USA npn National Phenology Network

Structuring Decisions for Forest Pest Management

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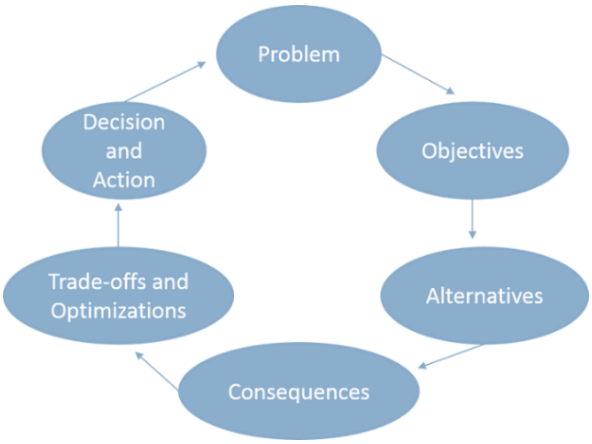
Insects and diseases have significant negative impacts on forest health, which are exacerbated by increasing temperatures and multiple invasions. In facing this challenge, managers must consider the implications for forests as well as human priorities in the context of current management capacity.

One approach for addressing such multifaceted challenges is the PrOACT Structured Decision Making Framework, a method for succinctly describing a problem and the possible solutions, to enable decision-makers to clearly see the consequences of each potential solution. The steps of the process are shown at right and more information can be found under Further Reading.

In a recent regional-scale effort, we applied the PrOACT framework to forest management in the Northeastern U.S. Our aim was to identify and weigh the complex choices available for addressing forest insect pests. Our working group consisted of forest managers representing state and federal agencies, researchers and non-governmental organizations. We held a two-day in person meeting, followed by monthly online meetings, over the course of a year, to complete the project. We selected three high priority pest-host systems, and applied the PrOACT framework to clarify the problem and solutions for these systems. Here, we present and reflect on our example application to assist decision-makers and stakeholders in identifying and prioritizing actions.



PROACT STRUCTURED DECISION MAKING FRAMEWORK

1. **Problem definition:** provides big picture clarity for a decision.
2. **Objectives:** clarify what we are trying to achieve.
3. **Alternatives:** describe actions that would lead to meeting our objectives.
4. **Consequences:** evaluates alternatives in terms of their effect on objectives.
5. **Trade-offs and Uncertainty:** are considered explicitly, as part of the Consequences step.
6. **Decision:** the final step is to take the actions identified by this process and evaluate their effects.

Steve Wood describes silviculture practices at the Quabbin Reservoir, September 10, 2019.

EXAMPLE APPLICATION OF THE PROACT FRAMEWORK

STEP 1: PROBLEM DEFINITION

Invasive pests in northeastern forests are causing devastating losses.

We chose to focus on gypsy moth, emerald ash borer and hemlock wooly adelgid.

REFLECTIONS ON STEP 1

Developing a shared understanding of the problem is foundational to the rest of the process and necessary for a shared vision among group participants. We quickly realized that we needed to consider the problem regionally and for a diverse set of species. There was consensus around focusing on the impact of these pests on societal values.

Working group members identify strategies for managing Hemlock Wooly Adelgid in September, 2019.

STEP 2: OBJECTIVES

The group identified the following objectives:

- **Minimize insect-driven tree mortality**
- **Minimize economic losses**
- **Maintain the health and capacity of the forest ecosystem**
- **Minimize forest type diversity loss**
- **Maximize carbon sequestration and storage**
- **Minimize adverse effects on water, including groundwater, surface water and stormwater management**
- **Maximize human health and safety**
- **Maximize support for human, social, spiritual, cultural values of forests**

REFLECTIONS ON STEP 2

In naming these objectives, we were able to focus on the desired future state and make societal values explicit. All members of the working group could see their priorities on this list, though they might weigh certain objectives differently based on their context. This step helped us recognize both trade offs and synergies among objectives. For example, a healthier forest enables more carbon sequestration.

STEPS 3 AND 4: A CONSEQUENCE TABLE

This table is comprised of alternatives (rows) and their consequences on objectives (columns).

		Feasibility	Economic Losses	Forest Health	Carbon Storage	Water Quality	Human Safety	Human Values	TOTAL
Reduce abundance of pests	Invest in Biocontrols								
Reduce spread of pests	Time harvest to avoid spread								
Reduce ability of the insects to infect trees	Spray/inject trees with insecticide								
Increase Resilience	Promote resistant or tolerant genotypes								
	Focus on secondary pest control								
	Increase age structure diversity and species diversity								
	Enhance regeneration								
	Transition to a different stand type								
Recover/ Adapt	Change public perception of healthy forest								
	Preemptively reduce hazard by removing oaks close to infrastructure or edges								

REFLECTIONS ON STEPS 3 AND 4

After defining our objectives, we identified *alternatives* (step 3) -- actions that could lead to realizing our *objectives*. We thought broadly, identifying new ideas as well as tried-and-true options. We compared these alternatives to our objectives in the consequence step (step 4). The resulting Consequence Table encapsulates the effects of alternatives on achieving objectives. Each alternative can be rated for effectiveness in reaching each objective, and objectives can be weighted by priority. We did not have enough time to complete the analysis by filling in the values. We present the table to show how to think systematically about how alternatives relate to objectives. The table was valuable as a conceptual tool to both help decision-makers become comfortable with the decision and to defend their decision to others. (Full Consequence Table developed by the working group : https://tinyurl.com/yxny6ovj).

In addition to crystallizing the problem, the Consequence Table helped us see how group members prioritize objectives differently based on their specific context. For instance, a manager in our group charged with protecting a reservoir gave more consideration to protecting water quality than managers representing the National Park Service, where there is a mandate to protect certain species, or in some cases individual trees, such as those carrying bullets from the Civil War.

Further Reading on the PrOACT Framework

- Thompson, Matthew P., et al. "The science of decisionmaking: Applications for sustainable forest and grassland management in the National Forest System." *Gen. Tech. Rep. WO-GTR-88. Washington, DC: US Department of Agriculture, Forest Service. 54 p.* 88 (2013).
- Hammond, John S., Ralph L. Keeney, and Howard Raiffa. *Smart choices: A practical guide to making better decisions*. Harvard Business Review Press, 2015.

LESSONS LEARNED

- This process supports sharing and defending choices to funders, others on a team, and stakeholders.
- We developed a broader framework to synthesize relevant information and options for the complex problems forest managers face. The diversity of the management contexts represented and the choice to create a broad framework made it difficult to complete the PrOACT cycle in the time we had allotted.
- We see similarities and differences across the pests-host systems in the consequence table. The similarities suggest that this framework would save a decision-maker time in developing alternatives for a new pest.
- We found utility in explicitly listing and evaluating the alternatives, as it enabled us to think beyond typical choices and open up new options.
- The researchers on our team found that this management-centered synthesis of a complex issue provides guidance for research directions.

Nicole Keleher presents to a general audience on forest pests as part of public education efforts.

WORKING GROUP MEMBERS

Audrey Barker Plotkin, Harvard Forest

Carrie Brown-Lima, New York Invasive Species Research Institute

Theresa Crimmins, USA National Phenology Network

Chris Donnelly, CT Dept of Energy and Environmental Protection

Joe Elkinton, UMass Amherst

Bob Fahey, University of Connecticut

Karen Jenni, Decision Science Center, USGS

Nicole Keleher, MA Dept of Conservation and Rec

James Mickley, University of Connecticut

Toni Lyn Morelli, NE Climate Adaptation Science Center, USGS

Mike Parisio, ME Dept of Ag, Conservation & Forestry

Valerie Pasquarella, Boston University

Nancy Putnam, MA Dept of Conservation & Rec

Brendan Quirion, Cornell University

Josh Rapp, Mass Audubon

Alyssa Rosemartin, USA National Phenology Network

Nate Siegert, US Forest Service, State and Private Forests

Talbot Trotter, US Forest Service, Northern Research Station

Aaron Weed, Northeast Temperate Inventory & Monitoring Network, National Park Service

Steven J. Wood, MA Dept of Conservation & Rec

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CONTACT INFORMATION

Alyssa Rosemartin
USA National Phenology Network
1311 East 4th Street, Tucson, AZ 85721
alyssa@usanpn.org
www.usanpn.org

PHOTO CREDITS

Page 2: Alyssa Rosemartin
Page 4: Southeastern Massachusetts Pine Barrens Alliance