Biofuels Sustainability Issues in an International Context: What we’ve been up to lately

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Research, education leader in multidisciplinary sustainability:

- Energy, Materials/Manufacturing, Complex Systems, International Development

“Wood to Wheels” – evaluating the entire value chain of forest-based biofuels
Prior biofuels sustainability work + International relationships =

**NSF Research Coordination Network (RCN)**

“RCN-SEES: A Research Coordination Network on Pan American Biofuels and Bioenergy Sustainability”

2012 - 2015

D. Shonnard, R. Donovan, K. Halvorsen, B. Solomon, (50 others)

Develop a research network of academic, industrial, government, and NGO partners interested in feedstock development across the Pan-American region
Rationale:

Why Biofuel / Bioenergy Sustainability?

The implications of large-scale biofuels and bioenergy production on environmental systems and social conditions are largely unknown, 

... and yet....

there currently is a rapid movement toward development of biofuels and bioenergy production systems that will likely lead to changes in extant human and natural systems
Pan-Am RCN

Rationale:

Why Pan-American Focus?

– Countries in the region have large land areas, productive soils, favorable climate, and relatively low pop. density.

– Several developing countries in this region could benefit from biofuels production and export.

– Some countries have large and growing biofuel and bioenergy industries, while other countries have active research and development programs. The potential of sharing sustainability knowledge is great.
Pan-Am RCN

Rationale:

Research Themes

1. Community Impacts
2. Water / Energy Issues
3. Biodiversity / Ecosystems
4. Biogeochemical cycles
5. Energy Policy
6. Life cycle environmental assessment
7. Food and other systems
8. Biomass supply transportation logistics
**Pan-Am RCN**

Approach:

**Workshops + Conferences**

- **2012**: Merida, MX (W)
- **2013**: Buenos Aires, ARG (W)
- **2014**: Recife, Brazil (Conf)
- **2015**: Houghton, MI USA (W)
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Approach:

Workshops + Conferences

2014 Pan-Am RCN Conference - Recife, Brazil
Pan-Am RCN

Approach:

Coordinated Journal Articles
Environmental Management, 2015 Special Feature

**Biogeochemical Science** – Gollany, Titus et al.

**Hydrological Science** – Watkins, Moraes et al.

**Biodiversity Science** – Kline, Mayer et al.

**Policy / Sustainability** – Solomon, Acevedo et al.

**Social Sustainability** – Selfa, Bain et al.

**Biomass Supply Chains** – Lautala, Hess et al.

**Life Cycle Assessment (LCA)** – Shonnard, Sacramento et al.
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Approach:

Research Roadmap Report

Lessons learned from Journal Articles + Discussions from RCN Conference

Current Challenges, Research Opportunities, Case Studies

*Common Themes across disciplines, across countries

In Preparation – December 2015!
Pan-Am RCN

Approach:

Education – Graduate Course

Faculty presentations, student-led discussion of assigned readings and other questions

16 Students: MTU(4), SUNY (3), UFPE-Brazil (2), UADY/other- Mexico (3), UTN- Argentina (2), N. Arizona, Purdue

Final Term Projects – multidisciplinary analysis of case / issue common to many bioenergy systems
**Pan-Am RCN**

**Approach:**

**Education – Graduate Course**

*Post - Pre Student Test Scores*

Max possible score 68

Greatest gain 21.5 points

Average gain 7.6 points
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Major Outcome:

New Research Teams / Research Projects

NSF Partnerships for International Research and Education (PIRE)
“Sustainability, Ecosystem Services, and Forest-related Bioenergy Development across the Americas”, 2013-2017

PI: Kathy Halvorsen (MTU), 50+ participants across region
Pan-Am PIRE

How is Pan American forest-related bioenergy development impacting socioecological systems, and associated ecosystem services, and how can those impacts best be measured, modeled, and mitigated?
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Aspen spp.

Eucalyptus

N. Hardwoods

Oil Palm

Michigan Tech
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Ecosystem Science: Biodiversity, Hydrology, BioGeoChem
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Socio-economic:

Qualitative Interviews: over 550 completed, coding ongoing...

Survey Development – multiple languages, useful/practical!
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Policy Analysis:

Key informant interviews of governmental and non-state actors, along with bioenergy policy evaluation for sustainability

50+ interviews completed to date
**Pan-Am PIRE**

**Metrics:**

Ever-evolving integrated sustainability assessment modeling is planned, with inclusion of data collected from other PIRE teams + other data to support full suite of desired indicators.

Case-specific transport logistics modeling, life-cycle assessment, techno-economic assessments.

Integration of ecosystem, survey data (plus finding other data) will be hard!
Thank you!

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