

**I PRO 331**

Spring 2010

Global Warming Outreach  
Sustainability Motivation  
Carbon Sequestration

# Background

- Research of global warming started in 1990s.
- Earth's temperature had risen between 1890-1935 by a half a degree Celsius.
- According to IPCC, temperature could rise 3° -4° C.
- Many solutions are being developed from alternative fuels and climate engineering to sustainable building and method of sequestering carbon dioxide.

# Purpose

- Educate the public in the Chicagoland area about the causes, effects, and solutions to global warming
- Obtain metric representation of CO<sub>2</sub> absorption by grass and provide the information to the City of Chicago so they can use it to help make a “greener” city.
- To understand, and quantitatively represent, what drives and influences consumer interest to invest in sustainable energy technologies.

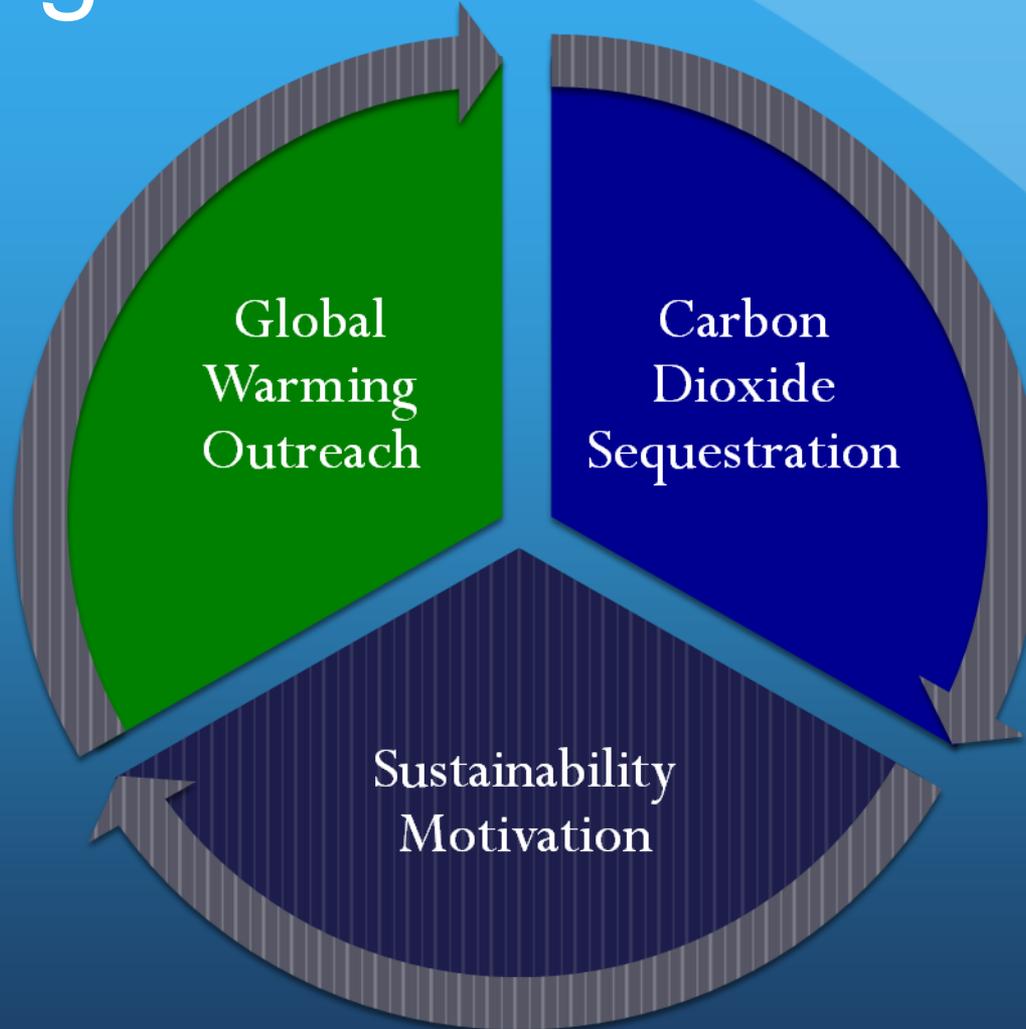
# Previous Work

- Provided a good foundation for presentation slides and brochure
- Focused on the four main topics: carbon dioxide and fossil fuels, consequences of global warming, alternative energies, and climate engineering
- Established some contacts for Spring 2010 semester



# Organization of the team

Arjun Jani  
Sapna Desai  
Kamil Bober  
Hashem Abu-Amara  
Haien Cho  
Daria Haznar  
Arturo Gonzalez



Anita Thomas  
Samantha Prokop  
Adam Jurczak

Hanna Pyrkh  
Chris Roberts

# Global Warming Outreach Objectives



- Update last semester's presentation to reflect current data
- Give a way for people with further questions to contact us
- Reach out to at least 1000 people
- Keep track of our progress throughout semester

# Team Approach



- Assigning roles to individual group members
- Splitting into three research groups
- Contacting schools and organizations around the Chicagoland area
- Analysis of presentation results

# Obstacles

- Communication between main group and emerging IPROs
- Finding reliable sources
- Finding contacts and scheduling meetings
- Organizing and coordinating presentations
- Scheduling and supplying transportation

# Survey

## Feedback Survey:

1. How informative did you find the presentation?

(Least) 1      2      3      4      5 (Most)

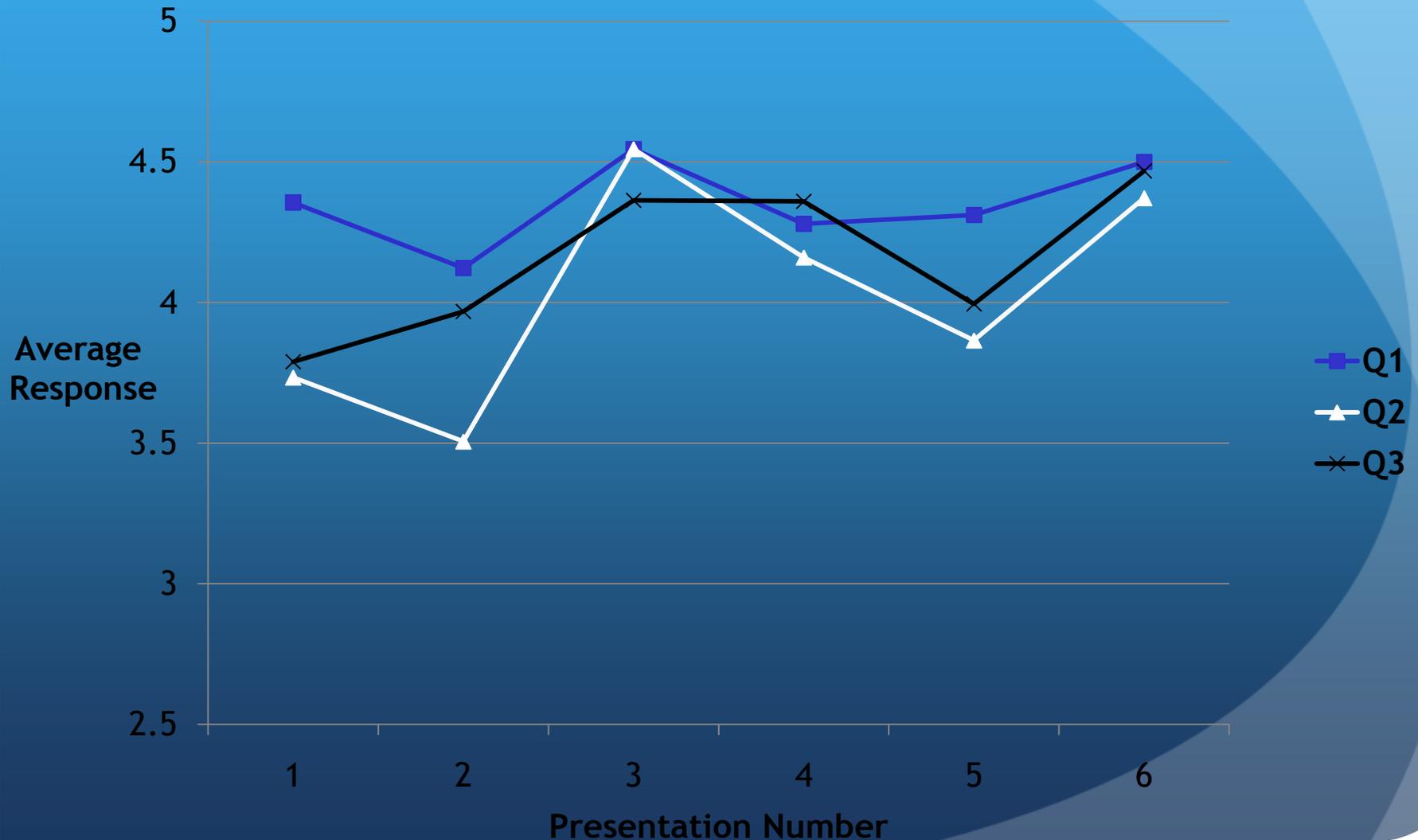
2. How interesting was the presentation style?

(Boring) 1      2      3      4      5 (Very  
interesting)

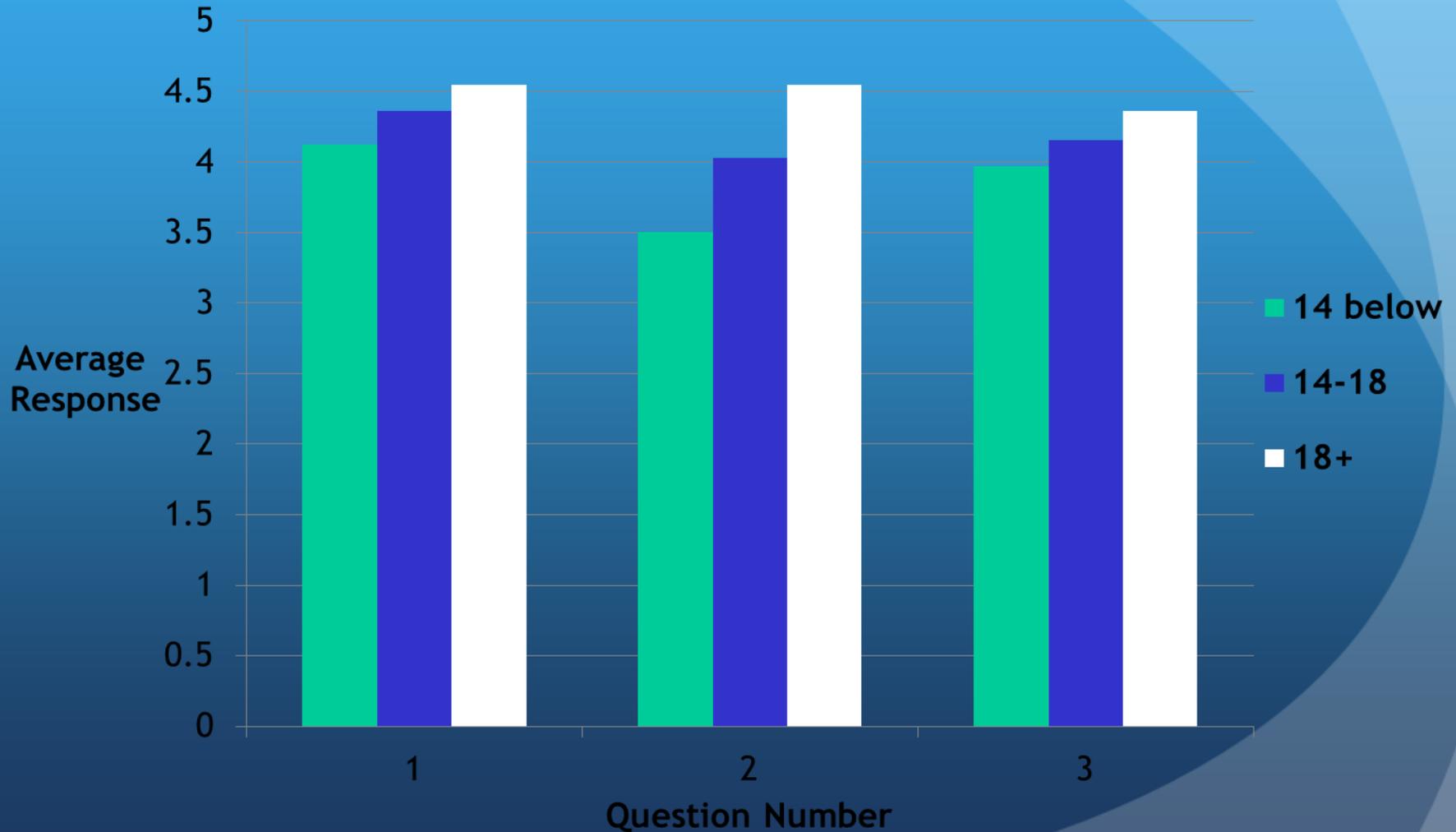
3. How much did the presentation increase your awareness  
of global warming?

(Least) 1      2      3      4      5 (Most)

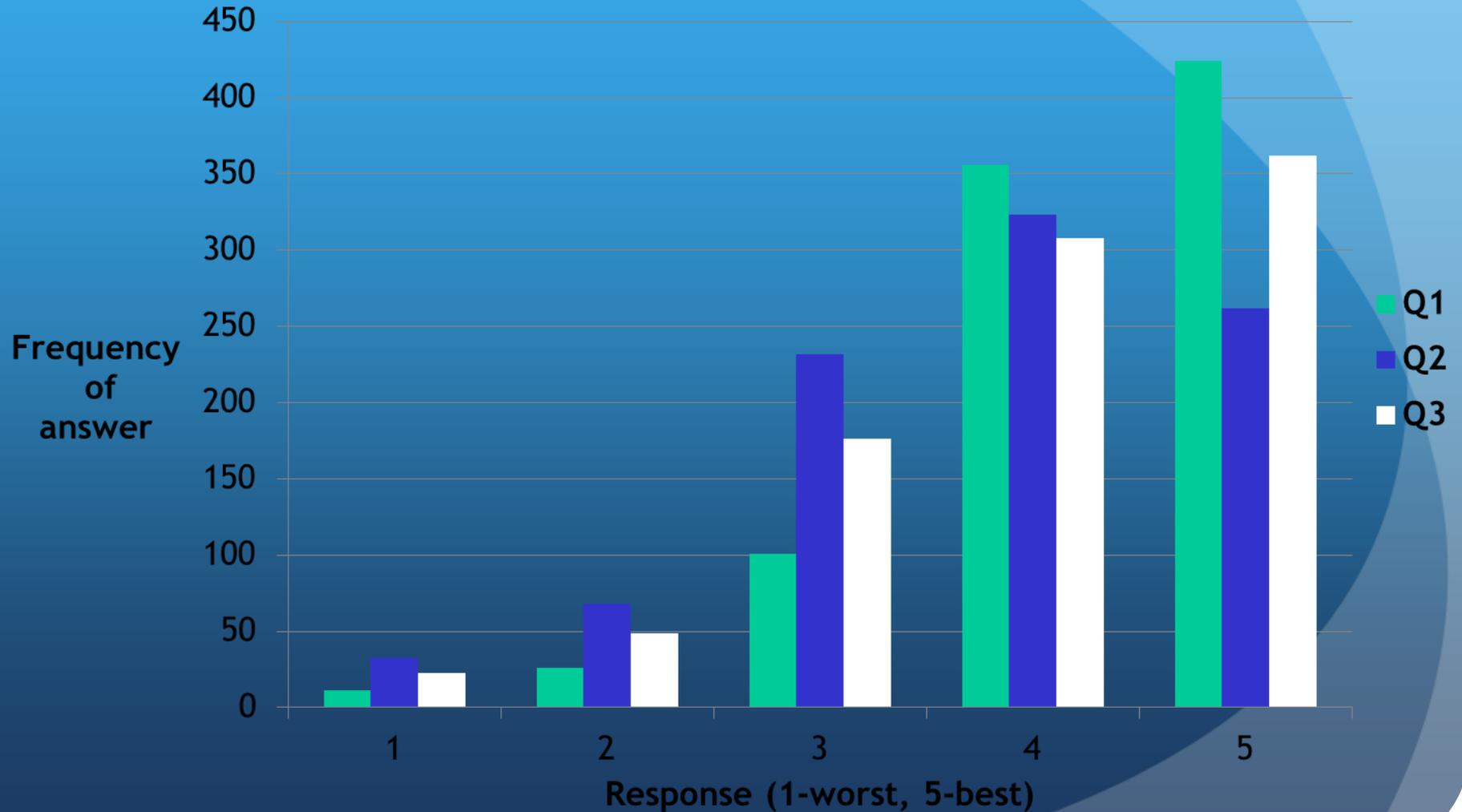
# Average Response to Questions as the Semester Progressed



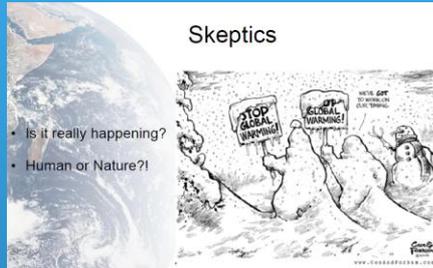
# Survey Results by Age



# Results



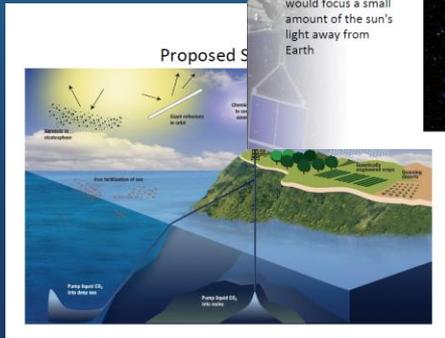
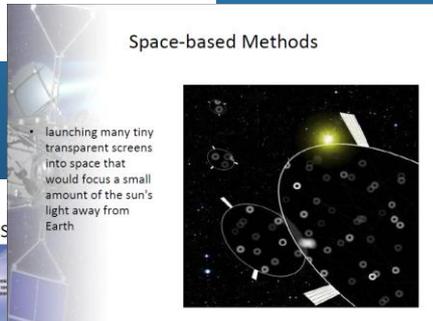
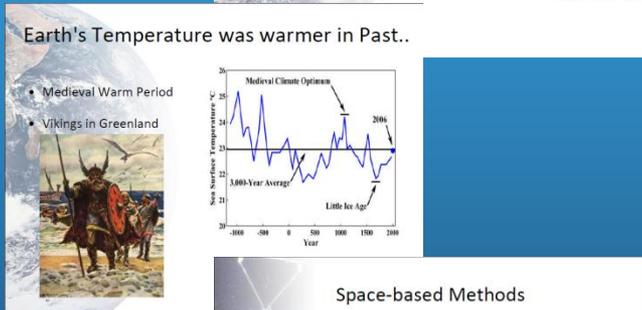
# Accomplishments



- Created Presentation

- Added new subtopic: Skeptics

- Updated climate engineering section



# Accomplishments

- Updated Brochure

## What Is Global Warming

The average surface temperature of earth has increased more than 1 degree Fahrenheit since 1900, but since 1970 the rate of Global Warming has increased threefold. Experts agree that human activities, mainly the release of greenhouse gases like carbon



dioxide from smokestacks, tailpipes, and burning forests, are probably the dominant force driving the trend.

## Effects of Global Warming

The consequences of global warming are the decrease in the Earth's snow and ice cover, which would increase the global absorption of solar radiation. This will significantly melt the land ice and raise sea levels. Average temperature in the Arctic is rising twice as fast as elsewhere in the world. In Alaska, temperatures have increased an average 3.0 degree Celsius between 1970 and 2000. This increase in temperature poses a threat to the ecosystems in the polar regions. Species such as the polar bears are facing endangerment because the ice is melting their habitat. The Gulf Stream that bathes Britain and northern Europe in warm waters from the tropics has weakened dramatically in recent years, a consequence of global warming that could trigger more severe winters and cooler summers across the region, scientists warn today.



## Climate Engineering

Climate engineering involves proposals to deliberately manipulate the Earth's climate to counteract the effect of Global Warming from Greenhouse Gas emissions. Proposals of this sort include ideas such as carbon dioxide capture from the atmosphere and methods of solar radiation management such as stratospheric aerosols. Climate engineering is the cutting edge of climate research and development and is still in very early stages. It will take many years for any of these proposals to get implemented but they will be the subject of massive research in coming years. While such approaches could be effective, it is very important to note that the potential of climate engineering should not divert efforts from reducing carbon emissions overall.



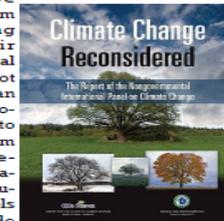
## Alternative Energy

There are many alternative fuels which can be used to obtain energy. Using crops high in cellulose, sugar or vegetable oil can form biofuels which create less CO<sub>2</sub> and get better gas mileage. Nuclear fission is a resource that can be utilized to obtain emission free energy. Nuclear fission entails the act of splitting atoms to releases large amounts of energy. While nuclear energy is a great resource, its main pitfall is the disposal of radioactive waste. Other forms of energy—such as wind and solar energy function without fuel. Wind energy is also emission-free and government subsidies are available for its use. Solar energy converts radiant energy from the Sun (the main source of energy for our planet) into useable energy.



## The Skeptics

Skeptics have been around from the beginning making their claims that Global Warming is not caused by human activity. They provide evidence to support the claim that measurements of temperature are not accurate and models do not provide reliable projections of future climate change. Other evidence for the view of skeptics is that Earth's temperature was warmer in the past and today there are regional variations in climate change. They believe increases in CO<sub>2</sub> do not cause global warming, and the effects of CO<sub>2</sub> can be more beneficial than harmful.



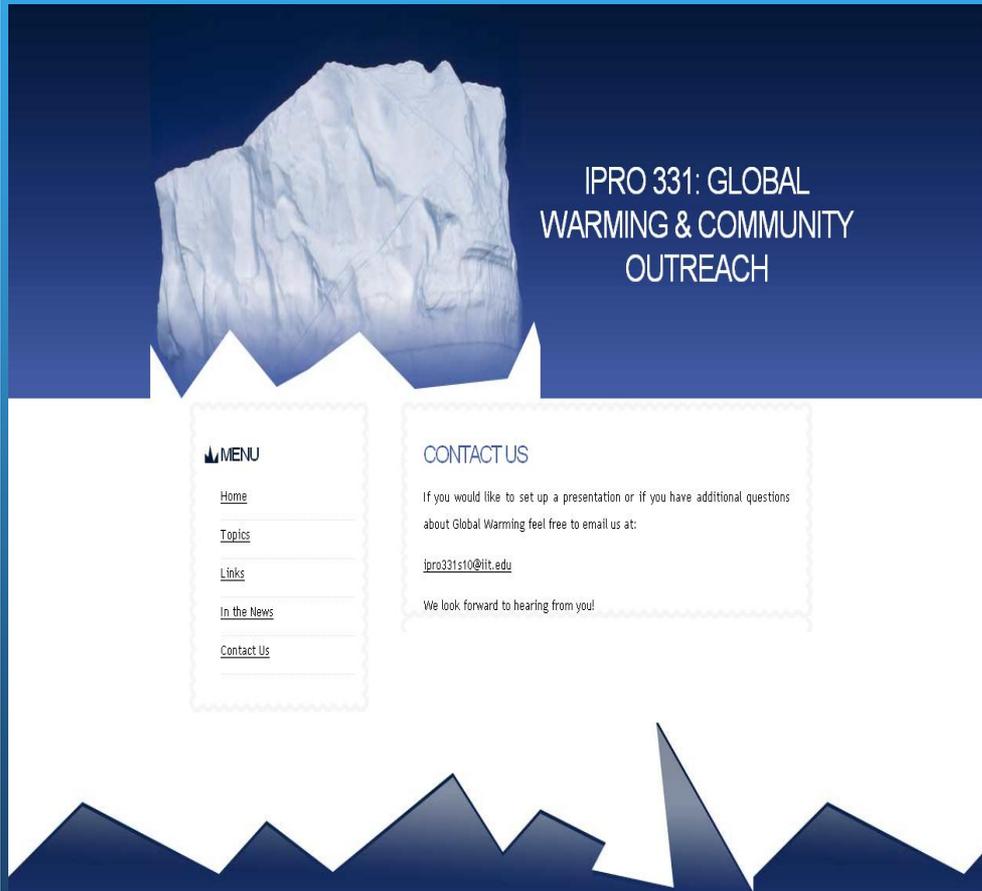
## What should we do?

Whether or not global warming is caused by human activity, developing new energy sources and becoming more efficient is still crucial. For example, the amount of fossil fuels is quickly declining and prices of non-renewable energy sources are increasing. Some ways to become more efficient are to reduce the use of electricity by unplugging unused electronics and switching to compact fluorescent light bulbs.

If you would like to learn more ways you could help out or are just interested in learning more about Global Warming, visit our website at:

<http://www.iit.edu/~ipro331s09/>

# Accomplishments



- Created Website and Email Address
- Incorporated Illinois State Education goals in our presentation style
- Presented to 918 people!

# Future Plans



- Keep presentation updated
- Make presentation more interactive
- Create multiple versions of presentation to suite different age groups
- Start getting contacts early

# Sustainability Motivation

Hanna Pyrkh and Chris Roberts

- Objectives

- Understand what drives and influences consumers who invest in sustainable energy technologies
- Find what information sources consumers rely upon when making decisions

- Considerations

- Environmental
- Financial
- Social

# Ethics

- Team ethics
  - Accountability
  - Communication
  - Cooperation
- Research ethics
  - IRB approval
  - Confidentiality
  - Attribution of sources (No Plagiarism!)

# Obstacles

- Vague initial goals
- Starting from scratch: No history to work with.
- Large scope, small team: What to focus on?
- Research
  - IRB approval
  - Getting enough responses
  - Interpreting subjective results

# Achievements

- Interview highlights
  - Scott Krone
    - Adjunct Assistant Professor at IIT College of Architecture and Co-founder of sustainable architecture & construction firm CODA
  - Thomas McGrath
    - Owner of Elemental Building and the sustainably built, solar powered “Greenest Garage in Chicago”
  - Marko Spiegel
    - Engineer and founder of Conservation Technology International, specializing in German “passive house” design.
  - Debbie Insana
    - Housing developer offering passive solar and photovoltaic panels

# Achievements

## 3. Motivation



\* 1. What motivated you to purchase alternative energy technology?

2. Do you recycle?

No

Yes

3. How environmentally active are you?

If you are a member of energy or sustainability related organizations, please list which ones.

Examples include Sierra Club, Greenpeace, and Republicans for Environmental Protection.

4. What is the estimated value of your home?

Before and after purchasing energy-efficient technology.

5. How long will your investment in energy efficiency take to pay for itself (through savings and/or incentives)?

\* 6. Please rate the following in terms of their importance to you when investing in alternative energy.

	Most important	Second	Third
Conserving natural resources	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Saving money	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental activism	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Prev

Next

- Survey is developed
  - Residence Questions
  - Government Incentives
  - Motivation Questions
  - General Questions

# Results & Conclusions

- **Motivation**

  - Environmental awareness

    - Setting community example, marketing sustainable business

  - Saving money

    - Short and long term savings, government incentives

  - Conserving natural resources

    - Renewable energy, increased efficiency, less carbon emissions

- **Information**

  - Non-profit organizations

    - Illinois Solar Energy Association, U.S. Green Building Council, Midwest Renewable Energy Association

# Looking to the Future

- Continued development of the survey
- Widen the scope of interviews
- Increase industry and business contacts
- Completion of NIH research training by every participant of the IPRO and renewal of IRB certification

# Objectives

(spring 2010)

- Create experimental design to determine metric representation of CO<sub>2</sub> absorption by grass
  - Urban setting
- Create base for potential standalone IPRO

# Team Organization

(Equal Responsibility)

**Samantha**

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**Adam**

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**Anita**

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- Time Manager/Agenda Maker/Time Keeper
- Format Manager
- Contacts Manager
- Writer

- IPRO Office Correspondence
- Budget Manager
- Research Manager
- Contacts Manager
- Writer
- iGroups Moderator

- Contacts Manager
- Recorder/Minute Taker
- Writer
- Proofreader

# Approach

- Research past studies
- Literature survey: Trees
- Determine which grasses/trees flourish in Berwin
- Contact experts
  - Morton Arboretum
  - Nature Conservancy
  - Chicago Botanic Garden
- Experimental design - test turf lawn's ability to absorb CO<sub>2</sub>

# Obstacles

- Three person team
- No history
- Limited access to grass due to weather

# Background

IPCC: Intergovernmental Panel on Climate Change

NIPCC: Nongovernmental International Panel on Climate Change

## Agreement:

- Atmospheric CO<sub>2</sub> content has increased since Industrial Revolution
- CO<sub>2</sub> increase largely result of burning fossil fuels.
- Global average temp risen since 1850
- Programs to counter increasing CO<sub>2</sub> have become prevalent

# Inspiration

## Volkswagen Blue Motion Program

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- Buy a car → offset emissions with trees
- Carbonfund and VW will plant 250,000
- Lower Mississippi Alluvial Valley

## Village of Arlington Heights Energy Efficiency Conservation Strategy

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- Optimize tree planting
- protect existing trees → maximum carbon reduction
- Optimize use of native plants

# Major Contacts

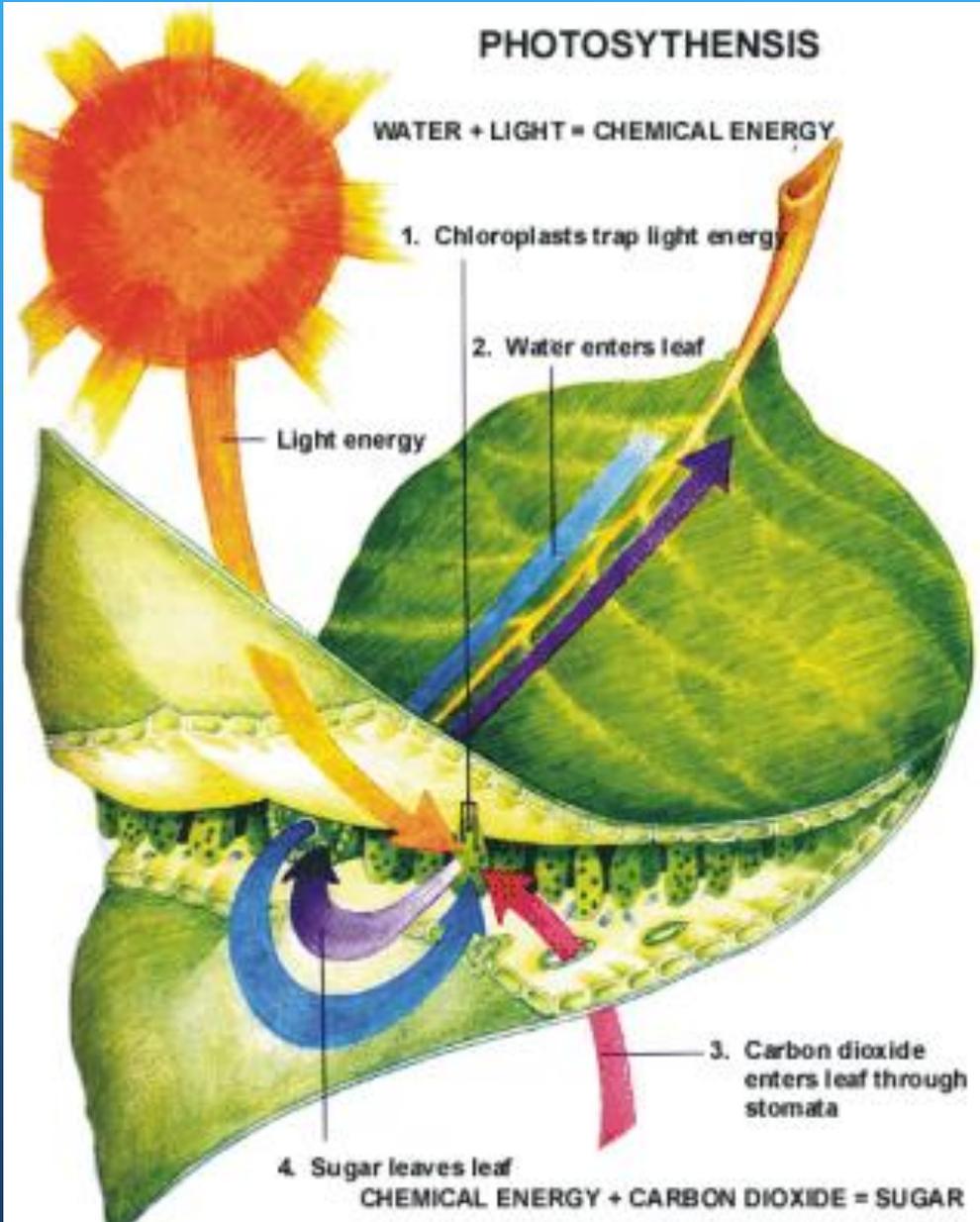
- Dr. Nowak, USDA Forest Service
  - Carbon sequestration of trees.
- Mr. Victor Bzdula, owner of B&W Landscaping
  - gathering and weighing samples

# Northern Research Station

- Field measurements and monitoring of urban vegetation structure
  - Species composition and distribution
  - number/size of trees
- Studies effects on various ecosystem attributes
  - Air temp, water quality, soil
- Assesses Urban Forest Structure
  - Obtain accurate measurements of vegetation structure
- Aerial Assessments
  - Develop cover maps
- Ground-based Assessments
  - Determine physical attributes of vegetation

## PHOTOSYTHENSIS

WATER + LIGHT = CHEMICAL ENERGY



CO<sub>2</sub> absorption by trees and grass depend on the fact that these plants are growing. To understand plant growth, knowledge of photosynthesis is essential.

# Trees: Carbon Sequestration

## Facts

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Store Carbon in cellulose - trunk, branches, leaves, roots

About 800 million tons of carbon stored in U.S. urban forests

One tree absorbs 48 lbs. CO<sub>2</sub>/year

Large tree reduces same amount of atmospheric CO<sub>2</sub> as released by typical car driven 500 miles

<http://www.coloradotrees.org>

## Dr. Nowak's findings

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### Conclusions on Chicago Forests

The city has about 3,585,000 trees with canopies that cover about 17.2% of the area

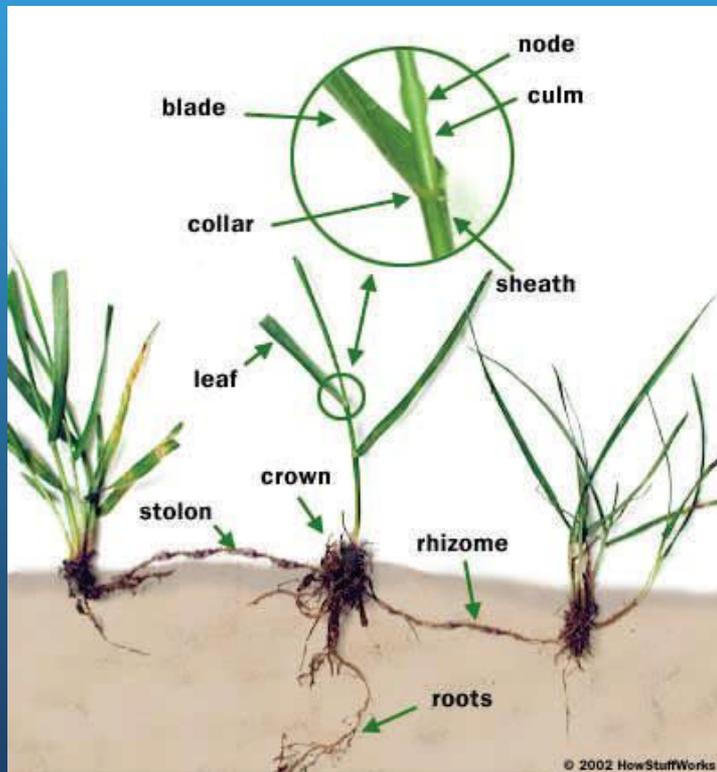
Chicago's urban forest currently stores about 716,000 tons of carbon valued at \$14.8 million

These trees remove about 25,200 tons of carbon per year (\$521,000 per year) and about 888 tons of air pollution per year (\$6.4 million per year)

Trees in Chicago are estimated to reduce annual residential energy costs by \$360,000 per year

# Grass

## Structure



## Facts

- 10 million acres of residential lawns are planted in U.S.
- 580 million gallons of gasoline used to fuel lawnmowers every year
- A well-watered and fertilized lawn is a carbon sink
- Eight average front lawns have the cooling effect of about 70 tons of air conditioning
- The average capacity of an average central air conditioning unit is about 3-4 tons

# Annual Auto Carbon footprint

Determine amount of grass needed to offset vehicle's carbon footprint using the following data:

2010 Ford Fusion Hybrid FWD:	4.7 tons
2010 Chevrolet Malibu:	8.3 tons
2010 Acura TL 2WD:	8.7 tons
2010 Buick Lacrosse/Allure:	9.2 tons
2010 Kia Sedona:	9.6 tons
2010 Honda Odyssey:	10.2 tons
2010 Toyota Tundra 4WD:	11.4 tons

# Conclusion

Total Burbank auto CO<sub>2</sub> emissions vs. CO<sub>2</sub> absorption by Burbank lawns

CO<sub>2</sub> emissions from a gallon of gasoline = 19.4 pounds/gallon

Estimate 25 miles/gallon → 485 lbs of CO<sub>2</sub> emitted per mile \* (19752 cars in Burbank \* 150,000 mile life time each) =  $1.436958 * 10^{12}$  lbs of CO<sub>2</sub> emitted by all cars in Burbank =

718479000 tons of CO<sub>2</sub> emitted by all cars in Burbank

Now offset CO<sub>2</sub> emissions with grass in Burbank

9,317 houses \* avg lawn size \* average CO<sub>2</sub> absorbed per lawn =  
CO<sub>2</sub> absorbed by grass in Burbank

Carbon analysis needed!

# Future Work

- This IPRO will continue as a science fair project at Oak Park River Forest High School
- It has potential to continue as a summer or fall IPRO that stands alone because:
  - Little research has been done in this area
  - Everyone can relate to the problem and help try to fix it with the information this IPRO will gather
  - We have done a lot of research, and the next IPRO can hit the ground running with this information

# What We Learned

- Environmental and technology issues
- Communication between groups and group members
- Collaboration with organizations
- Assigning tasks and working together to meet deadlines

“It is not the strongest of the species that survive, nor the most intelligent, but the ones most responsive to change.”

-Charles Darwin-