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Time for Paradigm Shift in How We Transfer Knowledge? Making the Case for Translational Science and Public Engagement

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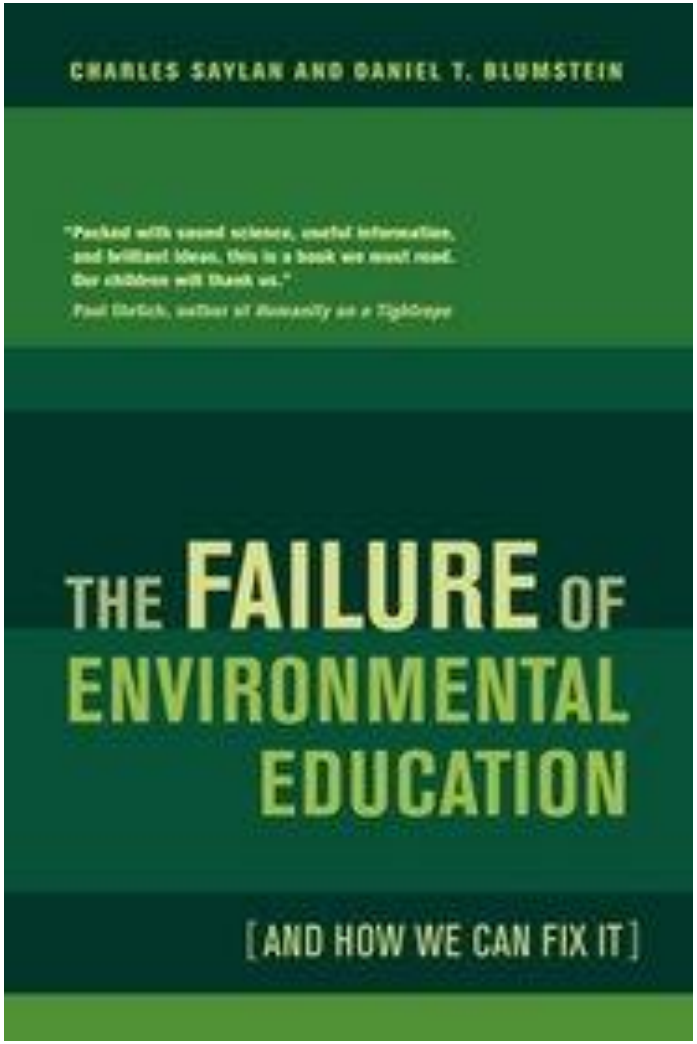
The Problem



By any measure, environmental education has failed to prevent or moderate the harmful effects of environmental change.

Saylan and Blumstein. 2011. *The Failure of Environmental Education*

…and scientists are key contributors to the problem

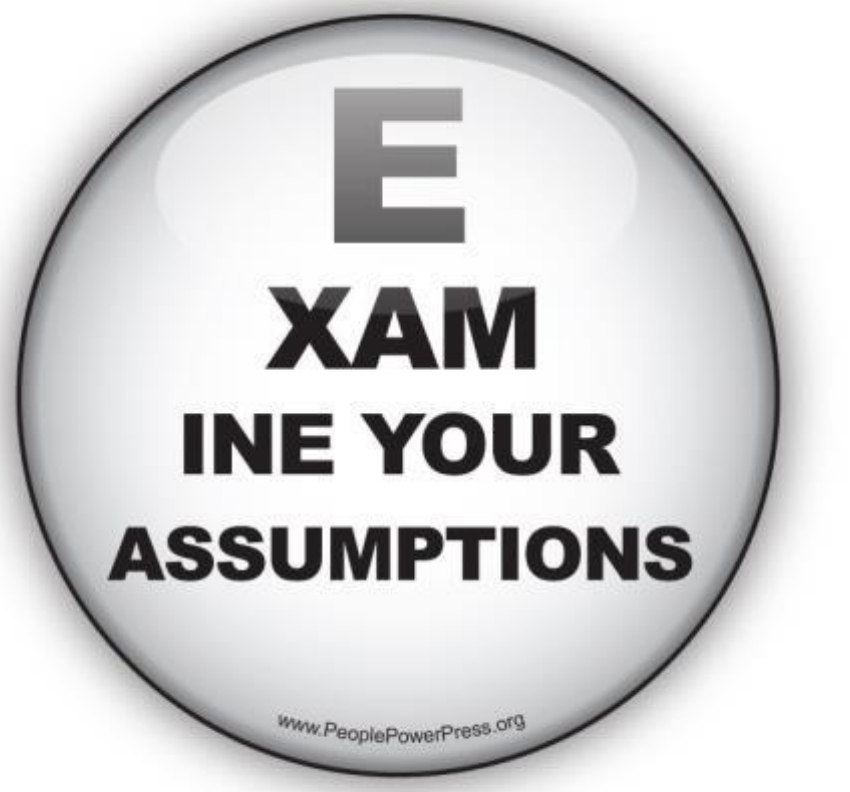
A major part of our failure in environmental education lies in how scientists understand (or misunderstand) and practice knowledge transfer.

…and scientists could/should be part of the solution.

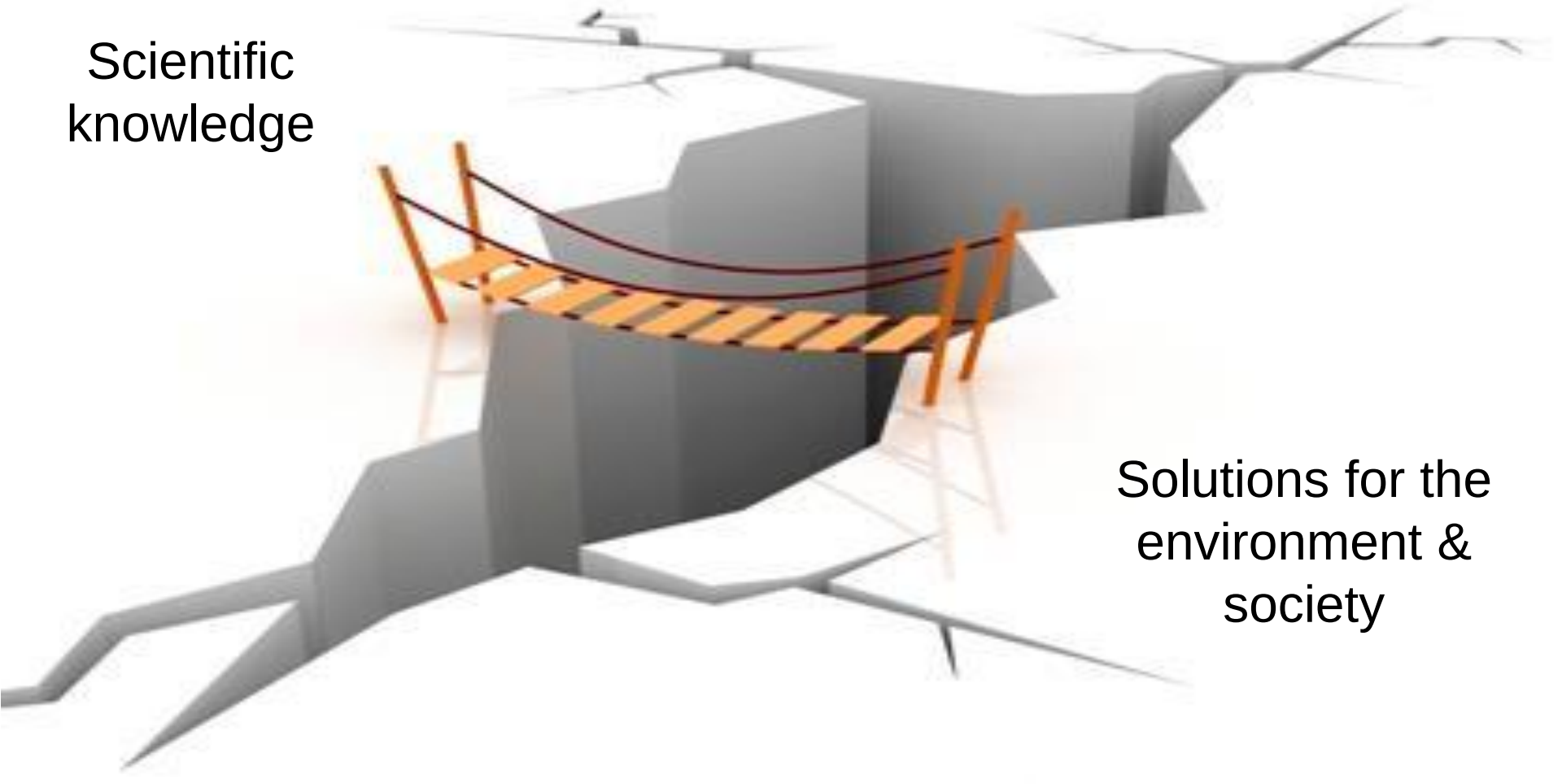
It is *not* a question of motivation

Generally speaking, **scientists want to make science more relevant to society**

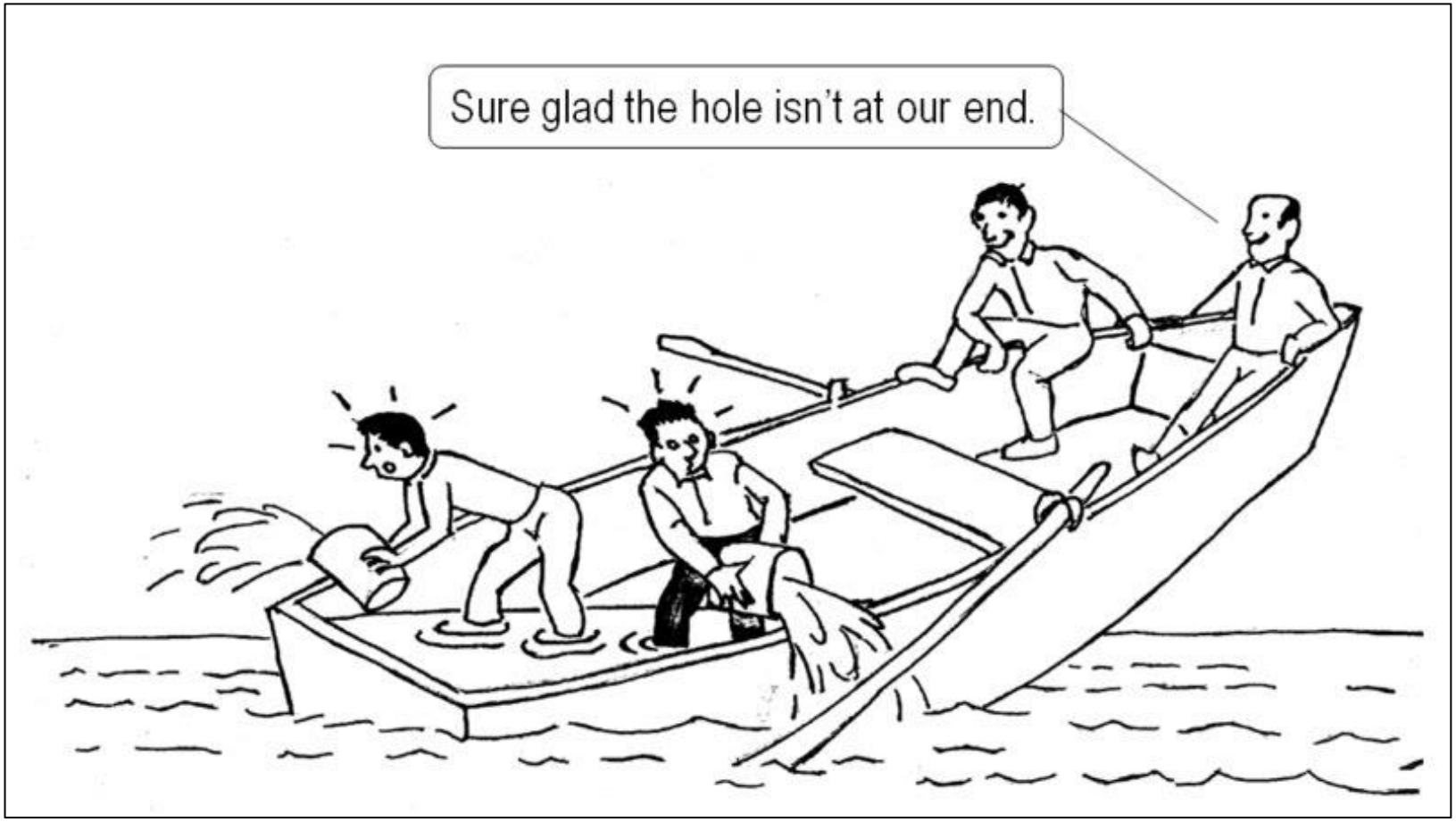
It *may be* a question of false assumptions



Though scientists recognize there is a knowledge transfer problem…



…many scientists *and* managers believe they are ***not responsible*** for knowledge transfer



Publish or Perish!
(¡Publica o muere!)

Generally speaking, **relatively few scientists invest in knowledge transfer beyond peer-reviewed publications**

…and few institutions dedicated to research reward anything else.

The "Loading Dock" Model

As a result, the majority of *scientific* knowledge transfer occurs this way:

Source: http://en.wikipedia.org/wiki/File:Warehouse_Loading_Dock.JPG

Scientists know that science and decision making are *not* the same

≠

But few scientists truly appreciate *how* they are different

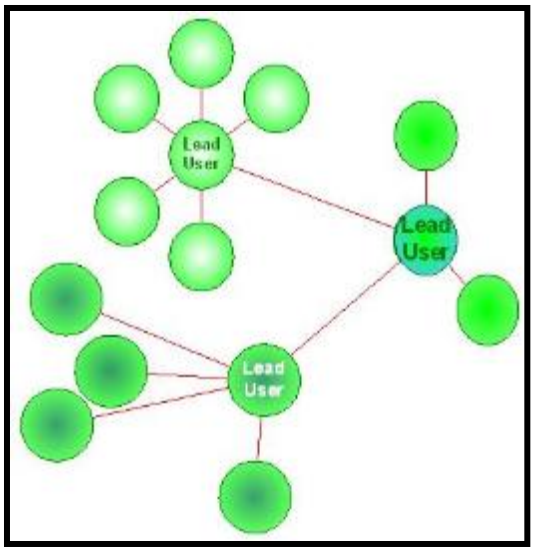
- **Science is reductionist and/or frequentist.**
  - **Researchers** strive to define or delineate the subject of interest, estimate an impact or predict a probable outcome.
  - Scientist try to find answers to questions.
- **Decision making is synthetic.**
  - **Decision makers** often must act with whatever information is available, often drawing from many (and potentially incommensurate) sources.
  - Decision makers decide what to do.

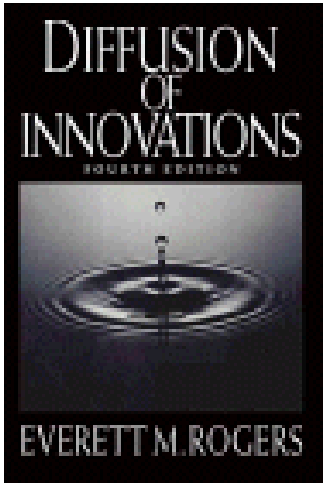
Scientists generally do not focus on how ideas actually spread

- Many scientists assume ideas spread based on the message, through good advertising or extensive and effective media coverage (**mass marketing**)
- But actually, ideas spread among people (**marketing that targets agents of change**).
- In other words, a good message and effective communication is a good start, but engaging the right people at the right time is essential.

Diffusion of Innovations

Diffusion, or the spread of an idea, method, practice, or product throughout a social system, occurs gradually as some users wait to see how it has worked for others before they are willing to adopt a new method.

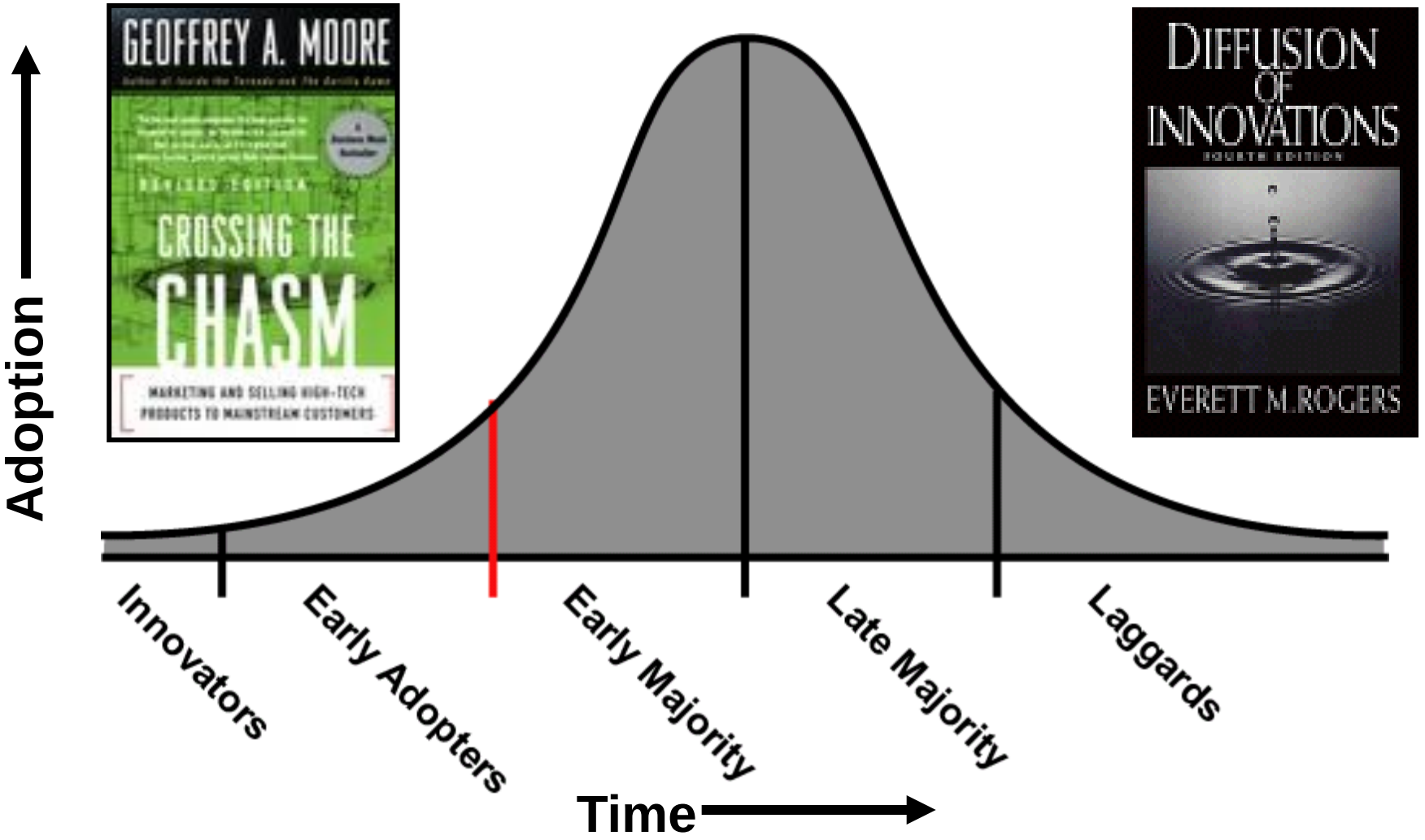




Rogers, 2003

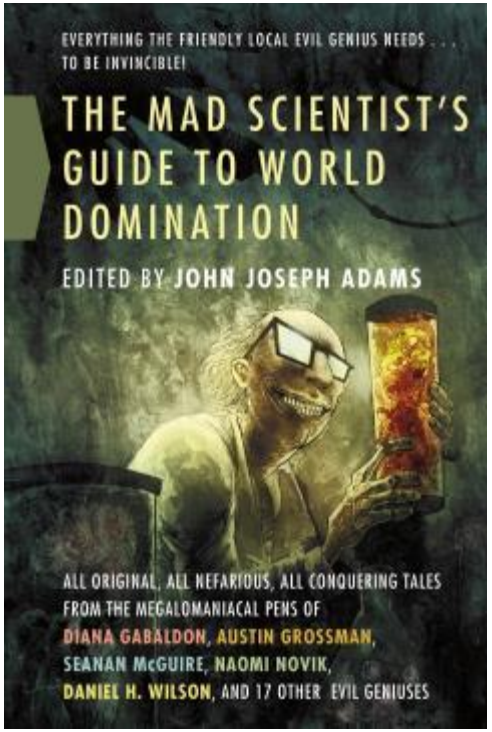
Diffusion of Innovations

Adoption Life Cycle



AND…

scientists are simply different!



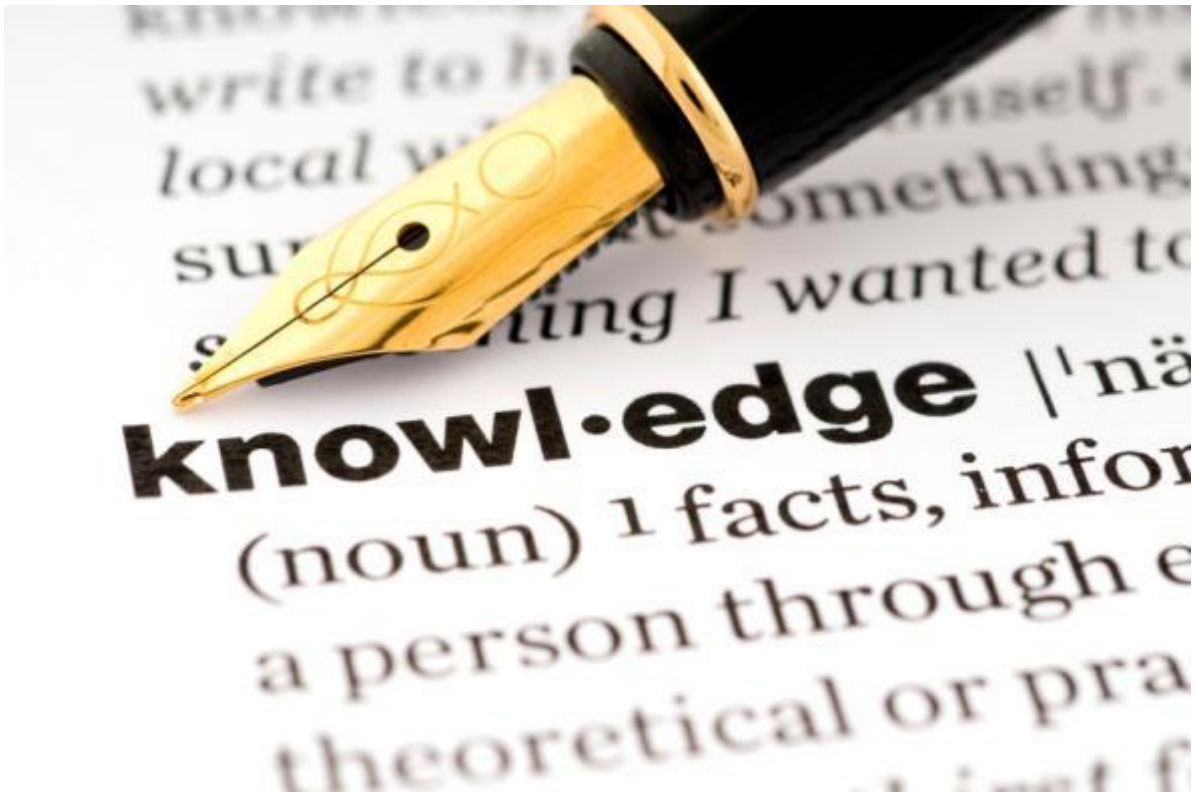
So, is the problem scientific literacy?

- Though arguably starting from low levels, **scientific literacy is actually on the rise**, however it is failing to keep pace with an increasingly science and technology driven – and dependent – society.
- In Europe, only a minority of young people (15-25 yrs old) report an interest in science, yet **40% expressed interest in the Earth and the environment** and new inventions and technologies.

Is the problem knowledge deficit?

Many scientists attribute the failure to prevent or ameliorate environmental problems to a **deficit in scientific knowledge** among stakeholders and the general public.

What motivates people to gain knowledge about a topic or issue?



Time for a two question quiz

1. Which of these is a strong predictor of both one's **level of knowledge** (on a given topic) as wells as the **motivation to gain knowledge**, and which is not?

A. **Subjective norms (social pressure, social trends)?**

   OR

B. **Interests (personal relevance)?**

Time for a two question quiz

2. Which of these two hypotheses forms the basis for the vast majority of scientific “outreach” / “dissemination” / “knowledge transfer” strategies?

A. **Subjective norms (social pressure, social trends)?**

OR

B. **Interests (personal relevance)?**

This fundamental *mis*perception about knowledge leads to false assumptions about:

- how and where we learn
- how science is effectively communicated
- how what is learned is interpreted and used
- how ideas and technology spread
- …and reach the mainstream
- how decisions are made
- the role of the online environment
- what leads to effective public participation

It also leads to two very different solutions to knowledge transfer:

When you think that knowledge acquisition is motivated by **subjective norms (social pressure, social trends)**, the solution pursued is generally based on the **"deficit model"** conceptualization of the knowledge transfer challenge. (Thus efforts are focused on **awareness raising / *out*reach**.)

…**supply driven processes designed to remedy a perceived deficit in knowledge**.

The alternative perspective

When you think that knowledge acquisition is based on **interests (personal relevance)**, the solution pursued is based on a **"engagement"** conceptualization of the knowledge transfer challenge. (Thus efforts are focused on **outreach AND *in*reach**)

…**demand driven processes designed to help scientists engage stakeholders**.

A side-by-side look

The Deficit Model	The Engagement Model
Hypothesis: knowledge acquisition is motivated by **subjective norms (social pressure, social trends)**	**Hypothesis:** knowledge acquisition is motivated by **interests (personal relevance)**
Method: awareness raising / *out*reach	**Method:** engagement / outreach AND *in*reach)
Process: supply driven designed to remedy a perceived deficit in knowledge	**Process:** demand driven processes designed to help scientists engage stakeholders

For more, see Groffman et al. 2010

Aspect	*Deficit model*	*Public engagement model*
Major influence(s) on public beliefs and decisions	Science literacy or the lack thereof	Values, trust, identity, and social networks
Proposed solution to societal inaction	To improve science literacy (ie to fill in the "deficit" in the public's technical understanding of an environmental problem)	To connect an environmental problem to public values while building trust and empowering public participation
Communication is a process of…	…transmission, which means "popularizing" and "simplifying" technical information that flows from experts to the public	…dialogue and the two-way exchange of perspectives; both the public and experts learn from this process
The definition of "reaching the public"	Increasing the amount and technical accuracy of science news coverage, focusing on traditional outlets such as the newspaper science beat, popular science magazines and books, or public television programming	Reframing a complex issue around relevant and familiar dimensions; engaging in local community forums and dialogue; partnering with opinion leaders and other societal groups; and complementing traditional science coverage with novel entertainment genres and social-media initiatives
Scientists and their organizations…	…are under attack in society; any communication failures are blamed on public ignorance, the media, or "politicization" and "anti-science"	…hold almost unrivaled trust, authority, and respect in society; scientists need to use this communication capital effectively and wisely, otherwise scientists share some of the blame for communication failures
The ultimate goal	To improve science literacy – once the public is brought up to speed on the science, they will view issues and decisions as scientists do, controversies will go away, and progress will occur in dealing with environmental problems	To motivate, enable, and empower the public to make decisions about environmental problems – yet, no matter how accurately communicated and understood the science, public decisions cannot be separated from values, political context, and necessary tradeoffs between costs, benefits, and risks

How??????

Science has multiple dimensions

- **Basic science** will always be necessary for discovery.
- **Applied science** will always be necessary to bring discovery into real-world context.
- Both basic and applied science can be conducted in isolation (without the public).
- But making science useful implies – and requires – a role for people, through what is called **translational science**.

The term "Translational Science" comes from *translational medicine*

- *Translational medicine* is "research that helps patients"
- *It is about m*oving research findings (expert knowledge) to patients…
  ….***while*** moving patients' knowledge to researchers.
- *"Results can be thrust from bench to bedside, but there is also much to be learned by pushing the other way."*

Heidi Ledford | 11 June 2008 | Nature 453, 843-845 (2008) | doi:10.1038/453843a

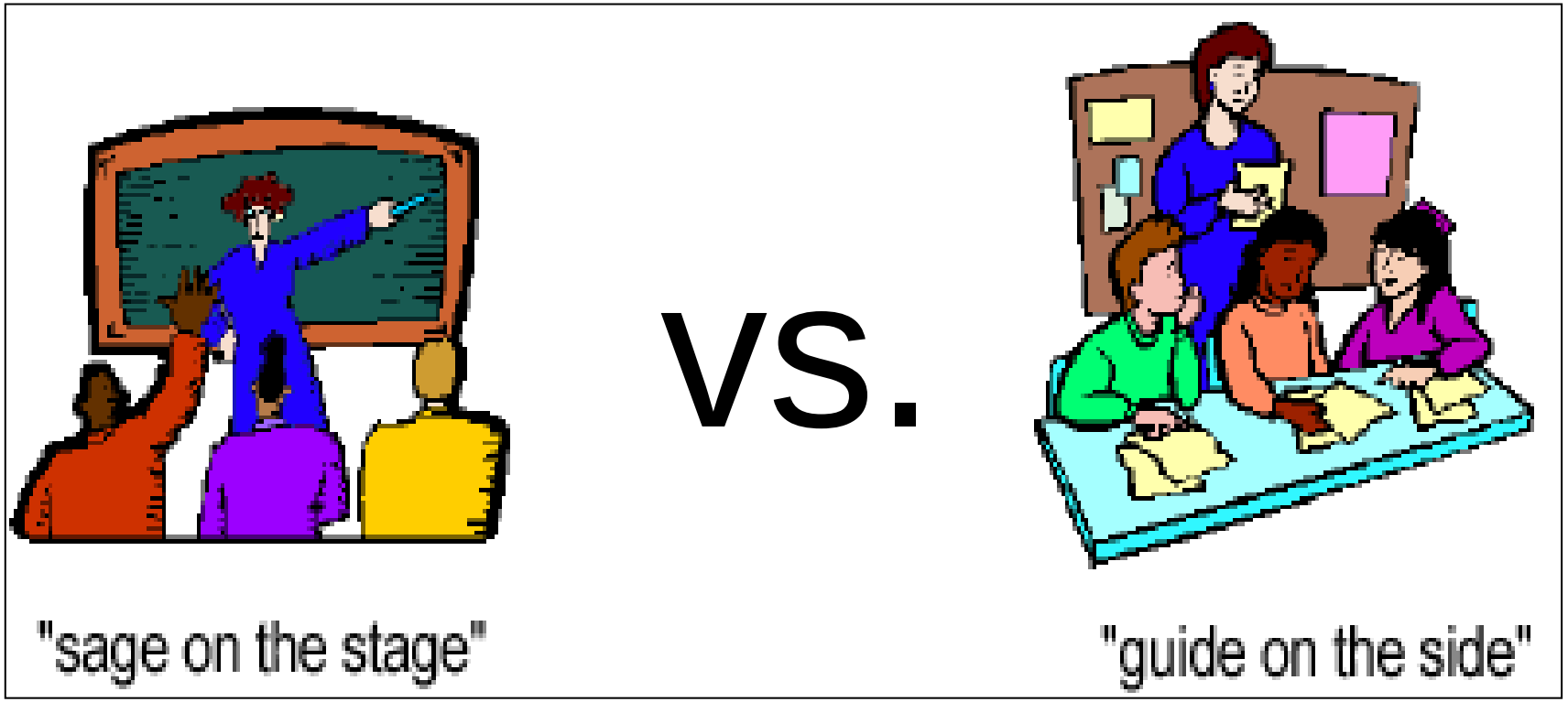
Translational research

- Is **formative**: the feedback from participants is iteratively used to adapt the research to better address the actual needs of the participants.
- Involves the interdisciplinary **co-production of knowledge**: not only can the answers change based on what is learned—so can the questions.

Translational research

- Is **participatory**: stakeholders of all kinds should be able to share the same state-of-the-art model of how things work, particularly considering their solutions may be better suited to local conditions.
- Involves the on-going **engagement** of stakeholders leading to **mutual learning** and **more informed decisions**.

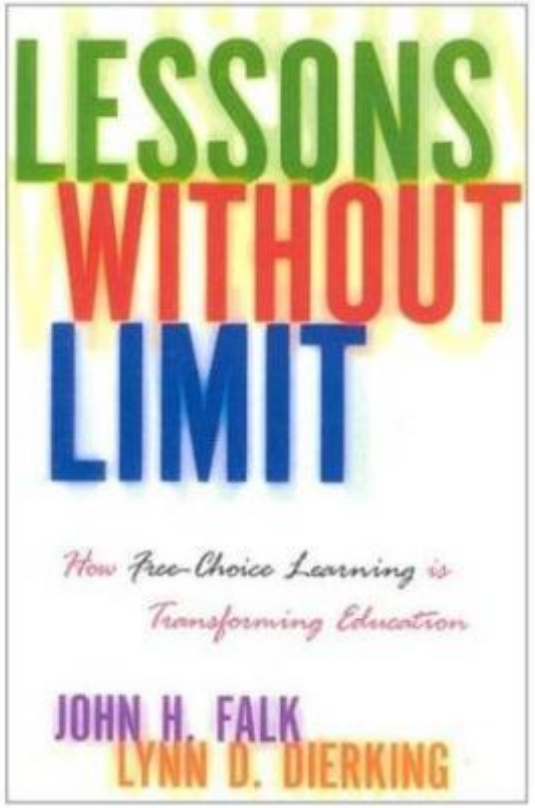
Scientists and managers come from academia. As a result, they think that learning results from *teacher*-centered approaches.



But the vast majority of learning voluntary, self-directed and *learner*-centered.

Informal Learning

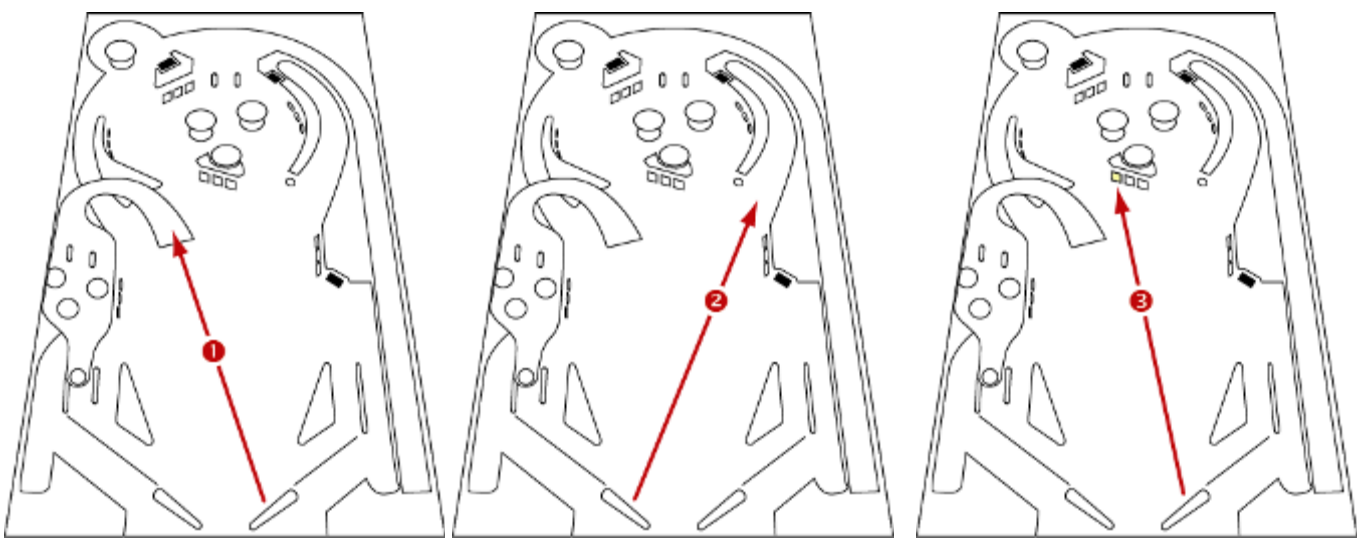
- "Formal" learning
  - Expert-led, in the classroom
- "Non-formal" learning
  - Expert-led outside class
- "Informal" learning
  - Voluntary
  - Self-motivated
  - Self-controlled
  - Cumulative and enriching
  - A daily, lifelong activity
  - Personally guided by an individual's needs & interests

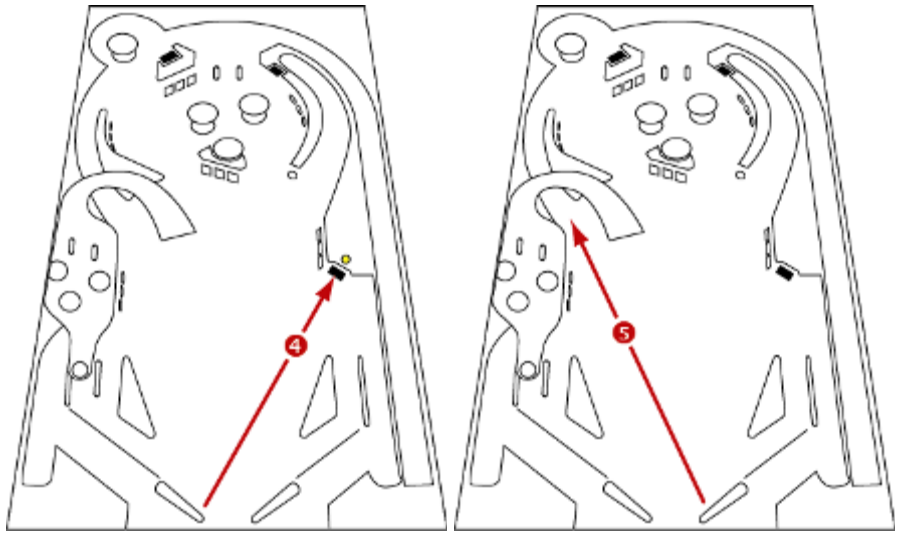


Institute for Learning Innovation: http://www.ilinet.org/display/ILI/Home

Creating opportunities to learn

Creating opportunities to learn

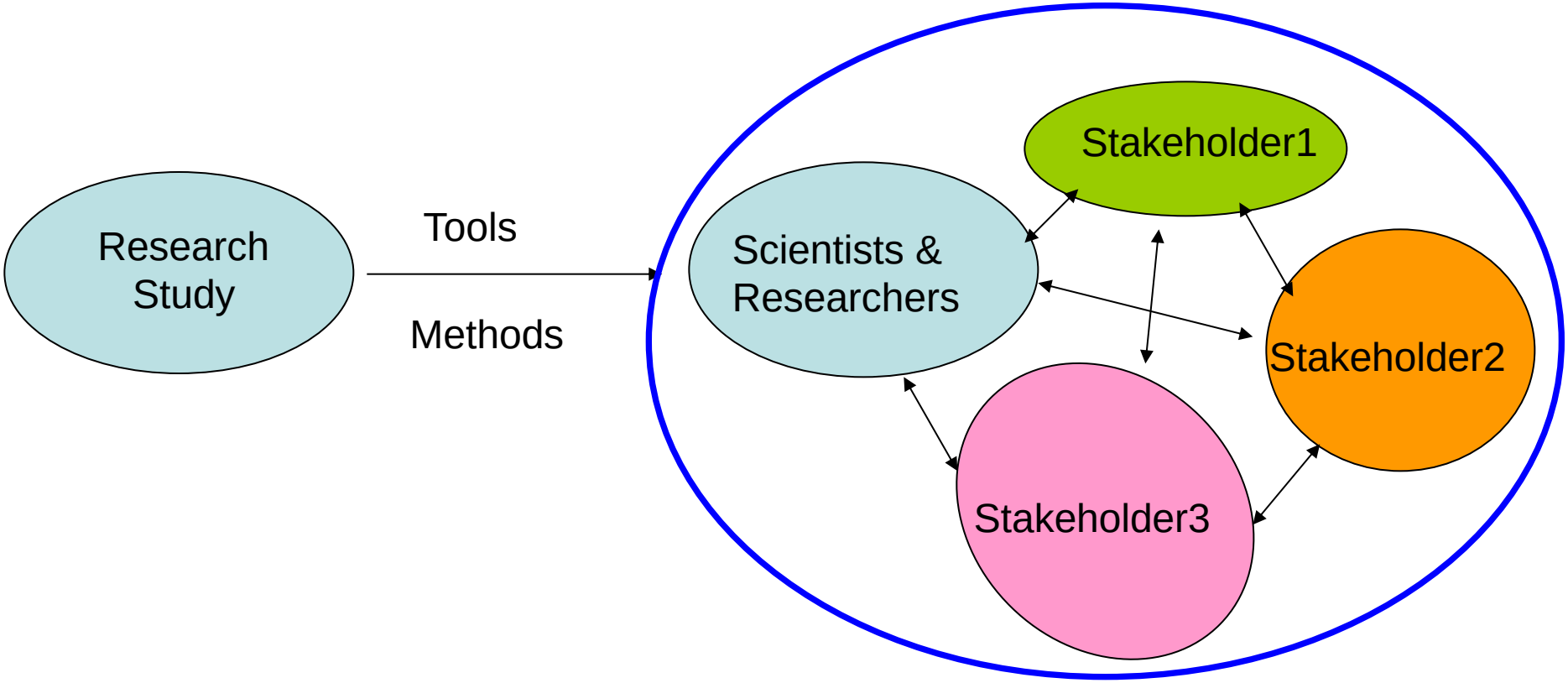




Source: http://www.rdrop.com/~half/General/GameTips/space.cadet.html

Social/Mutual Learning

- Collective self-reflection through interaction and dialog among diverse participants
- Co-production of knowledge



The solution is here!

The tools of translational science are within reach, *but not yet in the mainstream*.

The theory, frameworks, public engagement models, and the participatory research methods and tools necessary to more effectively transfer knowledge are available, but infrequently employed by environmental researchers and managers.

We need to use the tools we have…

- Tools that facilitate the **translation** of science into products that managers can use.
- Tools that facilitate the **synthesis** of information that might be used in making a decision.
- Tools that make it easier for scientists to strategically and effectively **engage** the audiences that can help them achieve broader impact from their science.

Some of the *many* tools available

Appropriate frameworks
Translational science
Ecosystem services
Human-environmental systems
Public engagement model of scientific literacy

Essential theory
Resilience
Participatory action research
Formative research
Informal learning
Problem-based learning
Social/mutual learning
Diffusion of innovation

Democratic stakeholder engagement
Collaborative multi-stakeholder platforms
Chain referral (comprehensive representation)
Communities of practice/interest
Maximizing interface organizations

Indicators
Participatory criteria selection
Participatory criteria weighting

Participatory data collection
Citizen science
Participant-led observations
Volunteered geography
Photo elicitation/Photo voice
Participatory mapping
Collaborative mapping

Knowledge integration
Integrating biophysical and social factors
Integrating local and scientific knowledge

Decision aiding
Facilitated data and modeling access
Online decision support tools
Multi-criteria decision analysis

Institutional analysis
Scale and nested hierarchies
Institutional change analysis tools

Innovation ecosystem
Business models to support good science
Building capacity in research-support SMEs
Participatory R&D

Portuguese farmer explaining the impact of his conservation measures to other farmers as well as ecologists and soil scientists. Photo by Barron Orr

Stakeholder’s in Greece identifying and prioritizing evaluation criteria for past land management and restoration actions. Photo by Vasilios Papanastasis.

Extension agent Bill Brandau (Graham County, Arizona) facilitating a discussion on the causes of past erosion in the San Simon watershed in southeastern Arizona. Stakeholders include ranchers, government agency conservationists, local town administrators, researchers and students. Photo by Barron Orr.

One-way knowledge transfer happens when scientists communicate results to the public. Success, however, is more likely when ideas are exchanged. This requires all stakeholders, including scientists, engaging in the co-production of knowledge. Photo by Niels Dreber (Miers, South Africa).

Moving from scientific reductionism to synthetic decision making can be facilitated by tools such as Multi-criteria Decision Analysis (MCDA) Photos by Barron Orr (Miers, South Africa).

Stakeholders can provide ground observations from their own perspective (photo elicitation) that can lead to action (photo voice) Photo by Taryn Kong.

Sign: perennial grass

"You can see that the grass begins to grow where the three-thorn has been killed. That is knietjiegras (*Eragrostis lehmaniana*), a good perennial grass. Here I have also extracted my animals after controlling the three-thorn."

Sign: animal condition

"If my rams are as fat as this one, then I know there's enough food in the veld for them."

Thank you!

Barron J. Orr

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PRACTICE
Prevention and Restoration Actions to Combat Desertification. An Integrated Assessment.

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