

# Agriculture, Climate Change and Climate Change Mitigation

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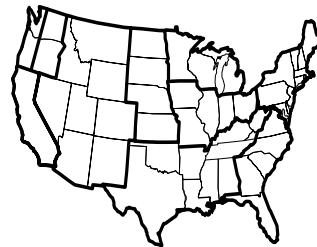
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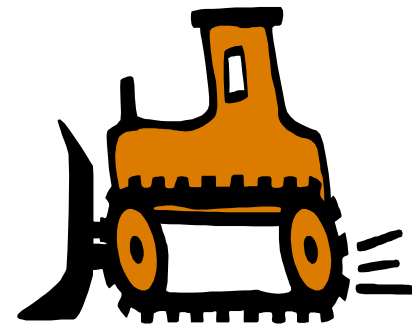
**Let's Avoid  
Climate Change**



**Mitigation**



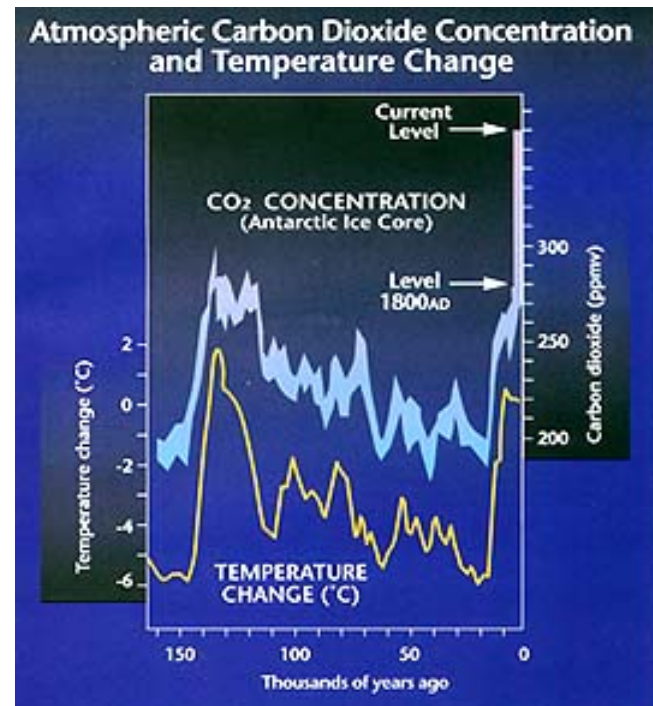
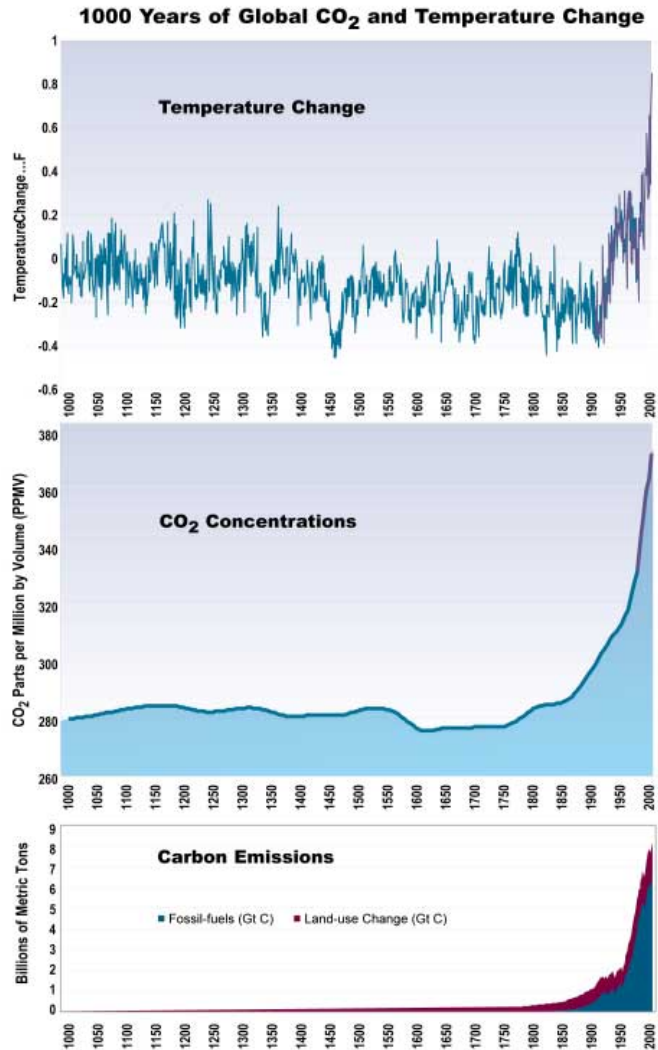
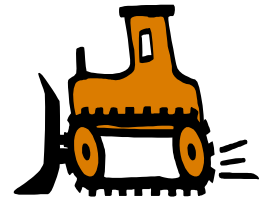
**Let's Let Climate  
Change Happen**



**Effects**

**Presented at Texas Recycling and Sustainability Summit  
San Antonio, Sept 29, 2004**

# Climate Change has in part a human cause

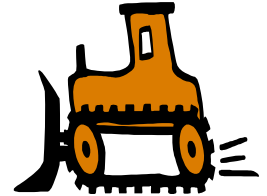
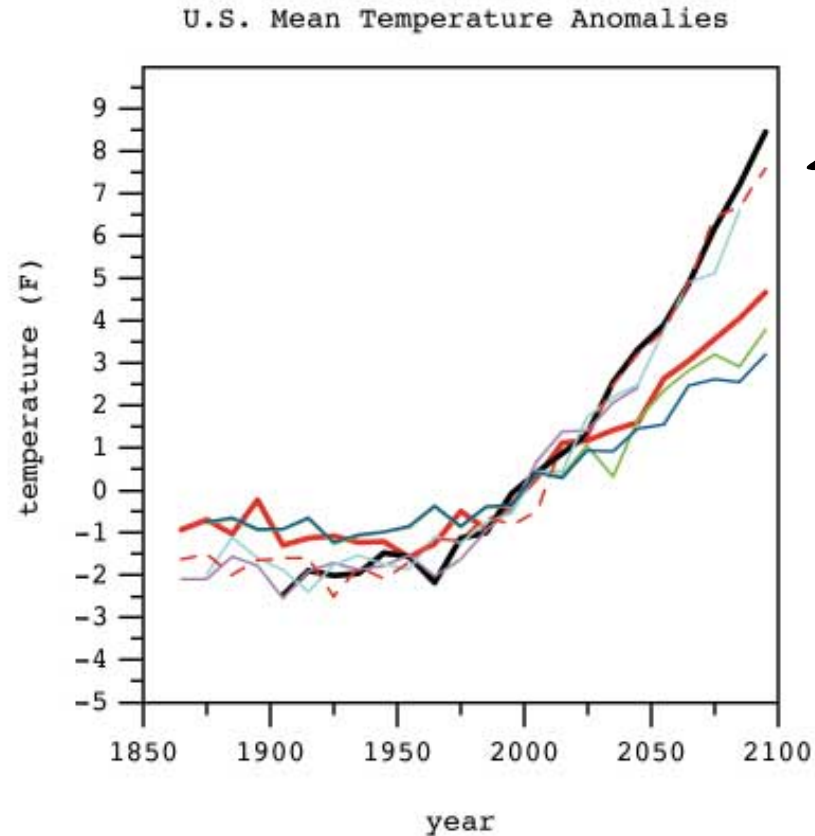


Source <http://ssca.usask.ca/2002conference/Bennett.htm>

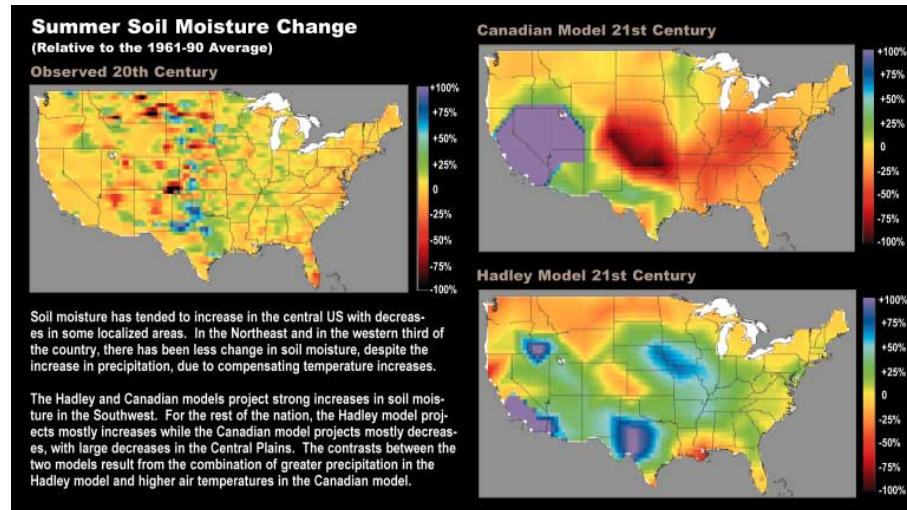
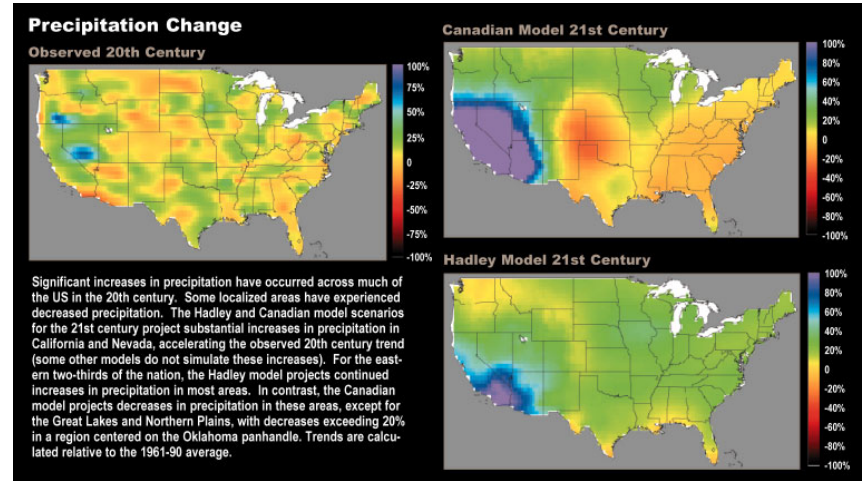
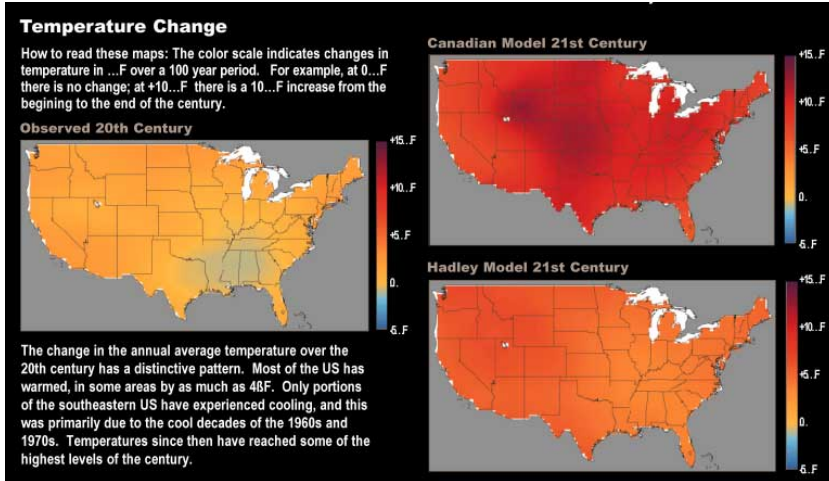
Source : U.S. National Assessment.

# Climate Change is projected to go on

Virtually all climate models predict increasing emissions will cause a temperature increase

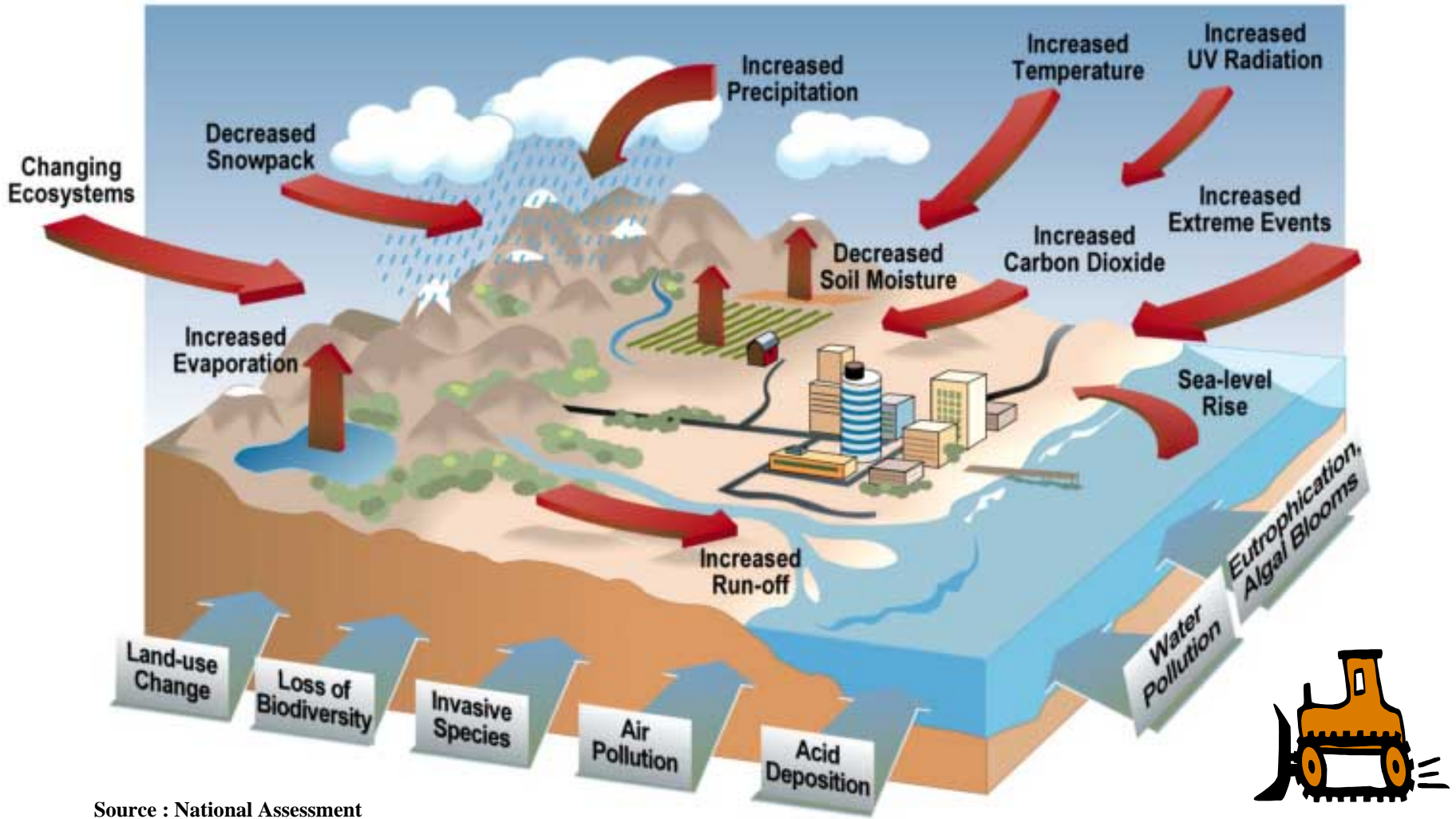


# Climate Change is projected to go on

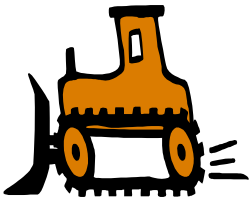


# Climate Change can be disruptive

## Multiple Stresses of a Changing Climate



Source : National Assessment



# Agricultural Effects to Consider

	Temp	Rainfall	CO2	SeaLevel	Extreme Events
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## Plants

Crop and forage growth	X	X	X		X
Crop /forage water need	X	X	X		X

## Soils

Soil moisture supply	X	X			X
Irrigation demand	X	X	X		X
Soil fertility	X	X	X		

## Animals

Performance	X	X			X
Pasture/Range Carry cap	X	X	X		X

## Irrigation Water Supply

Evaporation loss	X	X			X
Run-off/general supply	X	X			X
Non-AG competition	X	X	X		

## Other

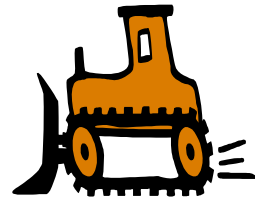
Water borne transport		X		X	X
Port facilities		X		X	X
Pest and diseases	X	X			
Insurance	X	X			X

# Methodology – Climate Change Assessment

<b>Climate Scenarios –</b>	<b>GCMs</b>
<b>Crop Simulation –</b>	<b>regional crop yields (dry and irrigated) regional irrigated crop water use</b>
<b>Hydrologic simulation –</b>	<b>irrigation water supply,</b>
<b>Expert opinion –</b>	<b>livestock performance,</b>
<b>Range and hay simulation and calculation --</b>	<b>livestock pasture usage, animal unit month grazing supply</b>
<b>Other studies –</b>	<b>international supply and demand</b>
<b>Regression –</b>	<b>pesticide usage</b>
<b>Economics –</b>	<b>ASM sector model</b>



# Percentage Changes in Crop Yield

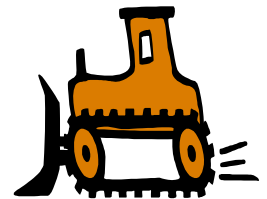
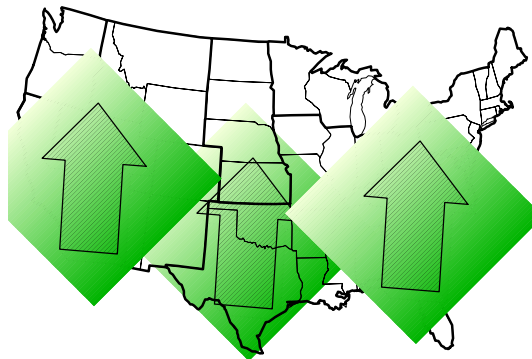


	Canadian		Hadley	
	2030	2090	2030	2090
Cotton Dry	+10%	+104%	+34%	+79%
Cotton Irr	+45%	+113%	+34%	+79%
Corn Dry	+19%	+ 23%	+17%	+34%
Corn Irr	- 1%	- 2%	+ 0%	+ 7%
Soybean Dry	+16%	+ 21%	+26%	+60%
Soybean Irr	+16%	+ 27%	+17%	+34%
Wheat Dry	-16%	+104%	+21%	+55%
Wheat Irr	- 4%	- 6%	+ 5%	+13%
Tomato Irr	-10%	- 22%	- 4%	- 9%
Oranges Irr	+32%	+ 99%	+40%	+69%
Hay Dry	-10%	- 1%	+ 2%	+15%
Hay Irr	+ 3%	+ 2%	+23%	+24%



# 2030 Regional Effects – Cropped Acreage

	Canadian	Hadley
Northeast	+ 3	+ 4
Lakestates	+63	+43
Cornbelt	+16	+14
Northplains	- 2	+18
Appalachia	-24	-25
Southeast	-60	-15
Delta	- 6	+25
South Plains	-24	- 7
Mountain	+30	+39
Pacific	+26	+47



# Climate Change Effects In Texas Regions

## Gainers

East Texas

Central Blacklands

Rolling Plains

South Texas

## Losers

High Plains

Edwards Plateau

Coastal Bend

TransPecos



# Some Findings - Climate Change Assessment

Climate change will not cause a food production disaster.  
Climatic alteration less than current range of temperatures

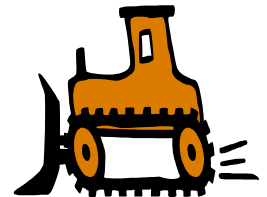
Regions can experience large changes in productive capacity  
and significant economic hardship.

Income reacts in opposite ways for consumers and producers.  
Less produced consumers' pay more, producers make more.

Producers can adapt crop mixes and practices

Effects are sensitive to CO<sub>2</sub> fertilization effect.

Pests problems and yield variability may be exacerbated.



# Extreme Events

Some suggest climatic change would make El Nino and La Nina increase in frequency and be stronger. From 1 year in 4 to 1 in 3

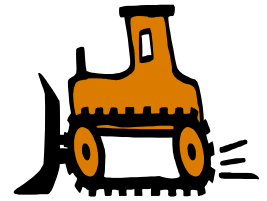
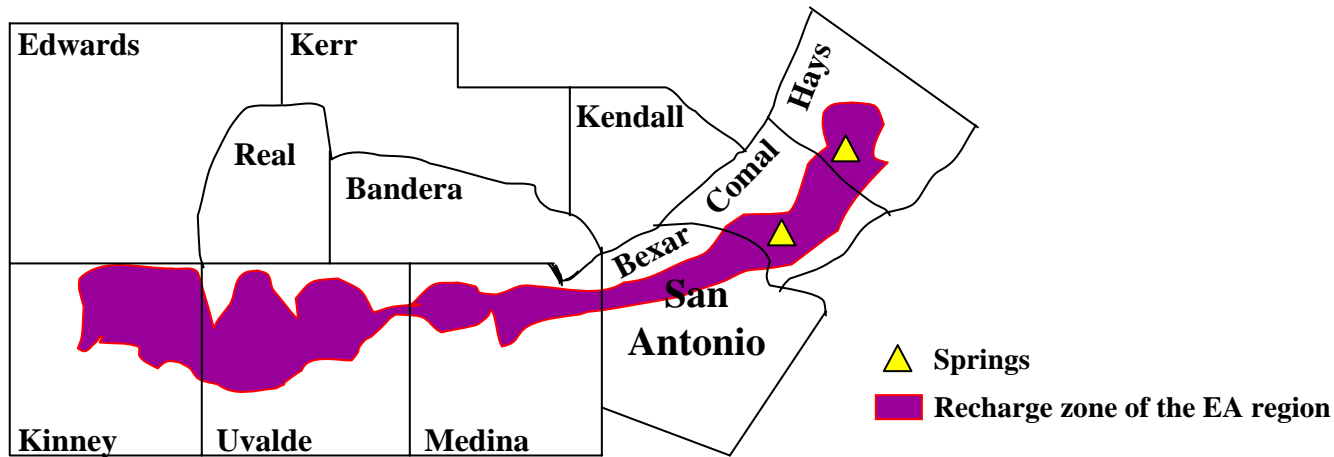
Agriculture loses - \$323 - \$414 mill under freq shift  
under freq and strength \$905 - \$1,008 million

Variability goes down

Losses as big as effects of climate change on the mean



# Edwards Aquifer Region



Water is the issue -- Less recharge, greater demand

Slightly neg welfare result in region but strong neg on the agricultural sector.

Ag water use declines while nonag water use increases.  
Springflow decreases.

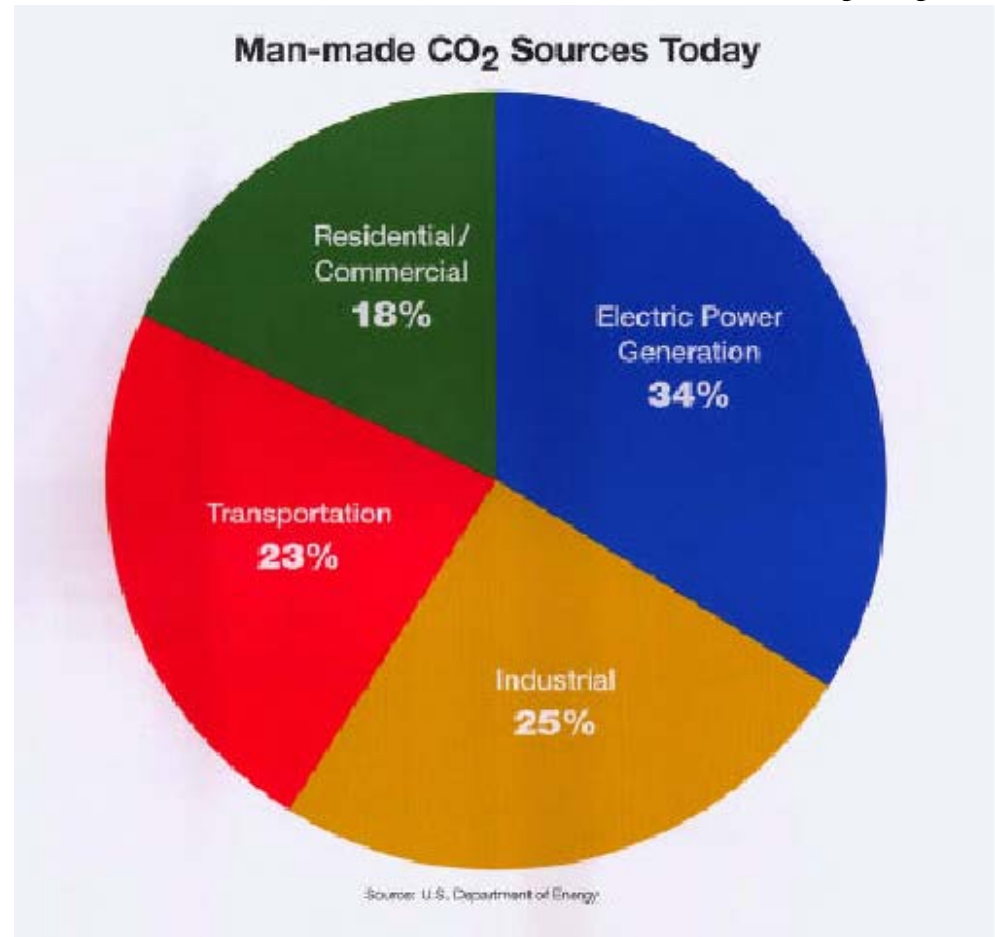
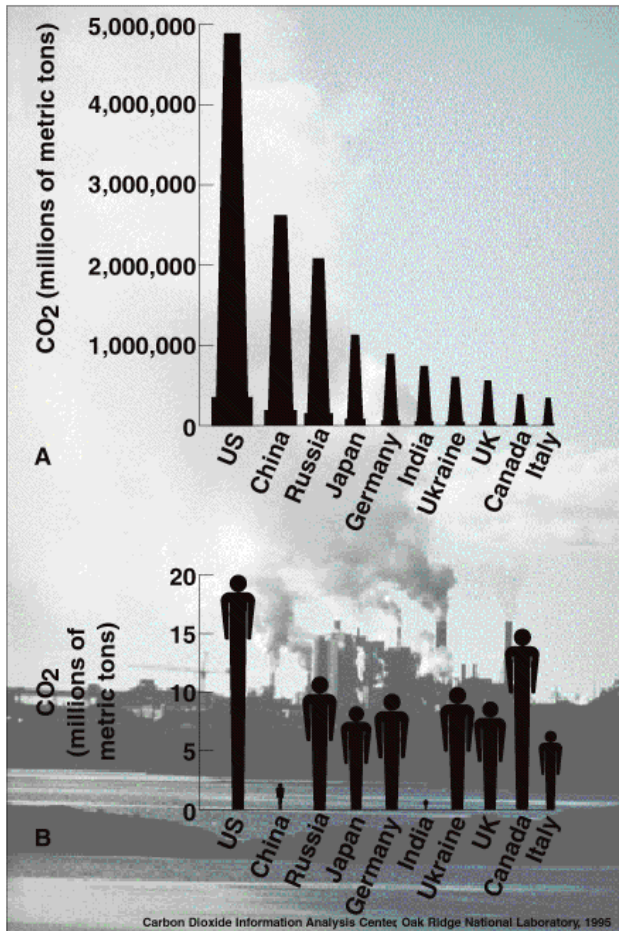
Maintaining ecology becomes more expensive.

# Do we have to passively allow climate change

Maybe not GHG emission control



Thompson and Turk: Earth Science and the Environment, 2/e  
Figure 18.16

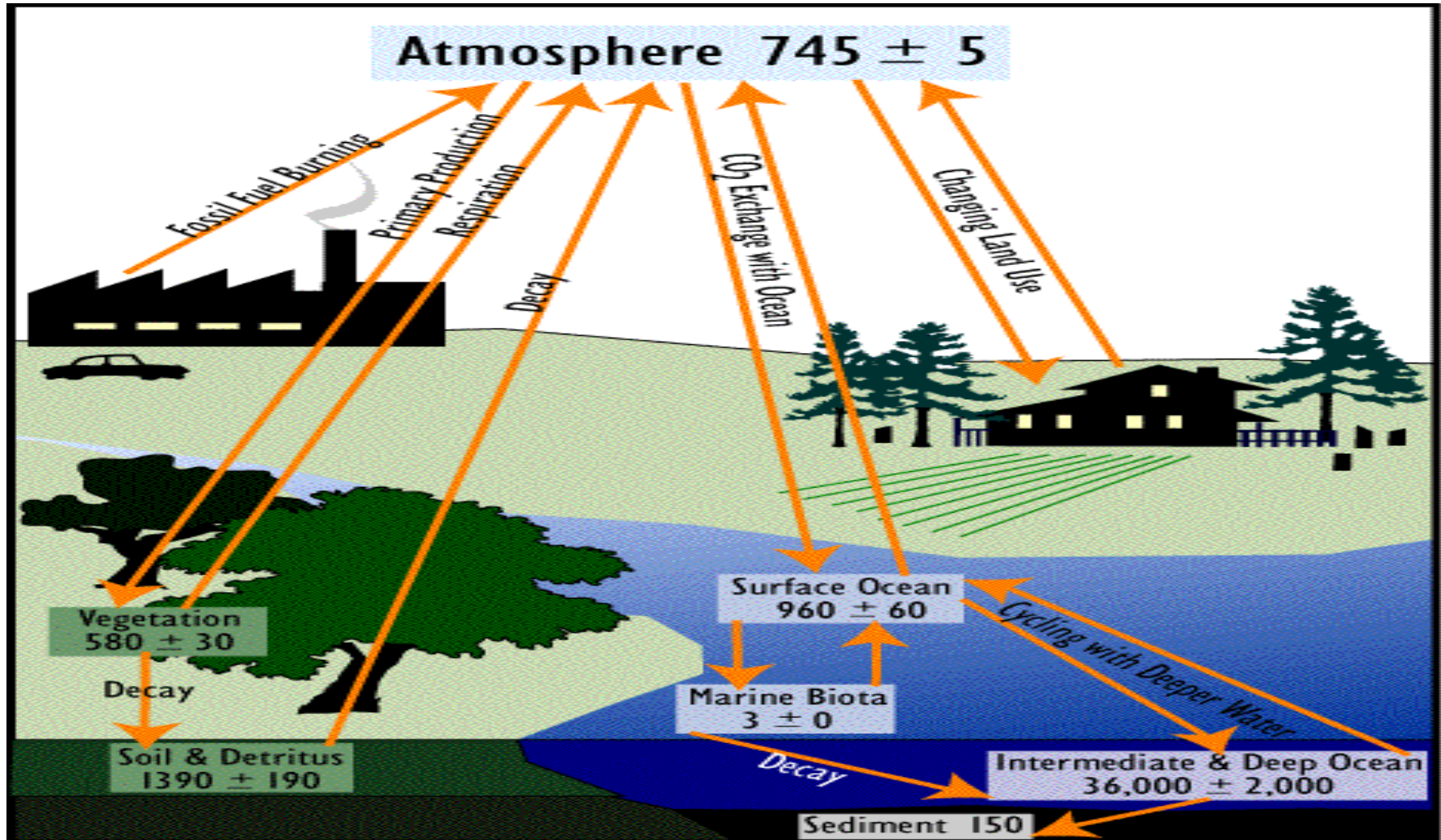


# Why Might We Mitigate?

- ❑ **Greenhouse gas forcing is causing climate change**
- ❑ **International agreements under UNFCCC - Kyoto Protocol**
- ❑ **International pressures for emission reduction**
- ❑ **Domestic policies at national or state level**
- ❑ **Industry planning under uncertainty**
- ❑ **Need for cheap emission offsets**
- ❑ **Congruence of programs with other agriculturally related societal desires such as farm income support and water quality protection**
- ❑ **Development of another market for farm products**



# Where does Ag and Forestry Come in?





# Role of Agriculture & Forestry in GHG Mitigation

- ❑ **Four agricultural and forestry roles w.r.t. GHG emission reductions**
  - **Emission reducers**
  - **A carbon or GHG sequestering sink**
  - **Offsetting net GHG emissions**
  - **Operating in a mitigating world**
  
- ❑ **The first place they will look is in the energy sector where 80% of the emissions come from.**
  
- ❑ **They will only come to the ag and forest sector if it is cheaper or otherwise attractive.**



# Ag and Forest GHG Mitigation Strategies

Strategy	Basic Nature	CO2	CH4	N2O
Crop Mix Alteration	Emis, Seq	X		X
Crop Fertilization Alteration	Emis, Seq	X		X
Crop Input Alteration	Emission	X		X
Crop Tillage Alteration	Emission	X		X
Grassland Conversion	Sequestration	X		
Irrigated /Dry land Mix	Emission	X		X
Biofuel Production	Offset	X	X	X
Paper Recycling	Offset	X	X	
Afforestation	Sequestration	X		
Existing timberland	Sequestration	X		
Deforestation	Emission	X		
Enteric fermentation	Emission		X	
Livestock Herd Size	Emission		X	X
Livestock System Change	Emission		X	X
Manure Management	Emission		X	X
Rice Acreage	Emission	X	X	X



The onset and exact effects of climate change  
are uncertain



Mitigation

Effects

But US & US Agriculture is Vulnerable  
And We will be squeezed

# Basic Resources

**Intergovernmental Panel on Climate Change. IPCC Third Assessment Report - Climate Change 2001: Impacts, Adaptation and Vulnerability, <http://www.ipcc.ch/>.**

**Intergovernmental Panel on Climate Change. IPCC Third Assessment Report - Climate Change 2001: Mitigation, <http://www.ipcc.ch/>.**

**Intergovernmental Panel on Climate Change. IPCC Third Assessment Report - The Scientific Basis, <http://www.ipcc.ch/>.**

**Intergovernmental Panel on Climate Change. IPCC Third Assessment Report – Synthesis Report, <http://www.ipcc.ch/>.**

**National Assessment Synthesis Team, US Global Change Research Program , Climate Change Impacts on the United States:*The Potential Consequences of Climate Variability and Change Overview: 2000* <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overview.htm>**

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**<http://agecon.tamu.edu/faculty/mccarl/papers.htm>**