Teaching Note: *Stopping a Wildlife Disease from Becoming a Crisis: A Collaborative Leadership Success Story*

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Audience:
Any group that is focusing on transdisciplinary research or cross-sector complex problem solving

Summary:
Using the example of a biodiversity crisis, this case study enables students or workshop participants to see a situation from multiple perspectives. Although the crisis is global, the case involves four key individuals—a scientist, a policy analyst, a journalist, and a government agency administrator who all work in U.S. organizations and are key players in various networks. To get an in-depth exploration, the students/participants:
1) produce a timeline with the key events to understand the activities and strategies;
2) draw actor maps to show the connections and get an overall view of the system or the socio-environmental, political, economic landscape.

What course might this case be applicable for:
A short course or workshop for graduate students, postdocs, or faculty on sustainability leadership
Note: The course was piloted with undergraduates participating in a capstone course for Earth Systems majors at Stanford University.

Socio-environmental synthesis domain (SESYNC framework): Boundary-crossing

Purpose or learning goal: *Make sustainability leadership visible.*
This case is intended to highlight leadership mindsets that contribute to catalyzing change. It draws upon the sustainability science research of linking knowledge to action and the leadership attributes required. One of the key components of sustainability leadership is *having empathy.* Given the complexity of environmental and sustainability challenges, there isn't just one relevant perspective, strategy, or type of knowledge. Respect for different kinds of knowledge and know-how is a critical starting point. Being able to set aside one's own mental models and appreciate another's reality, both emotionally and cognitively, is key.

Learning objectives: Using the chytrid crisis as a case study, participants will:
1) Use systems-thinking tools to discover key events and relationships;
2) Confront personal mental models about the integration of science into policy; and
3) Synthesize leadership attributes in the context of linking knowledge to action.

Overview of case content:
Amphibian Decline: Saving the Salamander – Short video clip produced by AAAS

Classroom management:
The case works best if done in a half-day session with background reading prior to the session. When piloting the case study, we divided it into two 80-minute sessions.

Room set-up:
It is important to have a flexible teaching space(s), not a lecture hall. Furniture should be moveable since the activities are done in small groups and a large group. Having a large blank wall or whiteboard is also essential.

Class size:
The activities are discussion-based and interactive. It would be very difficult to teach the case with more than 20 participants unless you have more than one instructor.

Jigsaw Method[1]

To simulate the challenge of the different perspectives, the authors designed the case using the jigsaw methodology. Designed by Elliot Aronson in the 1970s, it enables participants to read about one aspect of a complex problem and then share and teach the rest of the class about what they read.

Materials (see *Supplementary Materials)*

- 4 sets of *event cards* Make sure the event cards are in random order and are color-coded so that each color represents a different perspective.
- Actor cards
- Video - Amphibian Decline: Saving the Salamander
- Flip charts, markers, pencils, and tape
- White board or blank wall

Readings and assignment instructions

Prior to the teaching the case, assign participants to one of four "speciality"groups:

Scientists
Government agencies
Media
Policy analysts from nongovernmental agencies (boundary organizations).

Each group is responsible for reading and synthesizing one perspective of the unfolding of the chytrid crisis.

As you do the assigned reading, pay particular attention to two aspects of the chytrid story:

(1) important dates and events in the unfolding of the story; and
(2) the specific people, groups, organizations, and networks engaged in the story who are in the role/perspective that you've been assigned.

You will draw on this information to construct a timeline of the chytrid story and an actor map.

Background reading for everyone

Narrative: Description of key events as told through the eyes of Peter Jenkins, Su Jewell, and Karen Lips
Matson, Clark, & Andersson. Ch. 5. *Pursuing Sustainability* or
Pursuing Sustainability: Linking Science and Practice. Video lecture clip with Dr. William Clark (Harvard) speaking at the University of Michigan (1:07 – 1:12)

Specialty Group 1: Popular press

Riled Herpetologists Press Obama Administration to Protect America's Salamanders from a Fungal Threat. Andrew Revkin. March 21, 2015
http://dotearth.blogs.nytimes.com/2015/03/21/riled-herpetologists-press-obama-administration-to-protect-americas-salamanders-from-a-fungal-threat/

What It's Like to Watch a Species Go Extinct. Lizzie Wade, July 30, 2015
http://www.wired.com/2015/07/watching-species-go-extinct-frogs-bd-salamanders-bsal/

Stopping the Next Amphibian Apocalypse. By Karen Lips and Joseph R. Mendelson III, Nov. 14, 2014
http://www.nytimes.com/2014/11/15/opinion/stopping-the-next-amphibian-apocalypse.html

US Restricts Movement of Salamanders for their own good. Carl Zimmer. Jan. 12, 2016
http://www.nytimes.com/2016/01/13/science/us-restricts-movement-of-salamanders-for-their-own-good.html?_r=0

Can Congress act to block fungal threat to US amphibians? Andrew Revkin. Oct. 31, 2014
http://dotearth.blogs.nytimes.com/2014/10/31/can-congress-act-to-block-fungal-threat-to-u-s-amphibians/

Specialty Group 2: Government agency regulatory ruling

Injurious Wildlife Species; Listing Salamanders Due to Risk of Salamander Chytrid Fungus
A Rule by the Fish and Wildlife Service on 01/13/2016. *The Federal Register*

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[1] You can find many references to using jigsaw in higher education. One reference is as follows: https://www.schreyerinstitute.psu.edu/pdf/alex/jigsaw.pdf

Specialty Group 3: Science

Martel et al. (2014) Recent introduction of a chytrid fungus endangers Western Palearctic salamanders, *Science,* October 31, 2014
http://science.sciencemag.org/content/346/6209/630

Yap et al. (2015) Averting a North American biodiversity crisis. *Science,* July 31, 2015
http://science.sciencemag.org/content/349/6247/481

Specialty Group 4: Karen's perspective and a policy analyst's observations

Engaging in a policy discussion, blog post by Chad English
http://compassblogs.org/blog/2014/04/22/lessons-from-leopold-part-i/

Lessons from the policy trenches, blog post by Chad English
http://compassblogs.org/blog/2014/09/30/lessons-from-the-policy-trenches/#more-6034

Beyond more data are needed: How scientists can participate in the policy process, blog post by Karen Lips
http://web.stanford.edu/group/leopoldleadership/cgi-bin/wordpress/?p=4231

Sample timing for a half-day session

This assumes that participants have done the reading prior to the session.

Time	Activity	Materials/AV
9:00	Intro to case context and content	*Saving the salamander* video
9:25	"Specialty" group tasks	*Event and actor cards*
10:40	Reporting out	Building timeline
		Creating actor map
11:15	Debriefing	
Noon	Closing go-round	

Instructions for teaching the case

■ Introduction (25 minutes)

Provide an overview of the central purpose of *making sustainability leadership visible* by having participants: 1) read the excerpt from *Pursuing Sustainability*; 2) watch the short video clip from the lecture that Dr. William Clark gave at University of Michigan; or 3) provide a short lecture on the framework of linking knowledge to action or *transdisciplinarity* (see *Supplementary materials).*

Overview should include concepts such as:
• Collaborative, trust-building relationships are the foundation for building the credibility, saliency (relevance to the needs of users), and legitimacy (freedom from bias) of research-based knowledge
• Solutions are built through co-construction; and
• A web of relationships, rather than a pipeline, is the appropriate metaphor for the process of getting science into policy.

Discuss the purpose: *In what ways does this break the mold of traditional academic science activity?*

Introduce the case content by showing the video, *Saving the salamander*

■ Small group preparation (Specialty groups)

In your readings, you viewed the chytrid crisis through the lens of a particular specialty group. You learned about the strategies and policy tools used by individuals and organizations involved in the crisis from your specialty group. Now we will put the whole system together to gain an understanding of the web of relationships and look at the leadership that contributed to a successful outcome.

Give the small groups time to:
- discuss and summarize the key findings;
- identify the key individuals, organizations, and networks; and
- identify & sequence the key events, based on your readings.

Give each group color-coded event/activity cards and have them select and put in order the key events from the lens of the specialty group. Also have them prepare an *actor map*. For example, the science specialty group shows the connections that they learned about from their specialty group reading.

Note: All groups will have read the narrative and should use that resource in addition to the readings.

■ Timeline task and discussion

Timeline mapping is a process of arranging important events, activities, grants, achievements, and other milestone markers in chronological order, enabling insight into their relationships to one another and to the key contextual factors (social, economic, political, demographic, and cultural events and trends).

Prepare a timeline with dates from 2010 to 2016 spaced out across a wall with plenty of space between each time period. Dates are: *Prior to 2010*, *2010 – 2013, 2014, 2015,* and *2016.* Each group puts up the events they selected in the appropriate timeframe.

After the timeline is complete, ask participants:
Which are overlapping?
What's unique to just one perspective and why?

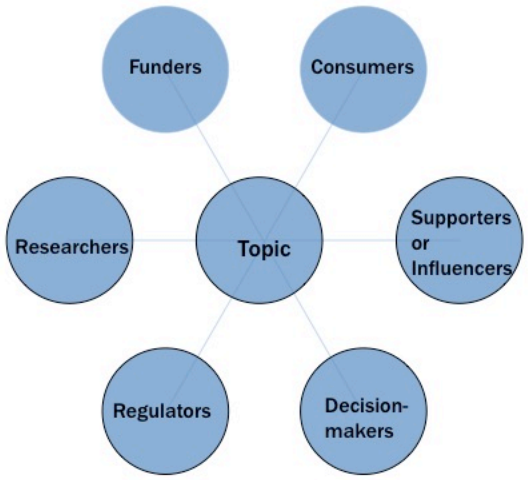
■ Actor mapping task

An actor map is a type of system map that focuses on relationships and interconnections between various individuals, groups, organizations, and networks. These maps help show how the parts of a system or the people within it are connected, identify weak connections or gaps, and bring out ideas for intervention points.

Reference: Actor mapping
http://www.fsg.org/tools-and-resources/system-mapping

1. Explain the purpose of doing an actor map:
   - Clarifies actors and their roles in the system; and
   - Shows the landscape of actors and their connections.

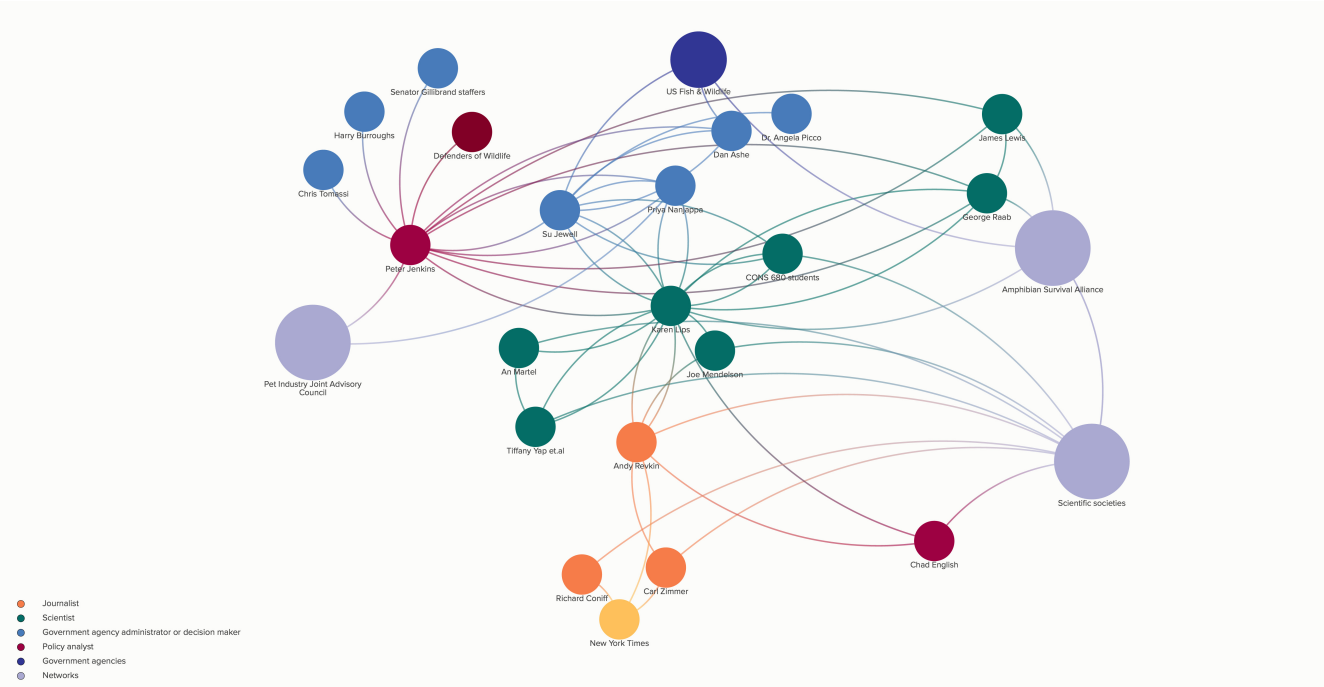
2. Using the figure below, draw an image of a generic system on the white board. Remove the consumers and funders since we don't have information about them relevant to this particular case study. Add the topic *Stopping importation of wildlife disease*



3. Give instruction to participants:
Using the color-coded actor cards, select the individuals, organizations, and networks that you read about in your specialty group readings. Create an actor map on a flip chart and:

- *Draw lines in pencil to show relationships. Indicate whether they are one-way or two way.*
- *Identify the boundary individuals or organizations.*
- *Use markers to make the lines lighter or heavier to indicate level of engagement.*

4. Each group presents their *actor map.* Then a group consisting of one representative from each specialty group will develop a final actor map. You may want students to compare the map with the actor map below. (It is best viewed from the web and via the software program, Kumu. The picture below is included is too small to be useful.)



■ Revisit the purpose

Restate both the learning objectives of the case study and why the using the jigsaw design was appropriate for this case. *It is intended to simulate the nature of environmental problem solving involving different actors with different*

areas of and kinds of expertise. No one can be in command of all the knowledge when solving wicked environmental problems.

This case is intended to highlight leadership mindsets that contribute to catalyzing change. It draws upon the sustainability science research of linking knowledge to action and the leadership attributes required. One of the key components of sustainability leadership is having empathy. Given the complexity of environmental and sustainability challenges, there isn't just one relevant perspective, strategy, or type of knowledge. Respect for different kinds of knowledge and know-how is a critical starting point. Being able to set aside one's own mental models and appreciate another's reality, both emotionally and cognitively, is key.

■ Discussion

Ask participants to consider the following questions:

- Where were the main blockages, challenges, and gaps? Or conversely, where were the opportunities for leverage and influence?
- What had to happen for this biodiversity crisis to move forward?
- What principles from "linking knowledge to action" did you see play out in this case?
- In what ways does this support your beliefs about how things change? In what ways does it contradict your thinking patterns about how things change?
- How would you describe Karen's leadership? How would you characterize her leadership in terms of specific attributes? In what ways does it contradict our notions of leadership

Provide the following after participants have described Karen's leadership and discuss any items that participants haven't touched on.

Handout: Chad's synthesis of Karen's leadership

What I heard:

- *You have had a rare second chance to tackle a problem that has defined your field for decades.*
- *Last time, you (and your colleagues) were fumbling in the dark and couldn't find a way to compel action.*
- *This time, you have been able to develop the understanding of the system, the leverage within your network, and the intense focus needed to help move the ball forward.*

This happened because:

- *We know the consequences of inaction (as a result of* Bd*).*
- *You directly engaged the one decision-maker with a clear potential role in the policy world (Fish & Wildlife, Office of Invasive Species). As part of this, you are "co-developing knowledge" to support decision-making.*
- *You mapped the policy landscape to understand where traction could (and mostly couldn't) be found.*
- *You were prepared with a clear sense of the messages/implications of your research.*
- *You leveraged the agenda-setting role of your publication to engage the agency and Congress at a high level. This includes the meetings and briefings, the paper, and the Op-Ed.*
- *You took advantage of your network (including boundary organizations and your participants!) to help make this all happen (i.e., to reach way beyond your personal capacity, and allow you to support, not do the connecting/advocating/policy and political analysis yourself).*

In the process, you operated as:

- *A researcher*
- *A network node and network weaver (being able to see across the landscape for which network connections could move the conversation)*
- *A validator (supporting others' policy efforts)*
- *An advocate -- for attention to the problem, and for robust solutions that reflect the state of our knowledge*
- *A storyteller -- you have been carrying the narrative arc of* Bd *and its relation to* Bsal*. That provides context.*

Sample Assessment

For this short, two-page writing assignment, we would like you to reflect on the chytrid case study as a narrative of interdisciplinary, social-environmental problem solving. We've provided the following questions as jumping-off points for your reflections rather than as questions you must address comprehensively for this assignment. You may want to refer to Chad English's concise synthesis of Karen's work as a leader as an additional resource for you as you reflect on using knowledge for action.

(1) Given what you've learned, what are some attributes of leadership that are important for boundary crossing?

(2) What do you consider to be some key lessons from this case study that you could apply to your own your work as an interdisciplinary, social-environmental problem-solver and leader? Did you learn anything during this case study that would be helpful in interdisciplinary groups you are currently working with?

(3) How might the concepts of relevancy, legitimacy, and credibility apply to your own problem-solving work?

(4) Did this exercise change your thinking about interdisciplinary problem solving in any way?

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