

# The Importance of Cross-Disciplinary Global Learning to Address 21<sup>st</sup> Century Challenges

A NAFSA Global Learning Colloquium

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## Issues to explore

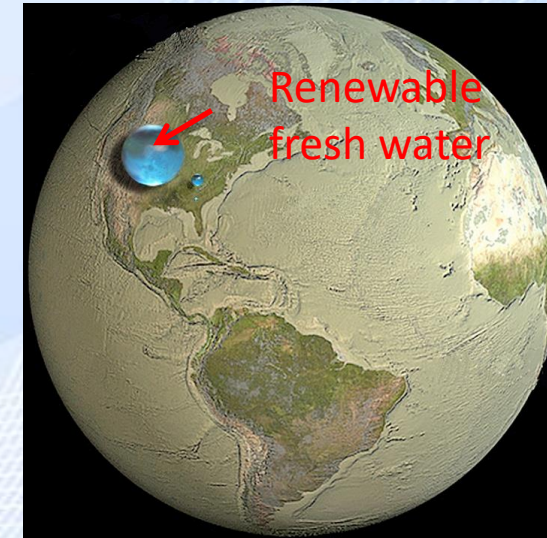
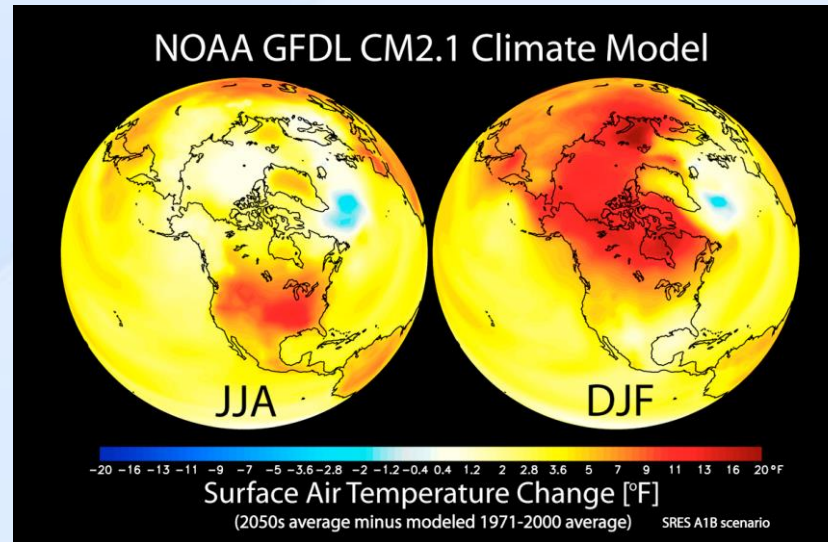
- What are our responsibilities as leaders in higher education?
- How do we prepare students to address the challenges they will face in their lifetime
- What does it mean to establish an interdisciplinary center? Why is it important? What are the challenges?
- How do we introduce flexibility and innovation into the curriculum to maximize learning objectives and opportunities for global perspective

# Addressing 21<sup>st</sup> Century Challenges

- The world is facing unprecedented environmental challenges:
  - Complex and interconnected
  - Global causes and consequences
  - Urgent
- Solutions are multi-faceted; many trade-offs, many unknowns
- Knowledge, perspective, and imagination are essential ingredients for navigating issues and providing hope and inspiration for the future.
- Higher Education must organize to provide opportunities for interdisciplinary learning and global perspective



# CLIMATE

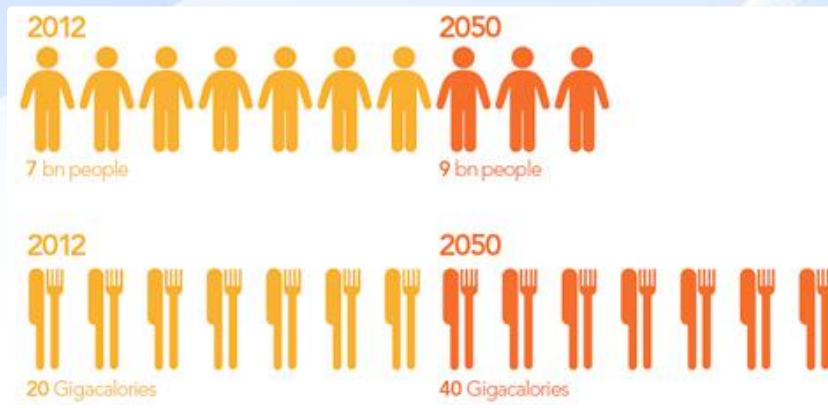


# WATER

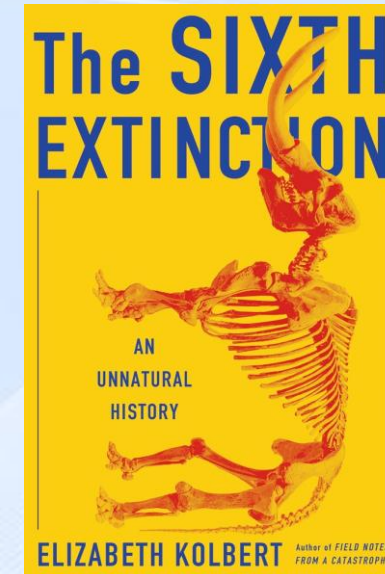
Water.USGS.gov

## 2050 Environmental Nexus

# FOOD



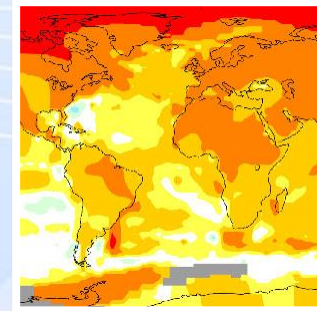
Core77.com



# BIODIVERSITY

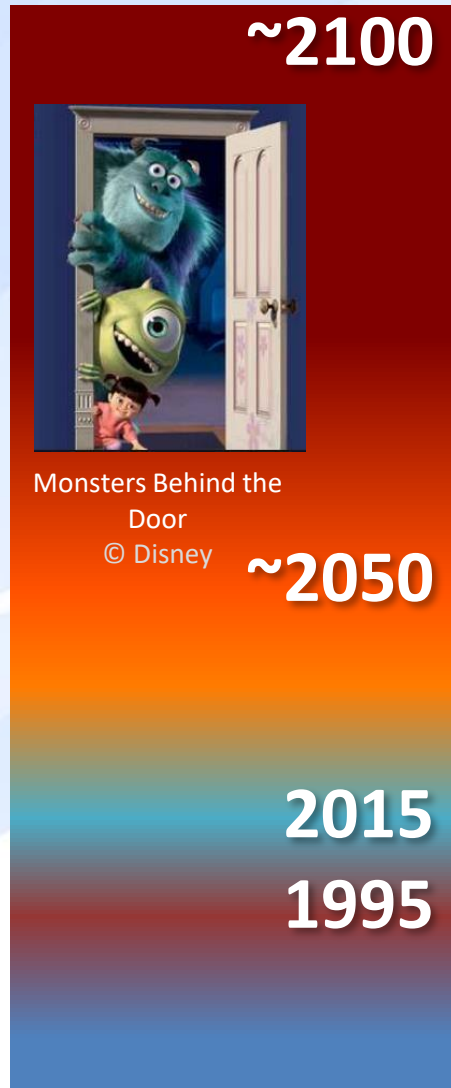
# The Climate Problem

- Burning of fossil fuels in the industrial era combined with the greenhouse effect has led to increased concentration of CO<sub>2</sub> in the atmosphere
- Planet is warming
- Detrimental effects are apparent today and are predicted to become more severe over time
- There is urgency to limit the rise in carbon concentration to < 450 ppm





# BAU Climate Problem: Tipping points



900  
850  
800  
750  
700  
650  
550  
500  
450  
400  
350  
300

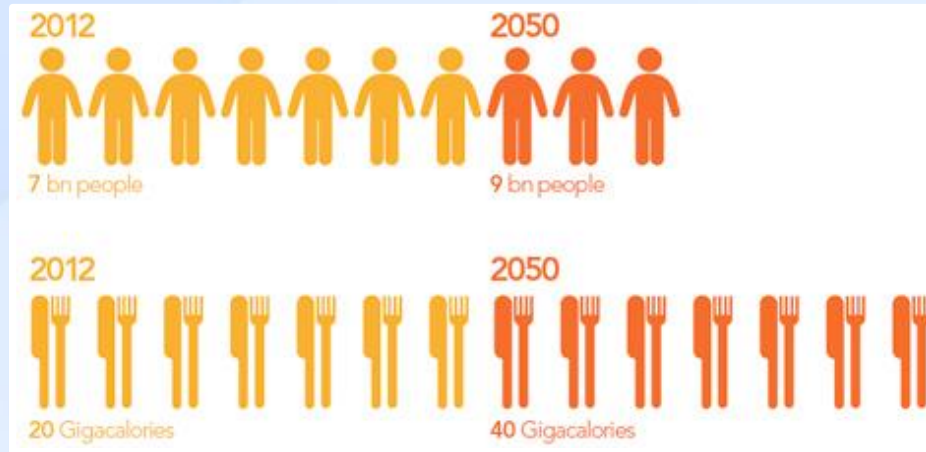
4  
◦  
3  
◦  
2  
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1  
◦  
0  
◦

- Deglaciation and Loss of Coastal Cities
- Mass Extinction
- Deep Sea Circulation Stops
- Tropical Famine

Paris goal

ppmv CO<sub>2</sub> 2100 warming

# Feeding the World in 2050



Worldwide food demand doubles by mid-century

Source: Foley et al. 2011



Worldwide food demands is expected to double by 2050:  
 Increase in global population to 9 billion  
 Change in World Diets (more animal protein)

Doubling agricultural lands will come at the expense of the tropical forests where bio-diversity is the highest



# Biodiversity

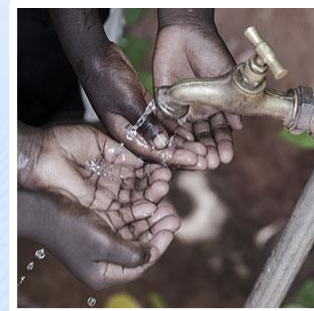
- Rate of species extinction is accelerating
- Habitat loss from agricultural expansion is greatest cause today
- Climate change is greatest cause in the future
- Expected to lose 60% terrestrial by 2050 from combined affects
- Risks and implications of lost biodiversity
  - Cascading impacts
  - Loss of ecosystem services
  - Economic value
  - Loss of beauty found in the natural world





# Water

- Water is essential resource for myriad human uses
  - Consumption, irrigation, mining, industrial, energy, livestock
- Anticipate 50% increase in demand for water (diet and population growth)
- Climate change is altering patterns of precipitation and types of storms
- Water issues will be experienced variably in different regions of the world
- Economic costs, political fall out , stress multiplier



## Solutions are feasible...

- New Energy Future is not only possible, but promising
- Advances in science and technology hold promise for agricultural production to improve yield, land use and water efficiency
- Evidence of political willpower and progress in international cooperation
- Shifts in human behavior motivated by self-interest and concerns for others are possible
- Global context ups the ante and makes things a lot more complicated





## **Academic Institutions must organize themselves to maximize contribution to addressing the challenges**

- Address complex issues through integrated solutions that are scientifically sound, technologically feasible, rationale from a global perspective and ethically just.
- Provide education that is relevant and equip students as problem solvers and global citizens.
- Break away for the conventions that impede exchange and in favor of innovation, flexibility and cooperation.
- Offer opportunities that are accessible to students and manageable for faculty.

# Princeton Environmental Institute

## *Environmental engagement across Disciplines*

**Mission:** Advance knowledge and develop the next generation of leaders to address global environmental challenges

- 120+ faculty, 27 disciplines
- Host interdisciplinary research activities including several long-term research projects
- Offer cross-disciplinary academic programs for undergraduate and graduate students
- Facilitate community (workshops, forums, events)
- Engage collaborations across campus and around the world

### PEI Faculty Membership

- Astrophysical Sciences
- Chemistry
- Ecology & Evolutionary Biology
- Geosciences
- Molecular Biology
- Physics
- Anthropology
- Economics
- History
- Politics
- Public Policy
- Architecture
- Art & Archaeology
- Comparative Literature
- East Asian Studies
- English
- French & Italian
- Gender & Sexuality Studies
- Near Eastern Studies
- Philosophy
- Spanish & Portuguese Languages
- Chemical & Biological
- Civil & Environmental
- Computer Science
- Electrical Engineering
- Mechanical & Aerospace
- Operation Research & Financial



# Educating students: the greatest opportunity

- The current generation will be at the peak of their careers at mid-century when these environmental issues reach crisis level.
- It is essential that we prepare today's students to:
  - Recognize the magnitude of the issues
  - Understand urgency and complicated nature
- Convey optimism in science, technology and effective policy making
- Fortify a sense of responsibility and an ethical framework for making tradeoffs and decisions



We are educating and motivating innovators and agents for change

# Program in Environmental Studies

*Preparing a generation to address environmental challenges of the 21<sup>st</sup> century*

- Core Courses and Electives
  - Lecture, Labs and Seminars
  - Diversity of offerings
  - Course-related field work
- ENV Certificate Program
  - Complements major
  - Foundation Course plus 4 electives
  - Senior Colloquium
  - Students from 29 disciplines
- Undergraduate Research
  - Independent Field Work and Internships

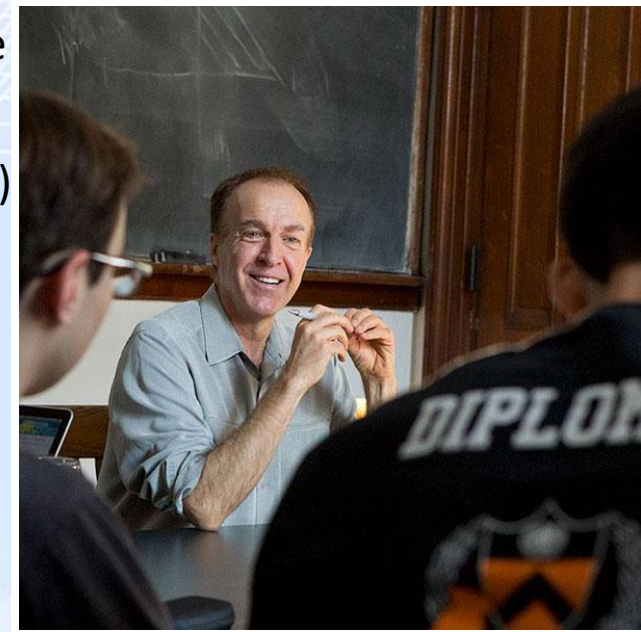


30% of undergraduates involved during 4 years at Princeton



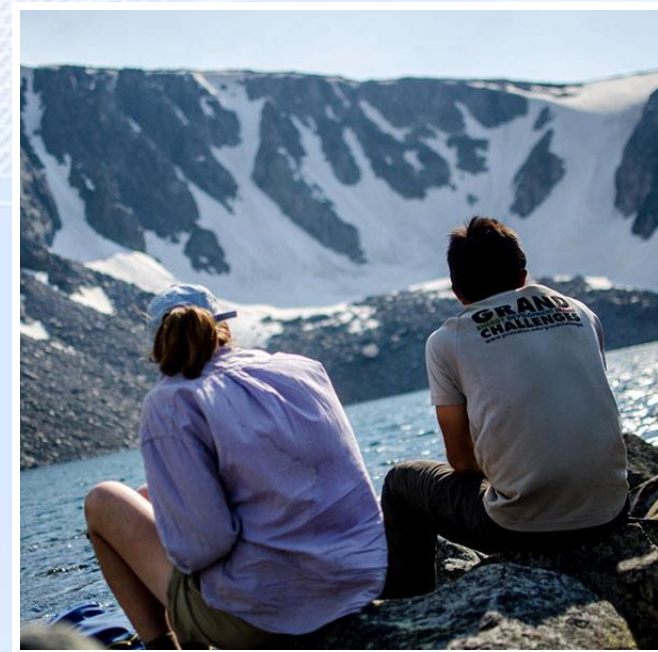
# Environmental Humanities

- Expand participation of faculty and students from the humanities
  - Humanities are ‘essential’ to the dialogue
  - Students in humanities as will occupy important leadership roles in society
- Opportunities for learning and enhanced perspective
  - World cultures, Environmental History
  - Expression/communication (e.g., literature, arts)
  - Ethics and moral values
- Humanities faculty including visitors have impacted
  - Course development (variety, creativity)
  - Research Activities
  - Creative programming and collaborations



# Grand Challenges

- Integrated Research and Teaching Program
  - Leverages faculty scholarship to address complex issues
  - Enable and support faculty to shift research focus
  - Engage all levels of campus community
- Annual Call for Proposals to support
  - New Research Directions
  - Multi-disciplinary Collaborations
  - Innovations in Undergraduate Education
- Awarded 95 seed research projects
  - Climate and Energy
  - Global Health & Infectious Disease
  - Sustainable Development
  - Water
  - Urban Environments
- 1800+ participating (faculty, researchers, students)





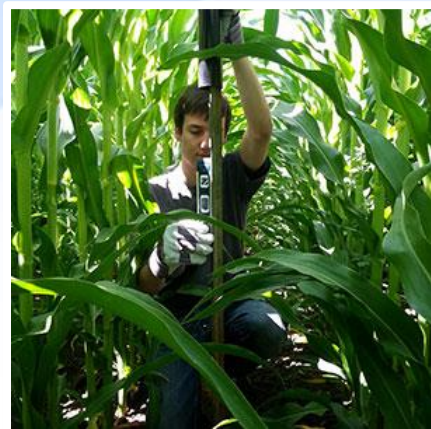
# Undergraduate Research Around the World Catalyst for Global Learning

- Summer internships
  - 100 students per year
  - Faculty mentored assignments, 8-12 weeks
  - 60% international, 91 countries
- Programming
  - Pre-departure Orientation
  - Summer Communications
  - End of Summer Symposium
- Learning Outcomes
  - Decisions about academic major/career
  - Ideas for future research/independent study
  - Publications
  - Connections to people, places and possibilities
  - Knowledge and desire to make a difference





# **Sending students overseas – an opportunity to see the world and confront its challenges**



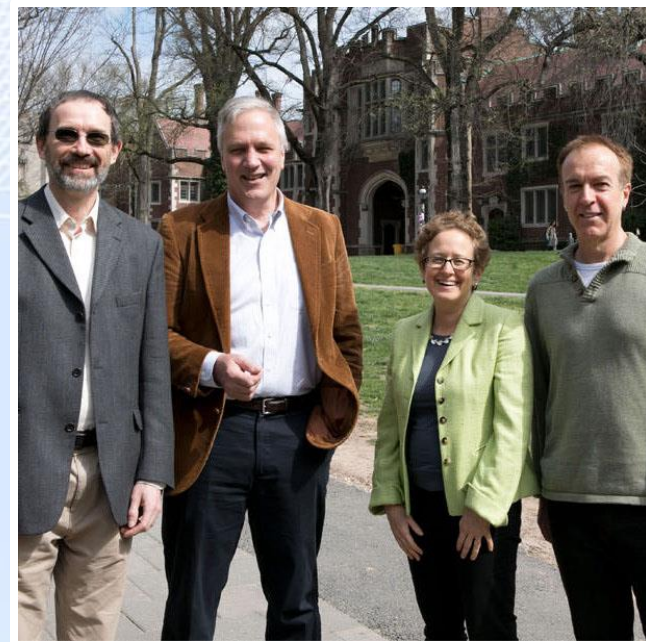






## Some reflections.....

- Establish and promote unifying vision and purpose
  - Solving the ‘big’ problems
  - Educating a generation
- Lower institutional barriers
  - Embrace disciplinary excellence
  - Complement versus compete
- Foster strong sense of community
  - Governance and responsibility
  - Dialogue and exchange
- Nurture collaboration and innovation
  - Incentives for interdisciplinary projects
  - Resources for innovative projects and teaching





## Addressing Global Environmental Problems

- Environmental threats are complex, interconnected and urgent.
- Solutions are possible but multi-faceted
- All disciplines have a role to play
- Higher education must seek innovative methods and approaches to provide multi-disciplinary global learning opportunities for the current generation

Therein lies the hope

## Questions for Discussion

What are the major challenges for institutions of higher learning in establishing cross-disciplinary dialogue and participation?

What are key levers for success in the implementation of interdisciplinary research and teaching programs globally?

How can academic institutions make global learning accessible to all students (including students in STEM disciplines)?