Using Applied Sustainability Science for Local Problem-Solving

Robert W. Taylor, PhD
Coordinator, Sustainability Science
Dept. of Earth & Environmental Studies Montclair State University
Email: taylorr@mail.montclair.edu

Presentation For Session G 1-3:00pm October 10, 214
Passaic River Institute Symposium
October 9-10, 2014
Goals of the Presentation

• To show the linkage between the goals of conservation and revitalization in the Passaic River Basin and Higher Education through a sustainability science focus.

• To show how Sustainability Science can become operational through the development of an Applied Sustainability Science “Regime” (ASSR)?*

• To show how this Regime can become an important strategy for problem solving in the Passaic River Basin Watershed?

*A “Regime” is defined as “sets of implicit principles, norms, rules, and decision-making procedures around which actors’ expectations converge (Krasner, 1983)
# Sustainability Science

## Definition

“An emerging field of research dealing with the interactions between natural and social systems, and with how those interactions affect the challenge of sustainability: meeting the needs of the present and future generations while substantially reducing poverty and conserving the planet’s life-supporting systems.” (PNAS, 2010)*

*Proceedings of the National Academy of Science

## Goals

- To conduct fundamental research on planetary challenges.*
- To nurture the next generation of sustainability scientists.*
- To build capacity for linking knowledge with action to promote a sustainable planet. This is the area of applied sustainability science – where theory is moved into Plans, Programs, Projects, Policies, Practices and Products – the Six P’s. (Taylor)

*Kates, 2011
Challenges in Sustainability Science: Fundamental Research

A Very Brief “History” of Mankind
When Humans Evolved, the Challenge was Survival in a World Dominated by Systems we could Barely Influence but that Determined how we Lived and Died
Sterman 2002

Humans Have become a True Force of Nature: Along with the Biosphere, Lithosphere, Hydrosphere, and Atmosphere Human Processes are Defining and Shaping the Global Landscape

ANTROPOCENE: AGE OF HUMANS!

Thus, Today’s Challenges are the Result of Systems That We Have Created ... it is the Unanticipated Side-Effects of our own Actions, Side Effects Created by our Inability to Understand and Act in Consonance with our Long-term Goals and Aspirations.
Sterman 2002

Global Change and the Earth System: A Planet Under Pressure
Steffen et al. 2005

The Road to Sustainability Will Take Two Forms:

- Reducing the Human Footprint on the Earth’s Resources, and
- Reversing the Centuries Long Damage to the Surrounding Life Support Systems that all Humans Depend Upon

Slides from M. Weinstein, 2012
Current Issues in Sustainability Science
## ASSR MATRIX

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Applied Strategy</th>
</tr>
</thead>
</table>
| **Ecosystem Preservation and Health**        | It is important to establish basic ecosystem maintenance metrics in order to assess plans, policies, projects. | • Green Infrastructure Projects  
• Habitat Preservation Plans  
• Watershed Management Plans  
• Trade-Off Analysis |
| **Collaborations and Public-Private Partnerships** | Applied Sustainability requires developing implementing successful collaborations and engaging in public-private partnerships. | • Collaboration Analysis  
• Stakeholder Analysis  
• Alternative Dispute Resolution |
| **Constructing and Implementing Policies, Practices, and Projects** | The Practice of creating and implementing sustainability solutions is critical in the transition to sustainability. | • Trans-Academic Engagement  
• Audits and Plans  
• Scaling Strategies |
| **Triple Bottom-Line Analysis**              | Triple Bottom Line Analysis determines the effectiveness of proposals on a metric of environmental protection, economic prosperity, and social equity. | • Triple Bottom Line Tool for economic analysis.  
• Making the Business Case  
• Ecosystem valuations for cost effectiveness of projects |
The Professional Science Master’s (PSM) degree is a graduate degree designed to fill a management need for technology-based companies, governmental agencies, and non-profit organizations. Students pursue advanced training in science, while simultaneously developing valued business skills. Professional Science Master’s programs combine rigorous study in science or mathematics with coursework in management, policy, or law. Professional Science Master’s programs emphasize writing and communication skills, and many include project management. Most PSM programs require a final project or team experience, as well as an internship in a business or public sector enterprise.
Examples of Completed Applied Sustainability Science Projects in the Passaic River Basin
Brownfields Assessment in Paterson, New Jersey

Passaic River & Brownfield Sites

Researchers: Any Ferdinand, PhD and Shevon Letang, PhD
Urban Agricultural Assessment for Passaic County New Jersey

Left: 5th floor, 20,000 sq. ft. Pro Forma for Vertical Farm (Tomato)
Right: 5000 sq. ft. for Roof top Greenhouse Production (Strawberries & Microgreens)

Research Done by MS-PMS Student Nanci Fioravanti
**Pro Forma for Potential Yields and Profit for Strawberries and Microgreens Grown on Rooftop Greenhouse**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Percent of Total Growing Area</th>
<th>Time from Sowing to Plant Maturity (days)</th>
<th>Expected Yield (lbs)</th>
<th>Value of Yield (per season)</th>
<th>Cost of Inputs (per season)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strawberries</td>
<td>60%</td>
<td>90</td>
<td>65,000</td>
<td>895,000</td>
<td>23,400</td>
</tr>
<tr>
<td>Microgreens</td>
<td>40%</td>
<td>20</td>
<td>1,500</td>
<td>5,000</td>
<td>1,13</td>
</tr>
</tbody>
</table>

**Pro Forma for Potential Yields and Profit for Tomato Cultivation in Vacant Building**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Percent of Total Growing Area</th>
<th>Time from Sowing to Plant Maturity (days)</th>
<th>Expected Yield (lbs)</th>
<th>Value of Yield (per season)</th>
<th>Cost of Inputs (per season)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strawberries</td>
<td>60%</td>
<td>90</td>
<td>65,000</td>
<td>895,000</td>
<td>23,400</td>
</tr>
<tr>
<td>Microgreens</td>
<td>40%</td>
<td>20</td>
<td>1,500</td>
<td>5,000</td>
<td>1,13</td>
</tr>
</tbody>
</table>
Opportunities

- **Clean Water State Revolving Fund Green Project Reserve (2014)**
- **The EcoCenter at Heron’s Head Park in San Francisco Demonstrating community sustainability and revitalization**
- **The 1,500 square foot facility is powered by solar energy. The EcoCenter also treats its own wastewater using constructed wetlands, biological treatment, and ultraviolet sterilization lamps. In addition, it features a green roof and native landscaping, which conserve water and prevent stormwater runoff.**

A teaching tool for sustainability and green building design. It exemplifies principles of community sustainability and livability by emphasizing the interconnection of social, economic, and environmental issues.
Dubuque, Iowa: A Model for the Passaic River Basin?

- America River Project – Turning a declining manufacturing city on the Mississippi into a successful downtown revitalization that integrated brownfields remediation, cultural place making, with storm water management.
- A aquarium and museum for educating people about the Mississippi and the Rivers of the World.
Concluding Remarks

- The ASSR Regime can provide us with an operational tool to engage in projects in the Passaic River Basin.
  - It emphasizes building the Business Case for project development.
  - It utilizes a triple-bottom-in analysis to determine the effectiveness of economic decision-making.
  - It stresses collaboration and public-private partnerships.
  - It encourages project-based education, student research involvement, and linkage between Higher Education and the Local and Regional Community.
Thank you for Listening