

Global Sustainability Institute



*Purdue-Mexico Workshop on Sustainability
April, 2013*

Discovery Park is the heart of large-scale interdisciplinary research and innovation at Purdue University.



Scholars from all disciplines work together to define whole new areas of research and solve grand challenges

Why do we have Discovery park?

Purdue University, 1990s:

- Very strong discipline based research
- Very traditional academic structure

How to build interdisciplinary research?

- **Interdisciplinary departments?**
 - could weaken traditional departments
 - very expensive and difficult to create
 - unlikely to be flexible and agile

Not the best solution for us

Building interdisciplinary research:

- **Interdisciplinary Centers (matrix structure)**
 - do not 'own' or pay faculty - people from many disciplines volunteer to take part
 - relatively agile / flexible
 - enhance departments / colleges
 - focus on external funding
 - provide unique facilities and infrastructure
- = the solution we pursued**



- Bindley Bioscience Center
- Birck Nanotechnology Center
- Burton D. Morgan Center for Entrepreneurship
- Discovery Learning Research Center
- Global Sustainability Institute
 - Center for the Environment
 - Energy Center
 - Purdue Climate Change Research Center
 - Center for Global Food Security
 - Water Community
 - EcoPartnership
- ACCESS: Advanced Computational Center for Engineering and Sciences
 - Cyber Center
 - Rosen Center for Advanced Computing (ITaP)
- Oncological Sciences Center
- Regenstrief Center for Healthcare Engineering



**Burton D. Morgan Center
for Entrepreneurship**



**Birck Nanotechnology
Center**



**Bindley Bioscience
Center**



**Gerald D. and Edna E.
Mann Hall**



**Hall for Discovery and
Learning Research**

PURDUE
RESEARCH PARK

PURDUE UNIVERSITY
Discovery Park

Founded	1961	2001
Purpose	Start-up companies	Interdisciplinary research
Location	Off-campus US 52 Highway	Main Campus State Street
# People	>3100 employees	~1000 faculty members
# Buildings	51	5
# Companies/ Centers	160 Companies	8 Core Units
Area	725 acres	40 acres

Discovery Park

Discovery with Delivery

- Enabling large interdisciplinary grants
- Providing facilities
- Building partnerships
- Facilitating commercialization
- Encouraging entrepreneurship
- Engaging students, faculty, and community

Infrastructure

■ Technical

- Research Cores – partner with academic units
- Equipment and facilities
 - \$27.8 million in new research equipment
 - 113,000 sq.ft. of research laboratory space
 - 93,000 sq.ft. office and support space

■ Administrative

- Administrative model breaks down barriers to build interdisciplinary collaborations
- Business team: Sponsored Program Services and Business Administration
- Project coordination
- Web site integration
- Special events



Project-Based Centers

- √ Interdisciplinary in nature
- √ Sponsored programs
- √ Affiliated with a core center
- √ Often opportunistic

Visual Analytics for Command, Control, and Interoperability Environments (VACCINE) \$15 million, U.S. Department of Homeland Security
Center for Direct Catalytic Conversion of Biomass to Biofuels (C3Bio) \$15 million, Department of Energy
Center for Prediction of Reliability, Integrity and Survivability of Microsystems (PRISM) \$17 million, National Nuclear Safety Administration
Indiana Clinical and Translational Science Institute (CTSI) \$25 million, National Institutes of Health
NSF Network for Computational Nanotechnology (NCN) \$28.75 million (with renewal), National Science Foundation
Network for Earthquake Engineering Simulation (NEES) \$105 million, National Science Foundation

Corporate Interaction





Vision

- *to advance innovative solutions to the grand challenges of sustainability from local to global scales.*

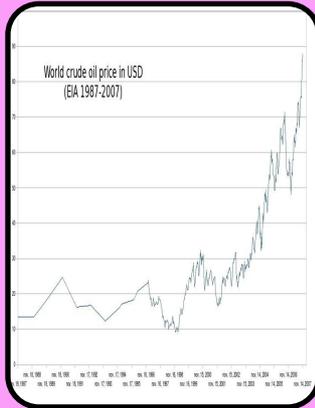
Mission

- Promote forward thinking on sustainability, and engage in the transition to a sustainable society by supporting research, practice and education.
- Facilitate, support and link sustainability efforts across diverse disciplines, centers, and colleges and promote global partnerships.
- Encourage the university to serve as a sustainability role model.
- Develop resources and vitalize sustainability infrastructure across campus.





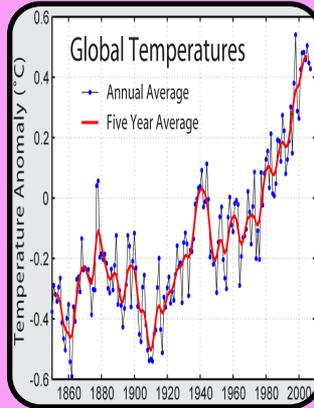
Energy



Limited Supply of Fossil Fuel

Increase in Demand and Price for Energy

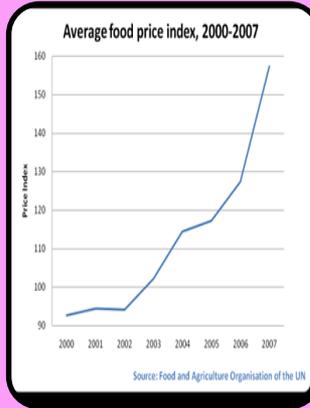
Climate



Rise in Green Gas Emissions and Global Warming

Adapting to Climate Change

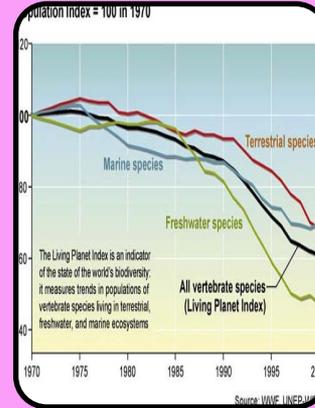
Food



Increase in Food Demand and Price

Decreasing Agricultural Land

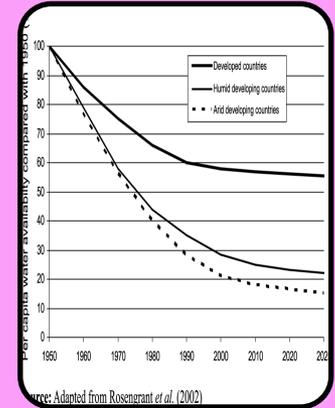
Environment



Loss in Biodiversity Due to Deforestation

Climate Change and Rise in Temperature

Water



Decreasing Access to Clean Water

Public Health

FOCUS AREAS

- Great Lakes and Inland Lakes
- Wabash River Ecology
- Climate Change and Water Supply
- The intersection of Agricultural and Water
- Engineering Sustainable Water Systems
- Water Infrastructure Management
- Public Health Impacts



EXAMPLES

- Studying contaminant fate and transport (nutrients, sediments, metals, and organics)
- Developing novel bio- and nano-based sensors for water monitoring
- Developing treatment systems for water disinfection and wastewater treatment
- Quantifying the impact of BMPs on water quality at multiple scales
- Understanding the human dimension of watershed planning and management



FOCUS AREAS

- **Power Generation**
 - Coal; Nuclear; Solar; Wind
- **Transportation**
 - Advanced Ground-Vehicle Power, Battery & Energy Storage; Bio; Hydrogen
- **Efficiency**
 - Smart Building; Smart Grid/Electricity Systems; Thermoelectric
- **Policy**
 - Energy/Electricity Systems; Economics; Environmental
- **Education and Outreach**
 - Electric Vehicles; Smart-Grid

EXAMPLES

- *Network for Photovoltaic Technology;*
- *Hoosier Heavy Hybrid Center of Excellence*
- *Solar Energy Research Institute for India and U.S.*



DOE/EFRC
Center for Catalytic
Conversion of Biomass to
Biofuel

THE ENERGY ACADEMY
JUNE 16-22, 2013

LECTURES TOURS HANDS ON DEMONSTRATION PROJECTS

The students and teachers will participate in a week-long program at the Purdue University West Lafayette (Indiana) campus.

THE ENERGY ACADEMY PURDUE UNIVERSITY Duke Energy



GOALS

- Provide Global Leadership
- Create Global Public Good
- Build Human and Institutional Capacity
- Strengthen and Grow Partnerships
- Develop Entrepreneurial Capacity



EXAMPLES

- *US Borlaug Fellows Program:*
 - *The annual Summer Institute on Global Food Security for US and international students with lectures, practicums, panels, field visits, individual and group projects.*
 - *Generous fellowships to support graduate research in food insecure countries up to 2 years in duration.*
- *Research and seed multiplication program with drought tolerant and pest resistant varieties of sorghum in East Africa.*
- *Research and policy recommendations to address food insecurity for communities affected by HIV/AIDS in Kenya.*



Center for Global Food Security: Mexico

Borlaug Fellows program supporting 6 US grad students for research in cooperation with CIMMYT (Centro Internacional de Mejoramiento de Maíz y Trigo – International Maize and Wheat Improvement Center). Including:

Ariel Rivers

- PhD, Entomology and International Agriculture, Pennsylvania State University
- CIMMYT, Mexico, 12 months
- ***Assessing the impact of conservation agriculture on predator and pest populations in El Batán.***

Sean Thompson

- PhD, Plant Breeding, Texas A&M University
- CIMMYT, Mexico, 6 months
- ***Estimating Wheat Root Biomass Using Ground Penetrating Radar at the Ciudad Obregon Research Station***



FOCUS AREAS

- Sustainable engineering: green electronics, building sustainable communities
- Maintaining environmental quality in managed ecosystems
- Soundscape ecology
- Emerging contaminants



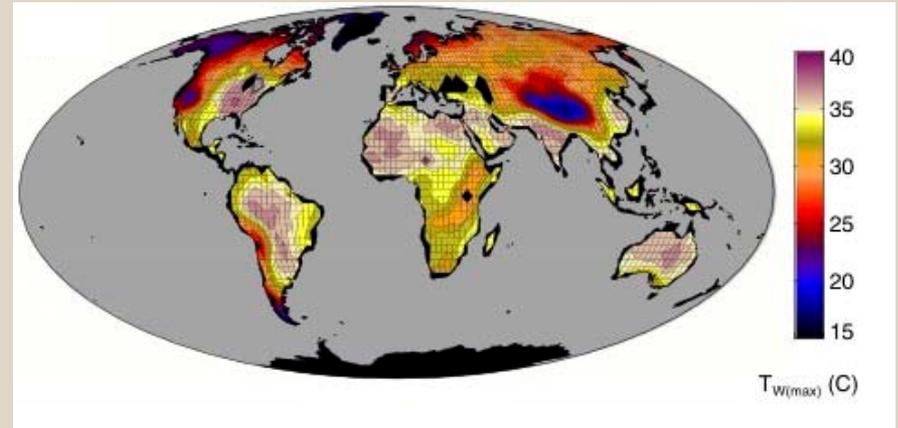
EXAMPLES

- The sustainable electronics program (NSF IGERT grant) is developing a new model of consumption for electronics using a life cycle assessment approach that also maintains a focus on simultaneously benefiting people, planet, and profit.
- Multiple projects focused on the fate, transport, toxicity, and remediation of environmental contaminants (e.g., PFOAs, PBDEs, nanomaterials).



FOCUS AREAS

- Climate and extreme weather
- Coupled biogeochemical cycles
- Climate Change Communication
- Building resilience to climate change
- Human and ecosystem health impacts of climate change



EXAMPLES

- Improving resilience and profitability of farms by transforming existing climate information into usable knowledge for the agricultural community
- Piloting a spatially-explicit, open source global database for analysis of agriculture, resource & environmental data for discovery and decision making



FOCUS AREAS

Collaborative bi-national (US-China) academic and Industry research and education to address:

- Sustainable use of natural resources.
- Land degradation by land use and climate change.
- Challenges of urbanization



EXAMPLES

- Bilingual *Technology Needs and Solutions* program to ease commercialization and tech transfer of university intellectual property to both solve environmental challenges and promote economic development among US partner institutions.
- Chinese Visiting Scholars Network to harness collective resources of Purdue University faculty and visiting professors to address common environmental challenges (e.g. biomass waste use for land reclamation).



- **Center/Community Directors:** Matthew Huber (Climate), Gebisa Ejeta (Food), Maureen McCann (Energy), Leigh Raymond (Environment), Ron Turco (Water), Tim Filley (EcoPartnership)
- **Managing Directors:** Gary Burniske, Rose Filley, Pankaj Sharma, Lauren Wu
- <http://www.purdue.edu/discoverypark/sustainability/>
- Reaching 450 faculty across Purdue – all colleges; external funding gives a 27:1 return on the Purdue investment



How do we build bi-national partnerships?

- US-China EcoPartnership Example:
Director: Professor Tim Filley
Program Manager: Lauren Wu



US-China EcoPartnership

Purdue, UTK, ORNL

CAS Institute of Geographic Sciences and Natural Resources Research,
Research Center for Eco-Environmental Sciences, and Institute of Applied Ecology.

a five-year initiative focused on joint research aimed at addressing the combined effects of climate change, renewable energy, and human activities on regional and global ecosystems.



EcoPartnership Framework

- “establish voluntary cooperative partnerships between the two countries at the sub-national level”

省市级合作

- private businesses, governmental entities, educational institutions and non profit organizations.

私营企业、政府机关、教育机构以及非营利机构

- “facilitate sharing best practices of economic growth and environmental sustainability”

共享经济发展和环境可持续发展的最佳实践



U.S.-China Strategic Economic Dialogue

EcoPartnership Objectives

Primary

- Provide **information** and **guided research** for informed policy decisions to our political leaders and other stakeholders in environmental sustainability
- Create the **next generation of sustainability scientists** with **international** research, business, and policy perspective.

Secondary

- Develop research and teaching capabilities, standardization of technologies for environmental accounting, **mutual trust and understanding** through social, cultural, and academic activities



Representatives from Purdue, Oak Ridge National Lab/University of Tennessee and Chinese Academy of Sciences signing Ecopartnership on Environmental Sustainability, May 10, 2011, Washington DC



National Development and Reform Commission (NDRC)
People's Republic of China



Our Approach

- Improving bi-national **coordination of research efforts**
 - **Annual symposia** – presentations **plus working sessions** to produce research plans and outlines (come to the breakout sessions today!!)
 - Topical **working groups** addressing information needs for policy decisions/ **collaborative research projects**
 - **Faculty/student exchanges** among partnering and affiliated institutions



- **Engaging representatives** from key governmental, non-governmental and corporate organizations for guiding research efforts and technology transfer
- **Continual examination and evaluation of best practices** as well as efforts to obtain funding for these activities from competitive sources including government agencies

Technology Impact



Basic research

Translational research

Proof of concept, testing

IP protection, Commercialization

Licensing, venture formation, B2B, market intro

**Market Adoption/
environmental Impact**

Policy Impact



Basic research

Validation & testing

Assessment of anticipated environmental Impact

Assessment of economic and political costs

Advocacy & Policy process

New policy/enforcement /environmental Impact

U.S.-China EcoPartnership for Environmental Sustainability (USCEES): linking partners for solutions

Research 研究

- Basic—new knowledge 新知
- Translational—verified in real world 转化

Application 应用

- Technology commercialized 技术商用
- Development & advocacy of improved policies 政策改进

Impact 影响

- New policies adopted & enforced 政策实施
- New market solutions adopted 市场进步

U.S.-China EcoPartnership for Environmental Sustainability (USCEES): lessons learned

- **Key building blocks** are real and sustained research collaborations between faculty and their students
 - Joint publications and joint grant proposals
 - Significant time spent together in both countries
 - Student exchanges, joint supervision, joint teaching
- **Seed funding**, jointly awarded stimulates activity
- Importance of **bi-lingual, bi-cultural, non-faculty center manager**
- A focus on **technology** development and **policy** encourages industrial and governmental partners

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