Team science and *'Natural Resources Science'*

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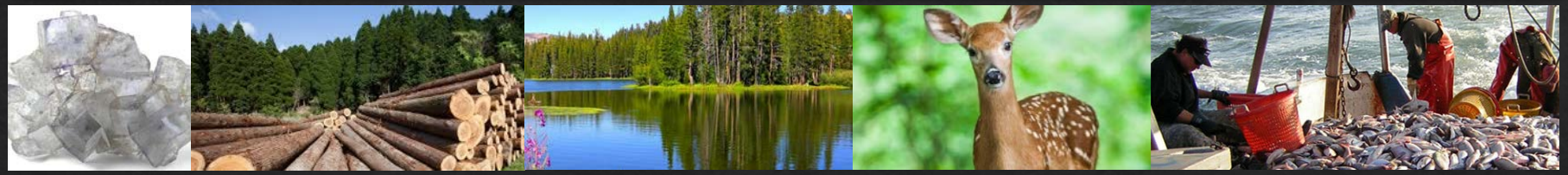
What is 'natural resources science'?

NATURAL RESOURCES = "Materials, substances, or living organisms that can be used for economic gain/human benefit, such as minerals, forests, water, wildlife, and fish."



NATURAL RESOURCES SCIENCE = "Conducting the **scientific research** needed to effectively manage natural resources for sustainable use, including conservation."

ANALOGY to 'translational medicine'?

TRANSLATIONAL MEDICINE = "The process of turning observations in the lab, clinic, and community into interventions that improve the health of individuals and populations."

… "results in changes in clinical practice, health of communities, health policy, with objective of having positive impact on health…."

ANALOGY to 'translational medicine'?

Natural resources science

the field or lab

~~TRANSLATIONAL MEDICINE~~ = "The process of turning observations in ~~the lab, clinic, and community~~ into interventions that improve the health of ~~individuals and populations~~."

animal or plant populations or resources

… "results in changes in ~~clinical practice, health of communities, health policy~~, with objective of having positive impact on ~~health~~ …."

management or policy of natural resources

ecosystem 'health' or 'integrity' as well as human well-being

ANALOGY to 'translational medicine'?

NATURAL RESOURCES SCIENCE = "The process of turning observations in the field or lab, or computer model output into interventions that improve the health of animal or plant populations or resources."

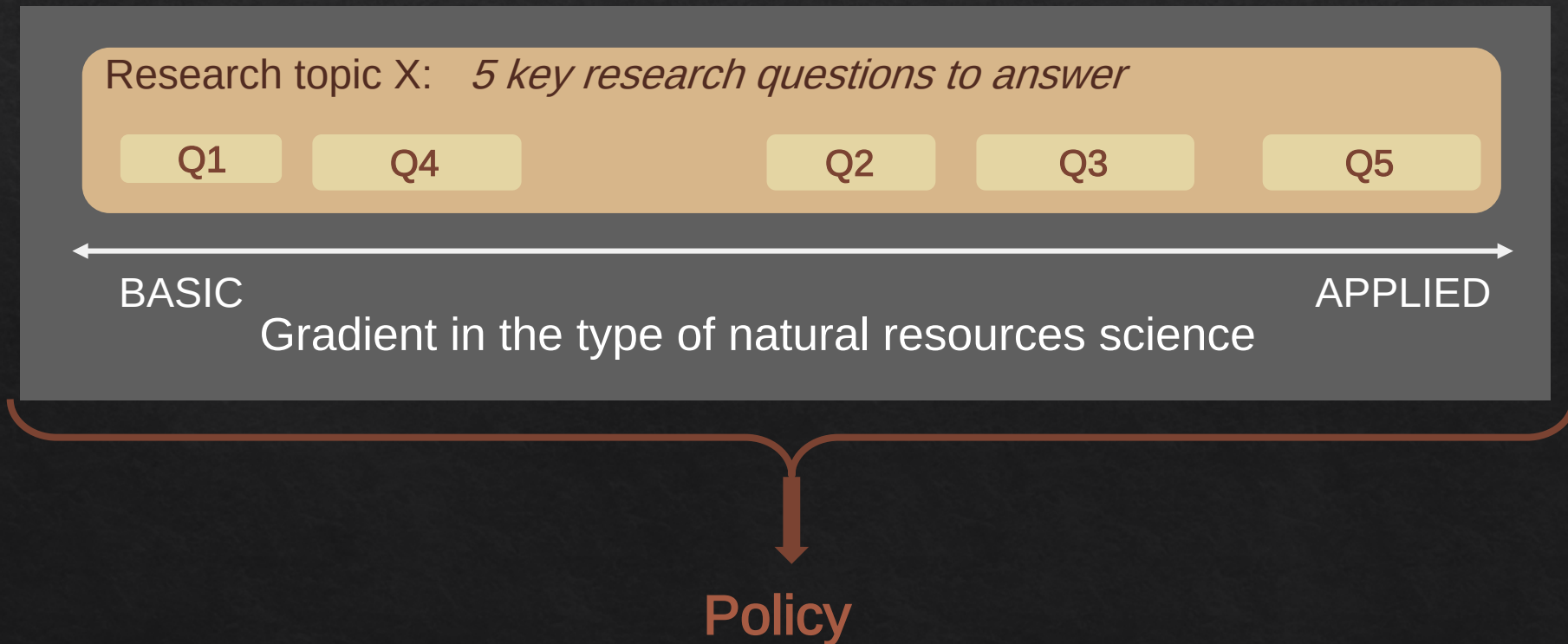
… "results in **changes in management, decision -making, or policies** of natural resources with objective of having positive impact on ecosystem 'health' or 'integrity' as well as human well -being."

EXAMPLE: Convention on Great Lakes Fisheries (1954)

Establishes the requirement to use science to manage the fisheries

Goals of natural resources science

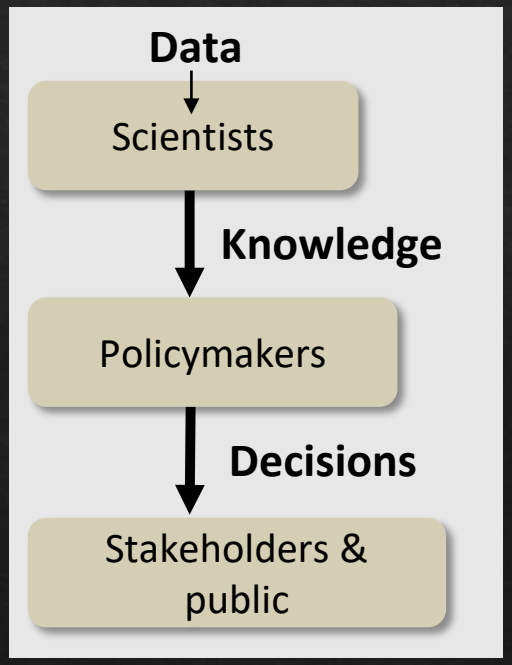
Conduct the science to create science -informed policies and decisions for managing and conserving fish, wildlife, water, and other natural resources that humans rely on.



Why is collaboration SO critical for 'natural resources science'?

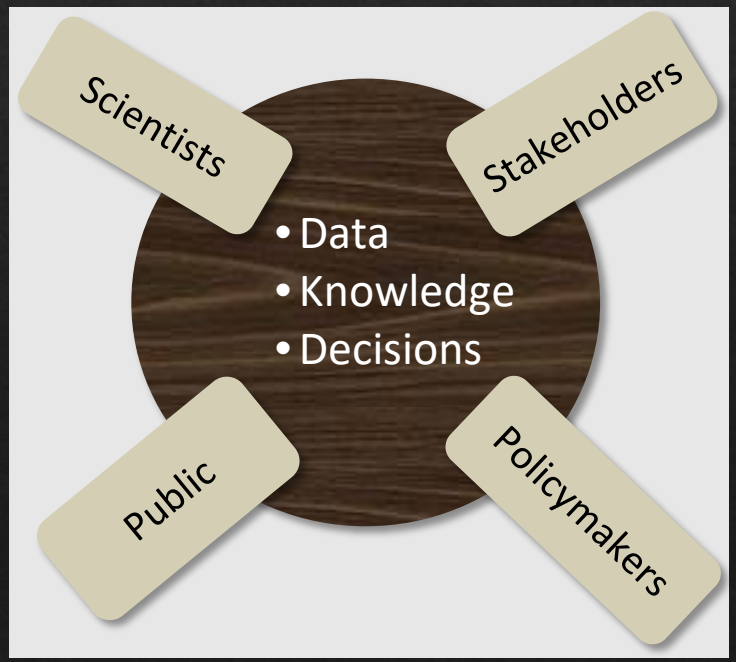
True collaboration results in better outcomes at the 'science-policy' interface

Deficit-linear model



VS

Round-table model



From: Soranno et al. 2015, & see citations within

Why is collaboration SO critical for 'natural resources science'?

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WHY???

- Is a way to incorporate the full range of 'values' rather than just those of scientists (*K.C. Elliott. Tapestry of Values. 2017)
- Create more robust research AND policy through novel insights and contributions from diverse stakeholders
- The public and stakeholders are more likely to accept the outcomes of science-based policy decisions when the process is transparent and collaborative

Round-table model

Example of natural resource framework: *Structured Decision -making*

= “A formal application of common sense for situations too complex for the informal use of common sense.
-- R. Keeney

Why are ‘natural resources’ decisions hard?

- Objectives that are complex, contradictory, or disputed
- Lack of knowledge of all possible alternatives
- High uncertainty in some system components (i.e., the science)
- Trade-offs are difficult to make

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Example: Using structured decision -making to manage the Grass Carp in Lk. Erie

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Structured decision-making to manage Grass Carp in Lake Erie

CHARGE = Develop a strategy for controlling grass carp in Lk. Erie to 'socially-' and 'ecologically-' acceptable levels

Research questions to answer:

Q1 – Best way to remove the carp to maximize population mortality?

Q2 – Are there behavioral or physical barriers that can limit birth-rates of the population?

Q3 - How exactly will the carp population respond under different strategies to control them? (i.e., predicted numbers)

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Structured decision-making to manage Grass Carp in Lake Erie

APPROACH

1. RESEARCH: Conduct research to answer Q1-3
2. MONITOR: current populations
3. PREDICT: effects of different management strategies on the carp populations (quantitative model)
4. FACILITATE A GUIDED DISCUSSION
   - Present alternatives to stakeholder group for discussion
   - Present LIKELY consequences of alternatives
   - Guide the group towards a decision

Conducted collaboratively or in consultation throughout the project with the multi-stakeholder group

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Structured decision-making

BENEFITS OF THIS TYPE OF APPROACH

1. Encourages values-focused thinking to find solution that maximizes objectives
2. Decomposes the problem into understandable chunks
3. Fosters transparency in decision-making

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Other types of natural resource problems/questions

- How do you prevent the spread of infectious wildlife diseases ?
- How do you prevent the spread of zoonotic disease in humans (i.e., infections spread between animals and people)?
- What is an acceptable level of harvest of wild fish populations in the Great Lakes?
- Why do some regions of Africa experience higher rates of human-carnivore conflicts than other regions?

COMMON FEATURES

- Complex problems at multiple scales (local, regional, national)
- Requires multiple disciplines (e.g., biologists, hydrologists, social scientists).
- Relatively high degrees of uncertainties in many components of the problem
- Often includes 'end -users'

How Science of Team Science can help

Team science* shows that:

- "Team processes (e.g., shared understanding of team goals, roles, conflicts) are related to team effectiveness."
- "Actions that foster positive team processes offer the best way to enhance team effectiveness: *team composition, professional development, leadership.* "

BUT, training in all of this is sorely lacking for natural resources scientists – at ALL career levels!

*NAS 2015. *Enhancing the effectiveness of Team Science*

But, current gaps?

Publications with keywords **'Team Science'**

- **537 articles** in Web of Science since 2012
- Average citations per article = 13 citations
- 5,586 citing articles

Publications with keyword **'Team Science' and 'Ecology'**

- **16 articles** in Web of Science since 2000
- Average citations per article = 12 citations
- 364 citing articles