Skill Check Week 2: Problem Framing Step of PrOACT
Course: NAT_R 8001 Decision Analysis for Research and Management of Natural Resources
Instructor: Brielle Thompson

Instructions:
I will provide you with details for a real-life natural resource management decision and using this information, you will:
- Answer the following:
  - What is the decision—what kind of action needs to be taken?
  - What triggered this decision?
  - What are the legal context and constraints?
  - Who is the decision maker?
  - What is the decision timing and frequency; are other decisions linked to this one?
  - What is the scope of the problem (how broad or complicated is it)?
  - What makes this decision hard (what is the primary impediment to the decision)?
  - Then make your own problem statement

- Then I will give you the published problem statement and you will compare your statement with the published statement

- Be prepared to share your answers with the rest of the class
  - What did you learn?
  - How did your statement compare with the published statement?
  - What more information would you have wanted to have?
  - Is this process useful for natural resource managers?

Group 1:

Source: Sepulveda, Adam J., Christine E. Dumoulin, Denise L. Blanchette, John McPhedran, Colin Holme, Nathan Whalen, Margaret E. Hunter et al. "When are environmental DNA early detections of invasive species actionable?." *Journal of Environmental Management* 343 (2023): 118216.

Background information:

"Sebago Lake is located in southern Maine (USA) ~ 32 km northwest of Portland, ME and its watershed includes all or parts of 24 towns (Fig. 1). It is a deep lake, with a maximum depth of 96 m and an average depth of 31 m. It is also a large lake; it is 19.3 km long, has 169 km of shoreline, a surface area of 123 km^2 and a volume of 4.5 trillion liters. The lake is an important natural resource for Maine. It has one of Maine's few indigenous landlocked Atlantic Salmon (*Salmo salar sebago*) populations and is a destination for recreational water activities. The Portland Water District uses Sebago Lake to supply drinking water to more than 15% of Maine's 1.2 million residents and to hundreds of thousands of visitors to Sebago Lake's watershed each year (Daigneault et al., 2021). Because the lake's water quality is high, it has a federal filtration exemption for human use which minimizes drinking water costs."

Najas minor is a submersed, freshwater annual plant that propagates when fragments with seeds in axils break off and disperse throughout the waterbody (Meriläinen, 1968). Small infestations can produce tens of millions of tiny (1.5–3 mm long and 0.5–0.7 mm wide), difficult to spot seeds, which can stick to boats and angling gear, be ingested by birds or dispersed by water currents. Seeds can remain dormant in the sediment and germinate years later. The annual phenology of *N. minor* makes control difficult (Capers et al., 2005). Individual plants live for one growing season and die after seed production. Manual removal efforts early in the season can be effective but are challenging, because smaller *N. minor* plants are difficult to observe and can be difficult to distinguish from congeneric native species (*N. gracillima* and *N. flexilis*), which also occur in Sebago Lake. Manual removal efforts later in the season are less effective, because the brittle stems break apart and disperse seeds that can germinate the next spring or be banked in the sediment."

…

"U.S. Geological Survey technical experts (n=9) worked with decision-makers from the Maine Department of Environmental Protection (DEP, n = 2), Maine Department of Inland Fisheries and Wildlife (IFW, n = 1), the Portland Water District (PWD, n = 1) and stakeholders from Lakes Environmental Association (n = 1) and Lake Stewards of Maine (n = 1)."

Group 2:

Source:
Sells, S.N., Mitchell, M.S., Edwards, V.L., Gude, J.A. and Anderson, N.J., 2016. Structured decision making for managing pneumonia epizootics in bighorn sheep. *The Journal of Wildlife Management*, *80*(6), pp.957-969.

Background information:

"To demonstrate the value and application of SDM, we illustrate its use by Montana Fish, Wildlife and Parks (MFWP) to make decisions for proactively managing pneumonia epizootics in bighorn sheep (Ovis canadensis). Herd health has direct implications for achieving management objectives, yet the probabilistic nature of epizootics makes it difficult to integrate health with decision-making for broader management programs without a formal decision-making process (Mitchell et al. 2013).

Pneumonia is a critical problem for management of bighorn sheep throughout their range in North America (Gross et al. 2000, Cahn et al. 2011, Wehausen et al. 2011, Cassirer et al. 2013, Plowright et al. 2013)…

Commonly, a lack of tools to predict and proactively manage risk of wildlife diseases leads to a reactive crisis management response to disease events, including for pneumonia epizootics in bighorn sheep (Woodroffe 1999, Edwards et al. 2010, Mitchell et al. 2013, Sells et al. 2015). Intensive, costly management may be required to help herds recover, including culling sick sheep (Edwards et al. 2010), and herd augmentation (MFWP 2010) or reintroduction (Singer et al. 2000) using sheep translocated from other herds. Such reactive crisis management may ultimately prove ineffective for herd recovery; proactive management designed to prevent epizootics from occurring is strongly preferred by managers

Pneumonia epizootics are relatively rare and difficult to predict, and managers could have varying degrees of risk tolerance to their occurrence. To make good decisions for managing epizootics proactively, managers thus need a means of better understanding and formally accounting for risk of a pneumonia epizootic…

To address these challenges, we developed a decision tool for proactively managing pneumonia in bighorn sheep in Montana based on the SDM process and following a prototype developed by Mitchell et al. (2013). Our decision tool incorporates an empirical model for predicting probability of pneumonia epizootics (Sells et al. 2015) to evaluate potential consequences of management actions. We worked with biologists and managers at MFWP to use existing information and incorporate their values, priorities, and constraints to make the process and resulting decision tool useful for MFWP staff in managing pneumonia in bighorn sheep as effectively as possible…

In 2014, we met with a working group consisting of different MFWP biologists and managers to… complete the decision tool"

Group 3:

Source:
Robinson, K.F., Fuller, A.K., Hurst, J.E., Swift, B.L., Kirsch, A., Farquhar, J., Decker, D.J. and Siemer, W.F., 2016. Structured decision making as a framework for large-scale wildlife harvest management decisions. *Ecosphere*, *7*(12), p.e01613.

Background information:

"We present a case study describing how we used SDM to incorporate the numerous stakeholder values present in large-scale harvest management decisions, predict the ability of different harvest management scenarios to achieve stakeholders' objectives, and make tradeoffs among the objectives to reach a decision. The goal of the SDM case study was to aid the New York State Department of Environmental Conservation (NYSDEC) in setting regulations for Odocoileus virginianus (Zimmermann) (white-tailed deer) buck harvest throughout the state. This case study provides a decision framework for determining the optimal management strategy for managing game species when multiple competing biological and social objectives and uncertainties exist, and describes the benefits of this structured approach to harvest management…"

"We conducted our study from 2012 to 2015, with the goal of recommending appropriate harvest-regulation changes throughout New York for 2016. NYSDEC managed white-tailed deer populations within the state to balance stakeholder interests within ecological constraints related to managing the species. We applied our decision framework to seven buck management zones in New York State. Each of these zones represented unique combinations of deer population characteristics that indicate differences in population growth and harvest (e.g., yearling antler beam diameter, mean fawn to doe ratio, buck kill/mi.^{2}) and environmental characteristics that can influence survival and population growth (e.g., depth and duration of snow cover, land cover and use, crop productivity; Kelly and Hurst 2016). The zones encompassed all of New York, except for Buffalo, New York City, and Nassau County (Fig. 1), where deer hunting was prohibited by state law."

Group 4:

Source:
Peterson, J.T., McCreless, E., Duarte, A., Wohner, P., Hamilton, S., Medellín-Azuara, J. and Escriva-Bou, A., 2024. Prototyping structured decision making for water resource management in the San Francisco Bay-Delta. *Environmental Science & Policy*, *157*, p.103775.

Background information:

The San Francisco Bay and Sacramento-San Joaquin Delta (BayDelta) is the largest estuary on the Pacific Coast and supports more than 500 fish, wildlife, and plant species, including several threatened and endangered species (Lund et al., 2010). … the Bay-Delta is also the home of more than ten million people and the freshwater resources of the area support tens of millions… The management of natural resources in the Bay-Delta involves the evaluation of tradeoffs between conservation objectives, such as restoring or conserving at-risk species, and a range of anthropogenic values, such as providing reliable water supply to the public (Thorne et al., 2015). Furthermore, managers often must make decisions under substantial uncertainty owing to complex, interacting, and difficult to quantify effects of natural and anthropogenic factors in the Bay-Delta such as salinity targets, imports and exports of water, and competing habitat requirements of varying species of concern, not to mention climate change (Thorne et al., 2015).

Although there is substantial information on the ecological resources in the Bay-Delta region … and the potential effects of human disturbances on the native biota … this information has not been integrated into an SDM approach… The development of an SDM approach for evaluating management alternatives for fish species of concern in the Bay-Delta may help make decisions transparent and repeatable, highlight areas of greatest uncertainty, and allow stakeholders to prioritize scarce water resources for multiple fish and water objectives...

The Bay-Delta is one of the most modified estuaries in the world… the State Water Project and Central Valley Project water export operations may divert as much as 65 % of the freshwater outflow from the estuary to Central and Southern California for municipal and agricultural use which is known to have negative consequences for wildlife species of concern... To counteract such impacts on species of concern, water through the Bay-Delta is specifically managed based on regulatory measures that are in place to protect special-status fishes like Chinook salmon (Oncorhynchus tshawytscha), steelhead trout (Oncorhynchus mykiss), and delta smelt (Hypomesus transpacificus). Water resources available for species of concern vary depending on the water year type with more water available in wet and above normal years and less in below normal, dry, and critical years (Wohner et al., 2022). Water year type classifications are generally based on the amount of unimpaired runoff from October to July and the previous year's water year type (i.e., whether dry, critical, wet etc.; California Data Exchange Center, 2021).

During an initial August 2017 meeting, one participant from each of several organizations (Delta Stewardship Council, CA Department of Water Resources, CA Department of Fish and Wildlife, CA Department Food and Agriculture, Delta Conservancy, Delta Science Program, San Luis and Delta Mendota Water Authority, Tehama-Colusa Canal Authority, Friant Water Authority, National Marine Fisheries Service, US Geological Survey, US Fish and Wildlife Service, US Bureau of Reclamation) met with the SDM facilitators to initiate the prototyping process.