertilizer use a fuel-intensive process that emits CO₂
2. Excess fertilizer applied to fields produces nitrous oxide, which has 296 times the warming potential as CO₂
3. Corn, used for feeding cows, is harvested, processed, trucked and stored, all of which use CO₂-emitting equipment
4. A cow belches annually 145 pounds of methane, which has 23 times the warming potential of CO₂
5. Refrigeration, production and packaging of cheese use CO₂-emitting equipment
6. Transporting the cheese requires refrigeration equipment as well as vehicles that emit CO₂
7. At the supermarket, the cheese is displayed in CO₂-emitting containers
8. Consumers travel to food stores and then go home and store the cheese in a refrigerator, and both activities emit CO₂
9. Cheese that is thrown out gets to a landfill which generates methane and CO₂

K. Weiss. April 22, 2008. Treading Lighter With Low Carbon Diets. Los Angeles Times
<http://articles.latimes.com/2008/apr/22/local/me-lowcarbon22>

Food Carbon Footprint Analysis

Cheeseburger Example



- View the Video -

Go to the webpage:

http://www.openthefuture.com/2008/02/cheeseburger_footprint_the_vid.html

- Estimates for the average American diet range from one to three per week, or about 50 to 150 per year.
- Annual greenhouse gas emissions from the production and consumption of cheeseburgers is estimated as the amount emitted by 6.5 million to 19.6 million SUVs. Today 16 million SUVs are on US roads.

Carbon Facts	
Product Size 1 Cheeseburger (130g)	
<hr/>	
Amount Per Serving	
Kilograms CO₂ Equivalent 3.08	
Kilograms CO ₂	243
Kilograms CH ₄	123
<hr/>	
Total C: Energy Sources	243g
<i>Transportation</i>	
Fossil Fuel (Diesel)	120g
Fossil Fuel (Gasoline)	48g
<i>Electricity Production</i>	
Fossil Fuel (Natural Gas)	75g
Fossil Fuel (Coal)	0g
<i>Other</i>	
<hr/>	
Total C: Non-Energy Sources	2840g CO₂E
Enteric Fermentation	81.0g (1864g CO ₂ E)
Manure	25.8g (856g CO ₂ E)
Other	5.2g (120g CO ₂ E)
<hr/>	
Carbon/Product Ratio	23.7
<hr/>	
Localism Rating	C+
Sustainable Production Rating	D+
<hr/>	
overall carbon code: orange	
<hr/>	

http://www.openthefuture.com/cheeseburger_CF.html

Conventional Animal Agribusiness Food Carbon Footprint Factors

- Animal agriculture sector accounts for approximately 9% of total CO₂ emissions, which are primarily the result of fertilizer production for feed crops, on-farm energy expenditures, feed transport, animal product processing and transport, and land use changes
- Escalating farm animal populations—in large, confined operations, in particular—have significantly increased methane emissions from both animals and their manure

Koneswaran & Nierenberg, 2008, Global Farm Animal Production & Global Warming, Env. Health Perspectives May 2008

<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2367646>

Conventional Animal Agribusiness Food Carbon Footprint Factors

- Cattle confined in feedlots or in intensive confinement dairy operations are fed an unnatural diet of concentrated high-protein feed consisting of corn and soybeans. This diet may also lead to increased methane emissions
- Farm animal manure is the source of methane emissions & increases are attributed to trend toward housing dairy cows and pigs in larger facilities that typically use liquid manure management systems

Koneswaran & Nierenberg, 2008, Global Farm Animal Production & Global Warming, Env. Health Perspectives May 2008
<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2367646>

Supportive Analysis: Sarasota Ecological Footprint (2004)

<u>DEMAND</u> – Footprint per capita in Sarasota County	Global acres /capita	<u>SUPPLY</u> – Biocapacity per Sarasotan	Global acres /capita
Absorbing CO ² from fuel use	13.2	Land reserved for CO ²	0.2
Growing Crops	3.8 *	Cropland	0.1 *
Grazing Animals	0.5 *	Grazing Land	0.2 *
Harvesting Timber	3.0 *	Forest Area	0.5 *
Accommodating Roads, Houses & Infrastructure	1.1	Built-up Area	1.1
Fisheries	0.6 *	Fishing Area	0.1 *
TOTAL – biocapacity used (not including space for biodiversity)	22.2 (7.9 *) * = food system	TOTAL – existing biocapacity	2.1 (0.9 *) * = food system

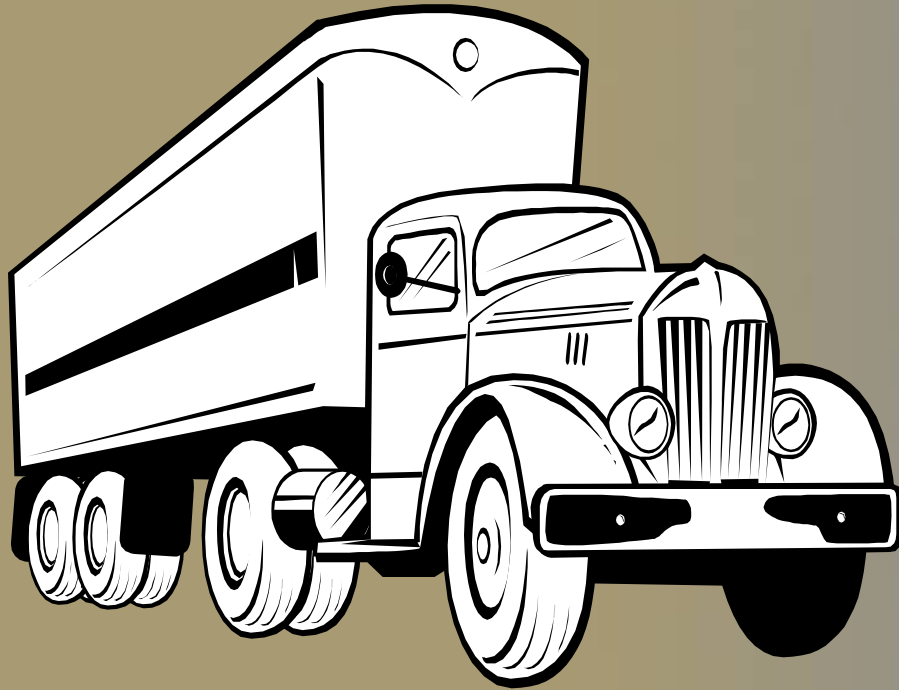
Sarasota Ecological Footprint: Food System Results & Recommendations

- 36% of required biocapacity is for our agriculture-based needs
- To provide for our county's food needs, each household would need to manage an 11 and 1/2 acre farm.
- Solutions:
 - Buy locally grown food
 - Eat more vegetables and grains and less meat
 - Buy sustainable agriculture produced food

Food Choice-Based Solutions

- Local Food System Development
- Sustainable Agriculture
- Local Ag Policies for Reduced Food-Based Carbon Emissions

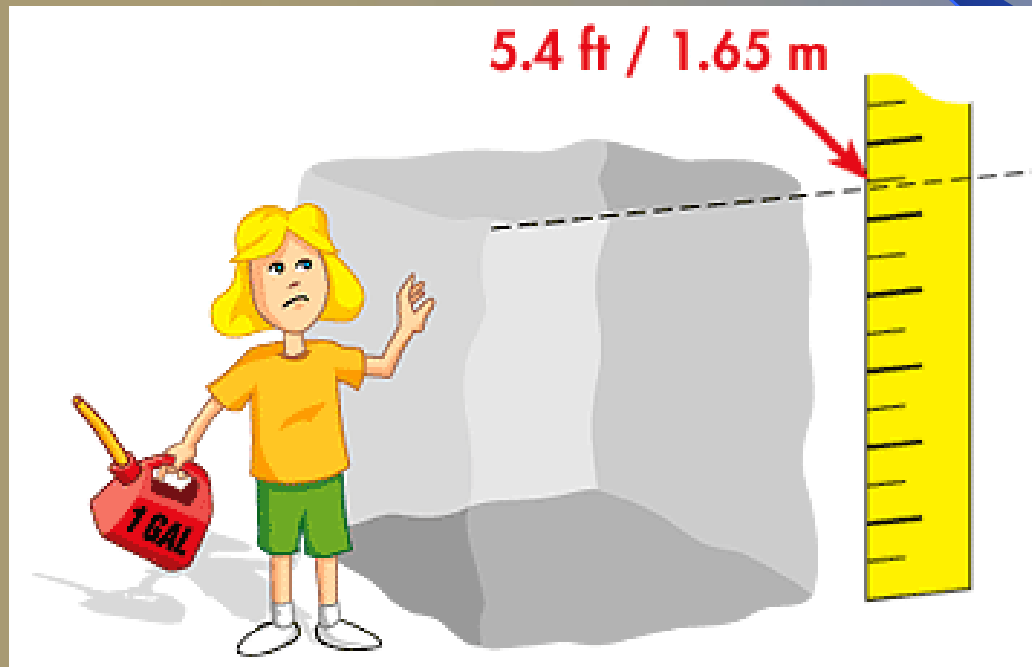
Current Food System



- Today in current food systems an average food item in the U.S. travels 1,500 miles * – up to 25% farther than in 1980
- Local food system development reduces the distance to approximately 56 miles

Shorter Food Mileage Means Less Fossil Fuel Usage

Gasoline is 85.5% carbon



1 gallon of conventional gasoline becomes
172 cubic feet / 4.87 cubic meters of CO₂

Current Food System and Energy

1 Can of Corn Example



- Energy required to produce, process, package & distribute is 6Xs the food energy contained in that corn
- Packaging alone uses more than 2Xs the energy of production
- Driving the corn home from the store and preparing it also uses more energy than production

Sustainable Local Food System

Healthy Food Production
Integrated into Community

The Goal:
Restore Steps
for Entire Food
System

Local Food
Distribution Channels

Compost
and other
products

Food Preparation and
Consumption
(Nutritious and Healthy)



How Do You Define Sustainable?

- **Recognition of the whole systems nature of food, feed, & fiber production**
- **Equitably balancing concerns of**
 - environmental soundness
 - social equity
 - economic viability
- **Functional interactions between agroecological & social/economic systems**

“How Do You Define Local?”

- Foods from a determined radius from your home (commonly either 100 or 250 miles) or

100 Mile Diet, <http://100milediet.org/>;
Food Routes, <http://www.foodroutes.org/>

- Within a day's leisurely drive of our homes or

Joan Dye Gussow. 2006. This Organic Life.

- Determined by the consumer with information about geographic origin of food.

Florida Association of Community Farmers' Markets (FACFM)

Solution Example: Local Sarasota Food Markets



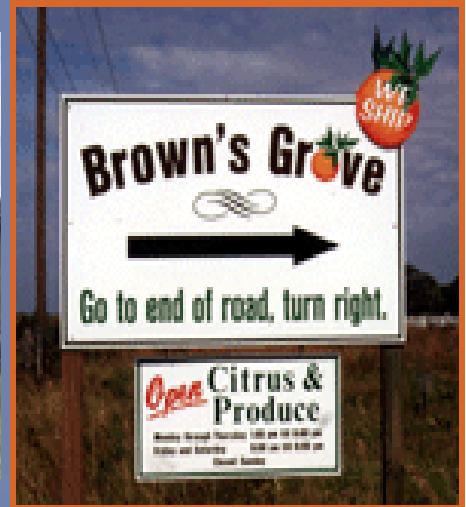
Farmers Markets:
Downtown Sarasota
Lakewood Ranch
Venice
Englewood
Siesta Key



Jessica's Organic Farm



Sarasota Farms



On-Farm Sales
& Community Supported Farms

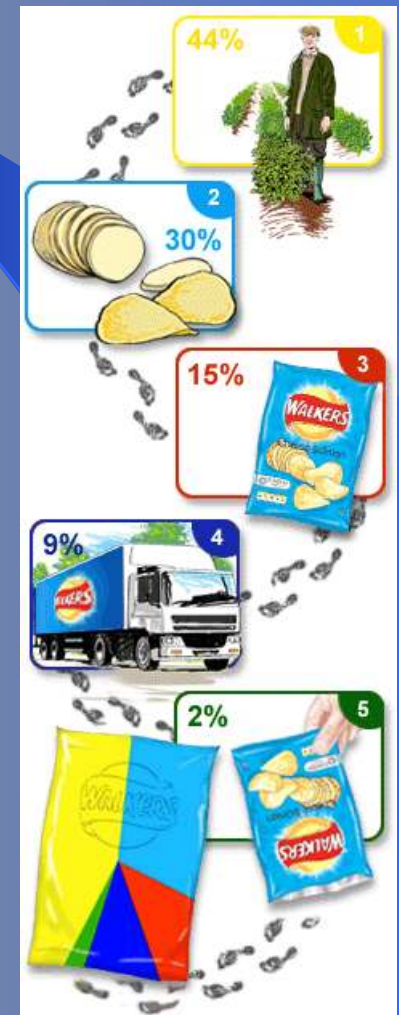
Solution Example: Consumer EcoLabels of Food Carbon Footprints



The final carbon footprint calculation is 75g for a bag of their chips.

- The flow-chart on this page shows exactly what percentage of our carbon footprint is calculated at each stage:
- **1:** Our raw materials: Potatoes, sunflowers and seasoning
- **2:** Manufacture: Producing crisps from potatoes
- **3:** Packaging our crisps
- **4:** Distribution: Bringing our crisps to you
- **5:** Disposal of the empty packs

http://www.walkerscarbonfootprint.co.uk/walkers_carbon_footprint.html



Solution Example: Institutional Local Food Purchase Policy

- **Bon Appetit food service company policy**
 - buy more food produced within 150 miles of where it's served
 - serve food that is seasonally available, e.g., tomato slices on burgers
 - substitute potato salad made with locally grown, organic potato and olive oil for cooked frozen french fries
 - buy meat or poultry, bottled water, vegetables & fruit only from North America, except tropical items

Ness, C. One Buger-Hold the Carbon, San Francisco Chronicle, April 18, 2007
<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/04/18/FDG0SP96IM1.DTL>

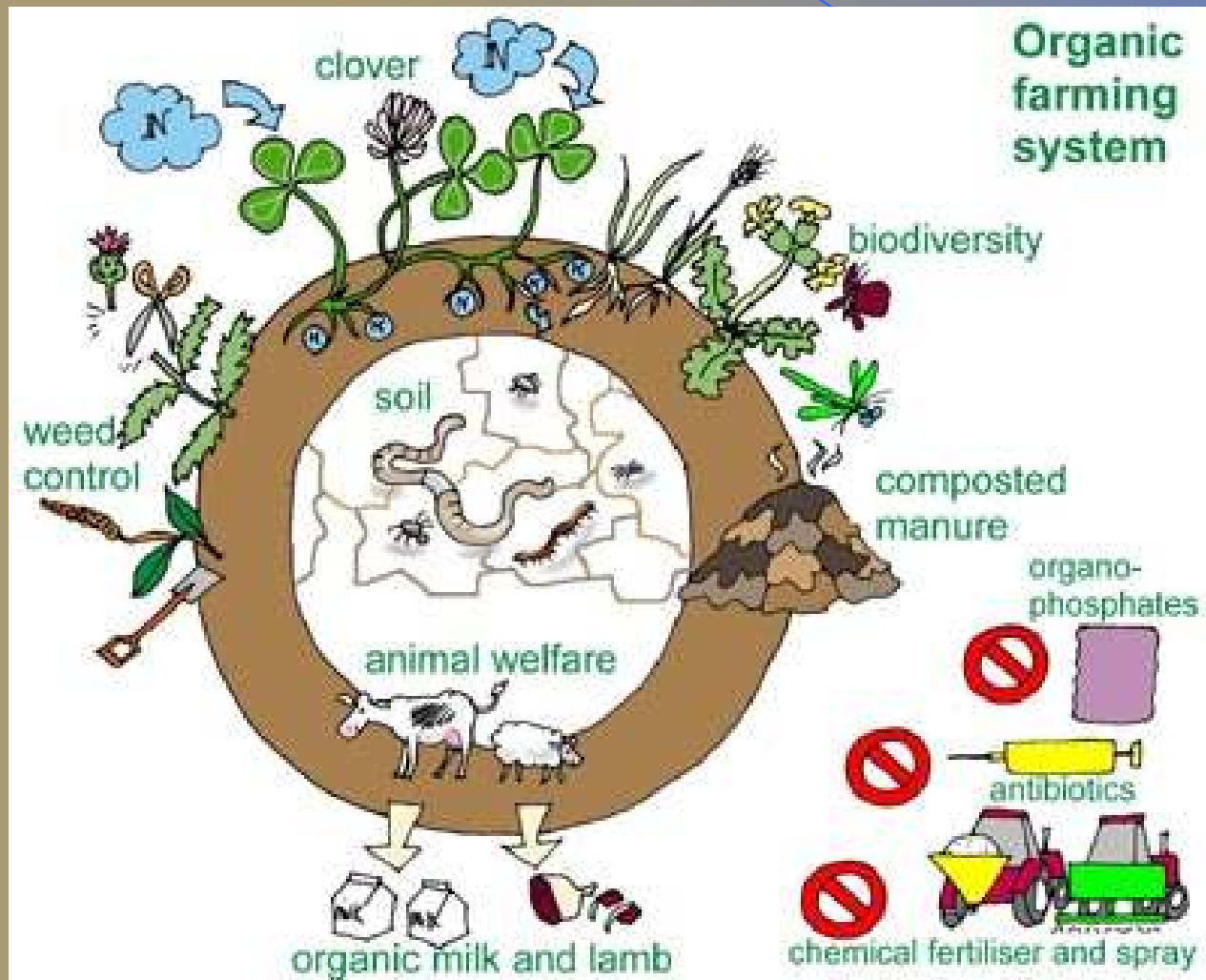
Food Choice-Based Solutions

Sustainable Agriculture

- **Satisfy human food and fiber needs**
- **Enhance environmental quality and the natural resource base**
- **Efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls**
- **Sustain the economic viability of farm operations**
- **Enhance the quality of life for farmers and society as a whole."**

Source: 1990 Farm Bill Definition

Sustainable Agriculture Example: Organic Farming & Foods



Organic Agriculture Food Carbon Footprint Factors

- **Organically managed soils can store (sequester) more than 1,000 pounds of carbon per acre, while non-organic systems can cause carbon loss ***
- **Organic farms have low outside inputs for fuel and soil amendments which reduce their carbon footprint**

* Rodale Institute, 2008

http://www.rodaleinstitute.org/global_warming

Food Choice-Based Solutions

Local Policy Initiatives

- **2006 New Agriculture Policies in Sarasota County Comprehensive Plan**
 - Sarasota Agriculture Policy Council (SAPC)
 - Provides broad community food system representation
 - Originator of recommendations that were adopted as 2006 Ag Policies
 - Based on promoting
 - sustainable agriculture
 - local food system development
 - farmland protection

Sarasota Ag Policy Opportunities

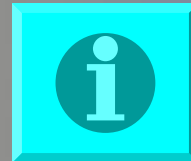
- **Sarasota County Comprehensive Plan Agriculture Policies**
 - Implementation is required
 - Join and participate in SAPC
 - Incentives need to be identified, such as market-driven, profitable approaches
- **Promote “Community Food System Assessment” for Expanded Carbon Emissions Inventory of Sarasota County**

Sarasota Ag Policy Opportunities

- **Woodbury County, Iowa, Model**
 - **County policy incentives to promote certified organic farming:**
 - property tax rebates (5 years)
 - local foods purchasing policy
 - View the video

Go to webpage:

http://web.mac.com/marqusee/Woodbury_Organics/Main.html



- Implement similar incentives for locally grown, organic foods in Sarasota County?



Food For Thought

- **“Eating is an agricultural act . . .”**
- **Wendell Berry**
- **“Eating is a political act . . .”**
– **Alice Waters**
- **Calculate you food carbon footprint on the website**

<http://www.foodcarbon.co.uk/index.html>

Food Carbon
Footprint Calculator

