The National Academies

Workshop on Landscape Approaches and Multi-Resource Analysis for Sustainable Natural Resource Management

Identifying Needs and Challenges

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Graphic Support by Eric Morrissey

The Need:

Trends in Natural Resource Models

The Challenges:

- Disruptive technology presenting risk
- Envisioning the product
- The Data: Integration and the Challenge of Scale
- The People: Integration and the Challenge of the Expert Mindset
- The Approach: Developing Behaviors that Cross Boundaries to Integrate
- How to train professionals to do this better going forward?

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Trends in Natural Resource Models

Moving from……	Going toward……
Descriptive monitoring and reporting on individual elements of natural systems	Multidiscipline, multipurpose assessments of natural systems; developing response strategies
Descriptions of state	Forecasts and scenario development
A few first-generation multifunctional multidisciplinary products and services	Routine way of doing business
Systematic 2 D mapping	Dynamic 3 D models
Layering of models	Interactivity and interoperability of data and models
Grab-bag of products with scale and content gaps	Seamless suite of products spanning all temporal and spatial scales
Ad hoc, stand alone efforts	Multi-agency, multi-stakeholder programs

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The Challenge: Integrated/Multi - Resource Assessment as a Disruptive Technology

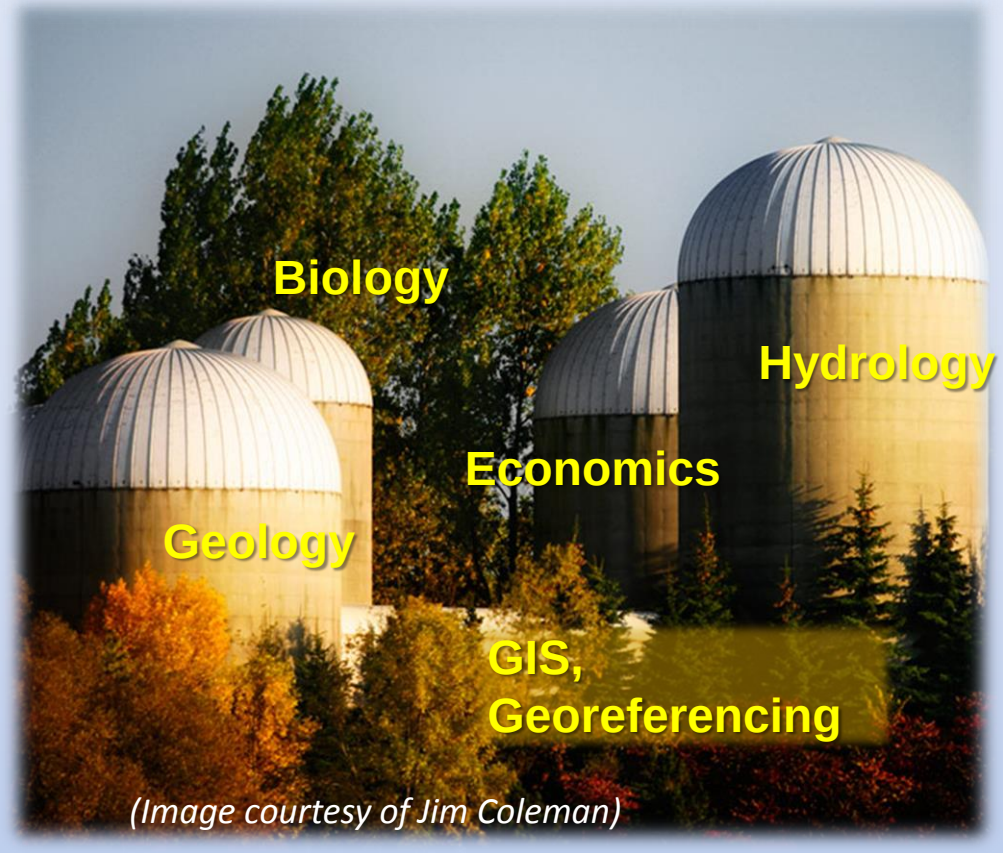
- Requires consideration of both monetary and non-monetary value of all products, services, and processes
- There are multiple, inter-connected resources and their associated cycles
- Consider wide range of factors – geoscience, engineering, business, economic, environmental, stakeholder, policy, regulatory
- Goal is to improve risk assessment and decision-making ability in the face of uncertainty and complexity

There is Risk Involved, and Rewards are Uncertain

(Graphic from: *Trusteeship, March/April, 2014)*

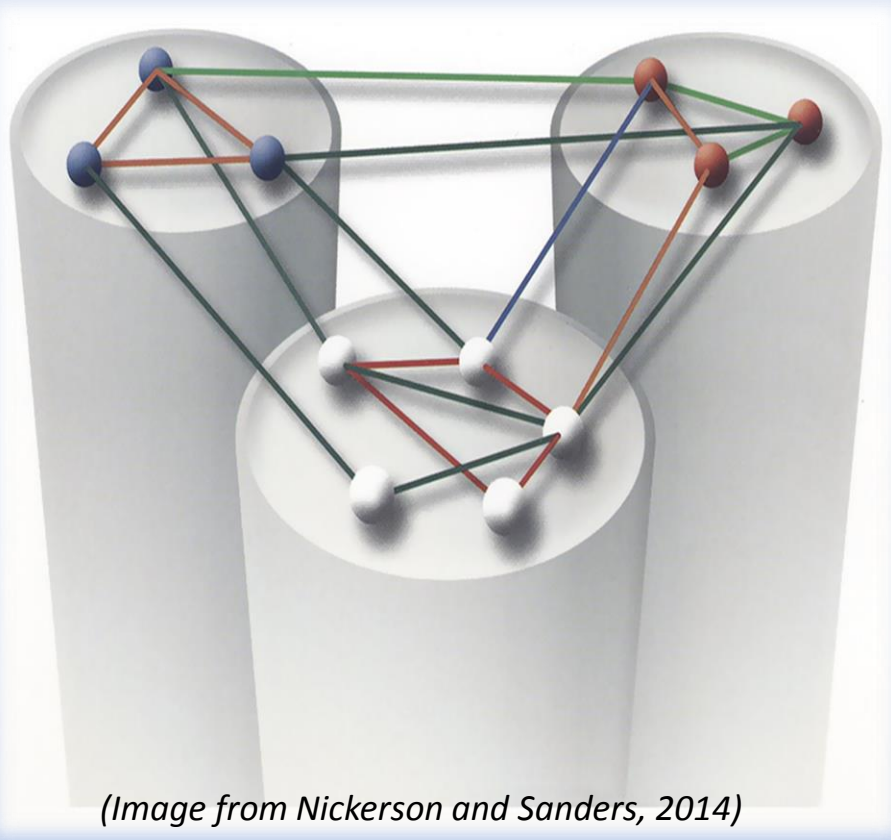
What *IS* the Product?

Traditional Silos



(Image courtesy of Jim Coleman)

Horizontal Integration



(Image from Nickerson and Sanders, 2014)

A new type and level of integration is needed.
Natural Science alone is not enough. Economics alone is not enough.
These need to be incorporated within a Decision Analysis framework in order to be most useful.

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(From Deering, Strange Brew)

The Data: Integration and The Challenge of Scale

- Most resource work is conducted at single scale of analysis using data collected at single scale when a multi-scale approach is needed.
- "Scaling up": Some data types are additive and others aren't. Data variability may be lost with aggregation.
- The levels at which data are collected and aggregated most frequently may not be useful for the question at hand.
- One of most difficult tasks is determining what level of complexity is needed and what components need more, or less, complexity

Adapted from: Evans, Ostrom, and Gibson (Indiana U and UC San Diego) 2002

Issues of Scale – Continued

Physical scale: We think we should be able to use knowledge of small things to predict and manage large-scale phenomena

But…

- Large scale is likely to have at least some characteristics we cannot predict at all from a knowledge of the small scale
- Small scale is likely to have at least some characteristics we cannot predict at all from a knowledge of the large scale
- Large scale processes and relationships mask the variability that exists at smaller scales.

Temporal scale: When studying short periods of time, slow moving variables are considered external to the system for simplification in order to focus on fast-moving variables

- Many users are interested in cumulative impacts

(Adapted from: Evans, Ostrom, and Gibson (Indiana U and UC San Diego) 2002)

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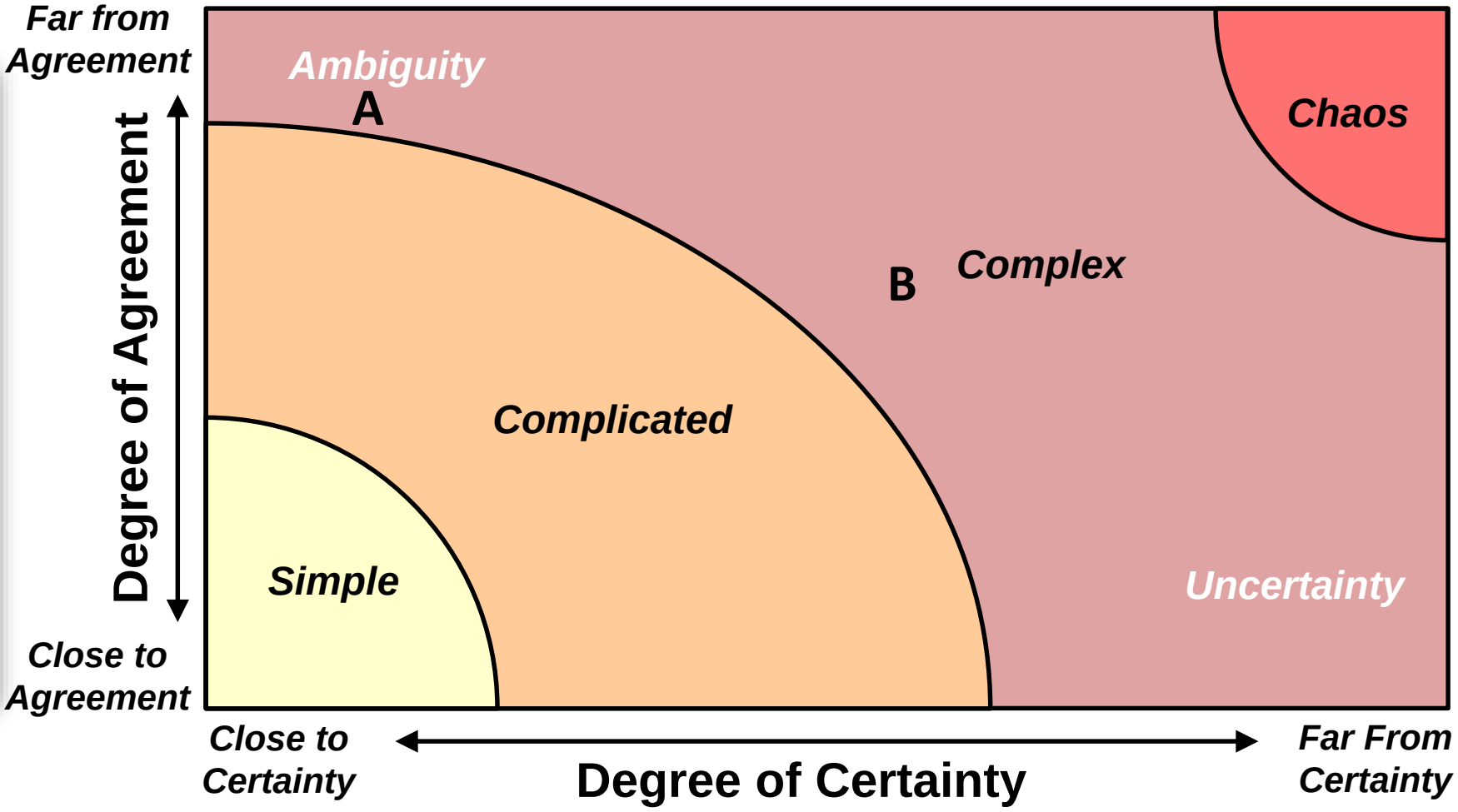
The People: Integration and the Challenge of the Expert Mindset



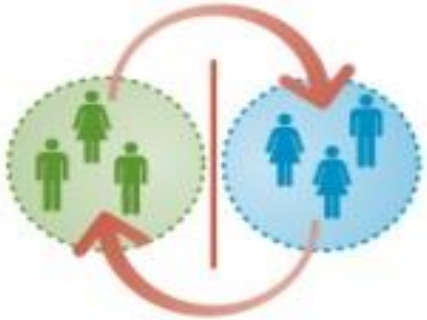
(From: S.J. Tepper, Chronicle of Higher Education, 09/2014.)

(Adapted from: David Weiss, CEO Weiss International, Queen's School of Business Innovation Summit, 2014)

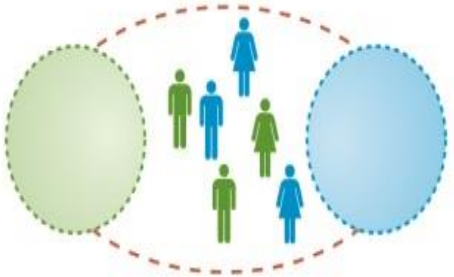
Having a Model that integrates the data is not enough.
You need models that integrate thinking and behaviors also.

Boundary Spanning Leadership

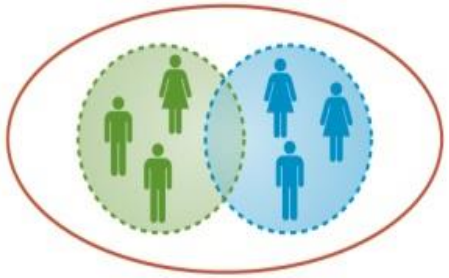
1. Bringing the right subject matter experts together



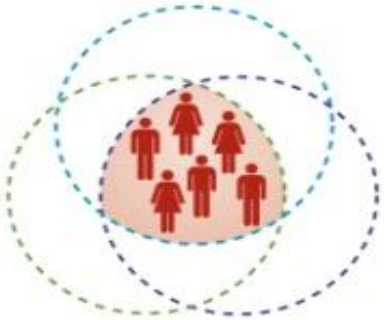
2. Learning what other experts can bring



3. Coming out of comfort zone to envision something new together



4. Integrating or weaving pieces of subject matter



5. Transforming into new fully integrated team

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(Adapted from the work of Ernst and Chrobot-Mason and others, Center for Creative Leadership)

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