

Leading a Multi-Disciplinary Research Proposal and Research Project

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Overview

- My experience as an example
- Three reasons (at least) for doing multi-disciplinary research
- Crafting a competitive proposal
- Some potential pitfalls and payoffs

My experience in a nutshell...

- **1998:** Economic modeling of land use change
- **2000:** Ohio sea grant project to study land use-water quality, no biophysical
- **2002:** First attempt: Lake Erie NSF Coupled Natural-Human Systems grant (11 senior researchers, multiple graduate students) → close but no cigar
- **2003:** Second attempt → even closer, but still no cigar
- **2004:** Third attempt → success!
- **2007:** First papers with integrated modeling in manuscript form
- **2008:** Success in securing multiple other interdisciplinary grants
- **2009:** First papers with integrated modeling published

Assessing my experience with the Lake Erie project

- Interdisciplinary work is interesting and personally rewarding
 - It has made me a better economist
 - Allowed me to reach a broader audience
- Lasting collaborations with several team members
- Established myself as an interdisciplinary researcher
 - Served on multiple NSF interdisciplinary panels and launched other interdisciplinary projects
- Publications in a variety of journals
 - Many are interdisciplinary; getting integrated modeling papers published in disciplinary journals has been harder

Assessing my experience with the Lake Erie project

- Substantial time and effort invested in organizing and managing modeling team
 - Large group of modelers (about 8-10): we spent lots of time talking
 - Smaller sub-groups (about 2-3): this is where the real work got done
- Some successes, some failures in terms of achieving the project's goals
 - Extended existing models; developed new dynamic coupled models (highly stylized)
 - Unable to develop empirically-based coupled system models; ran out of time on achieving grand goal of integrating across multiple spatial, temporal scales



Why engage in multi-disciplinary
research?

Why engage in multi-disciplinary research?

1. Follow the question

- Many of the most interesting problems lie at and beyond the margins of existing disciplines
- Extensive disciplinary specialization can limit innovation; multi-disciplinary research leads to meaningful advances in science
- Multi-disciplinary research is more oriented to dealing with "real world" problems

"Nature don't know disciplinary boundaries."

-- Comment from a biologist during a meeting at NSF in late 1991



Why engage in multi-disciplinary research?

1. Follow the question

2. **Follow the people**

- Exposure to researchers from other disciplines can lead to fruitful collaborations – given mutual interests and compatibility

Why engage in multi-disciplinary research?

1. Follow the question
2. Follow the people
3. **Follow the money**
 - As an example: NSF allocates \$22.5 million annually to human-environment research (approximately the same as the NSF economics program budget)
 - personal communication from Tom Baerwald

Why engage in multi-disciplinary research?

- 1. Follow the question**
- 2. Follow the people**
- 3. Follow the money**

- All three reasons are legitimate
- While money may provide the impetus, it is the question and/or people that keep researchers engaged in doing multi-disciplinary research



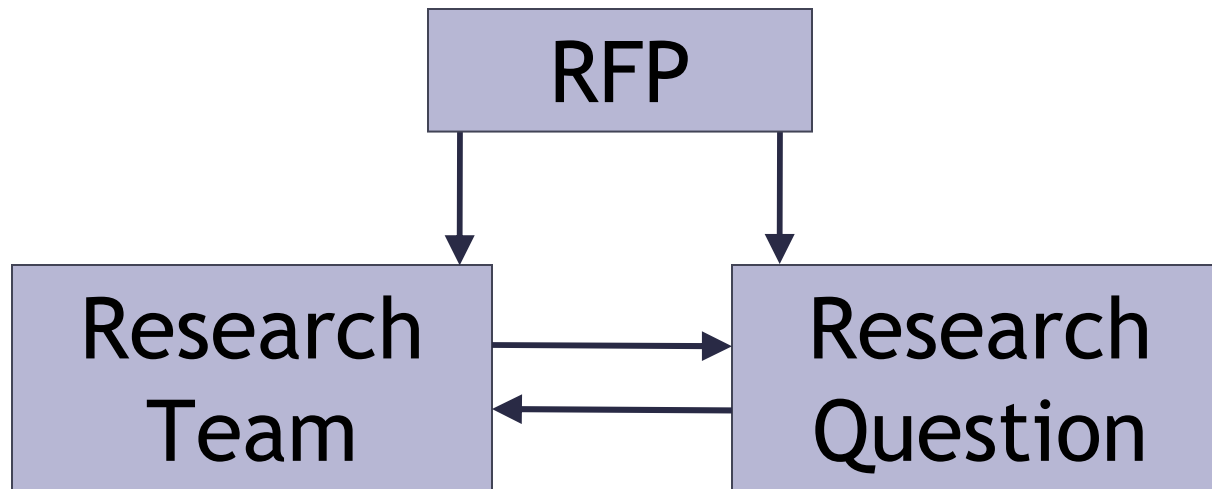
Crafting a competitive grant proposal

Crafting a competitive grant proposal

RFP

- The RFP provides the focus and necessary starting point
 - Example: NSF advises PI's to take each word in the CNH competition title very seriously...
Dynamics of Coupled Natural and Human Systems

Crafting a competitive grant proposal



- The research team and central research question(s) flow from the RFP
- The team and the questions and are jointly determined



Crafting a competitive grant proposal

- In principle, this is no different than a disciplinary-based grant proposal...
- However,
 - Identifying an integrated and compelling research question is (much) more difficult in an interdisciplinary setting
 - Forming, engaging and managing the research team is (much) more difficult in an interdisciplinary setting

Identifying the research question

- Focus on questions that are important in your own and others' fields
 - Identify theoretical foundations that are shared or that are complementary and can be integrated
 - Formulate specific questions that are testable, but also generalizable
- From this...
 - Develop an overarching integrative question from which specific sub-questions or tasks (that may be more disciplinary based) logically follow
 - Use a simple diagram to show linkages among component parts

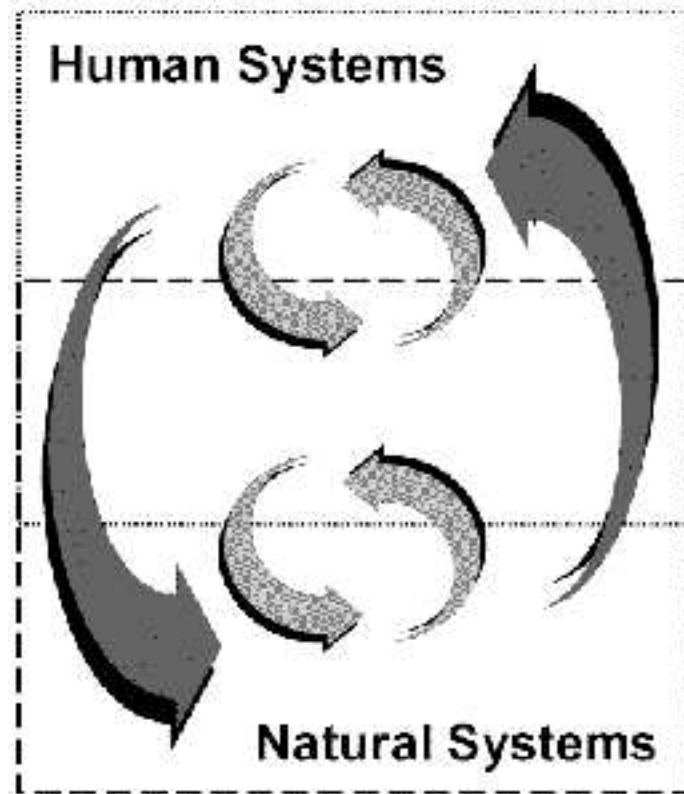
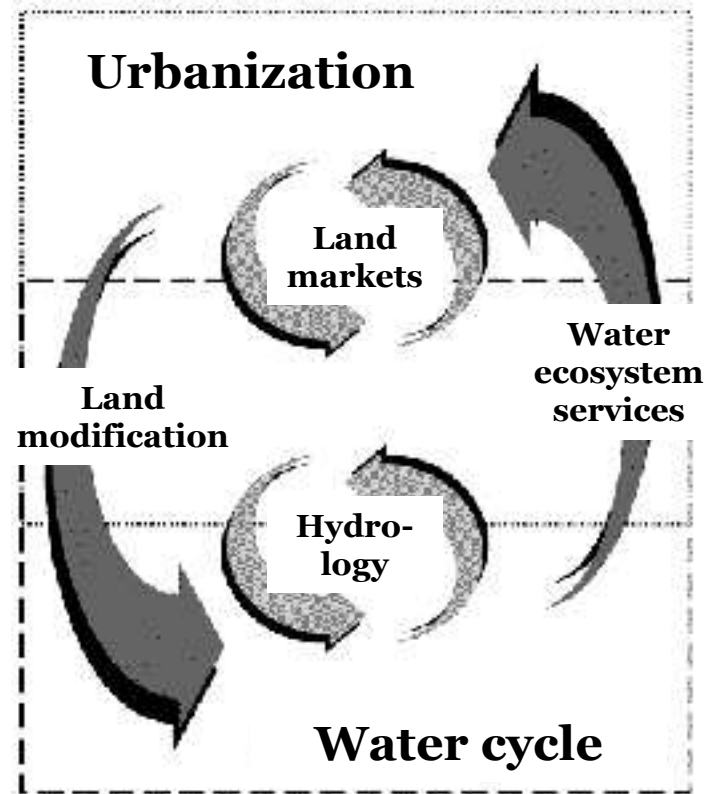


Diagram used by NSF to illustrate Coupled Natural-Human Systems



Example of same diagram adapted to specific research question

Forming a research team

- Identify the disciplinary needs; find collaborators who are well-qualified and passionate about what they do
 - Do background checks regarding their past participation in collaborations
- Recognize the importance of personality
 - Work with people who are not only smart, but also nice
 - Find people who are open-minded and who do not prejudge other disciplines
- Be who you are -- don't try to become someone else
 - Recruit experts in appropriate fields to fill gaps
- Understand the potentially different roles of team members
 - For example, securing the grant versus getting the work done



Engaging a research team

- Learn as much as you can about others' interests, perspectives, and approaches
- Feel comfortable saying "I don't understand" ... and don't fret when other say that to you
- Seek to understand in order to be understood: Spend 90% of your time listening and 10% of your time talking

Some potential pitfalls

- The confusion of words
 - e.g., equilibrium has different meanings to different disciplines
- Different research platforms, methods, goals
 - Quantitative versus qualitative research designs
 - Different units and scales of analyses
 - Modeling methods and goals can vary (stochastic versus deterministic; optimization versus not; explanation versus prediction)
- Time: it's not on your side
 - Each phase of the research project (proposal writing, start up, implementation, outputs) – takes longer than planned and often longer than the length of the grant funding
- Less acceptance of interdisciplinary models or methods in disciplinary-specific journals

More potential pitfalls (specific to managing...)

- Getting agreement and commitments from a large and diverse set of people with varied interests and goals
- Balancing individual researcher needs/goals with team needs/goals
- Achieving a fair allocation of resources across biophysical and social components and scientists
- Managing budgets, annual reports and proportioning of “who gets credit”

Avoiding the pitfalls

- Select a good team
 - An ideal team member is highly accomplished, wicked smart, refreshingly modest and always open-minded
 - Aim for a smaller team with lots of complementarities
 - Avoid resource hogs, negativity and overcommitted individuals
- Invest in graduate students
 - Graduate students can provide the glue and momentum
 - Require additional training to be effective in an interdisciplinary setting
- Invest in project management
 - Budget for project management and facilitation
 - Develop effective communication, collaboration and information management tools early

Avoiding the pitfalls

- Take time to communicate and develop a common language
 - Consider developing a lexicon for the project
- Agree on responsibilities at the outset
 - Determine who will be responsible for what and on what timeline
 - Get sign-off from all collaborators; refer back to this often
 - Agree on products and agree on how credit will be given
- Ensure that project meets both disciplinary and multi-disciplinary objectives
 - Individual researchers may be unable or unwilling to participate without the ability to do disciplinary research
 - The proposal will not succeed if it does not go beyond a list of discipline-based research questions

Avoiding the pitfalls

- **Be patient and persistent**
 - Be prepared to invest time at all stages of the process
 - Be prepared to fail and try again
 - Start small, then go bigger
 - Seek to build a platform not an empire: work to build enduring teams
- **Practice grace and openness**
 - Recognize the inherent reciprocity in any collaboration
 - Be aware of and do all you can to eliminate power imbalances
 - Be open-minded: don't prejudge, don't constrain

Some potential payoffs

- Professional growth
 - Exposure to different perspectives and approaches builds and broadens one's own knowledge and understanding
- Additional resources
 - Funds to support own research program
 - Lasting collaborations with some
 - Additional opportunities for external funding
- Research impact
 - Publications in many of the interdisciplinary journals will generate bigger impacts (e.g., compare impact factors of Science (30.3), Nature (31.2), PNAS (10.2) to our disciplinary journals)
- Ability to deal more effectively with “real world” problems
 - Enhanced interactions with practitioners, stakeholders, policymakers



Some potential payoffs

- Longer term payoff
 - Advancing science: interdisciplinary research can generate a more substantial and meaningful research contribution than otherwise would have been possible

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