

## US Fish and Wildlife Service | Problem Definition \_part 1\_

---

[MUSIC PLAYING]

Let's begin Module B. Module B is about problem definition. Sarah talked to you about the Proact sequence in the previous module, and we're going to be talking about the "Pr" part of Proact, the problem definition.

Some people say this is the most important part, and the hardest part, of decision analysis, is really understanding the nature of the problem, the nature of the decision that you're wanting to analyze. And so, in this module what we're going to do is talk exactly about that in ways that you can help define the problem at the beginning. I do want to acknowledge that this module was developed by Jean Cochrane, Angela Matz, and Mitch Eton.

So the objective, then, in this module is to try to understand the importance of clearly defining the problem to be addressed and how a problem statement can guide the rest of the structured decision making. In essence, what we're doing is identifying the essential components of a problem definition at the beginning of a decision analysis.

In this module, we're going to do a number of things. We're going to outline the steps for developing a useful problem statement. We're going to preview the suite of structured decision making tools that are associated with different problem classes. We're going to look at some of the pitfalls of poorly defined problem statements, and we're going to practice reviewing and revising a short problem statement. You'll have a little interactive activity to do at the end of this module.

The trouble is this. The trouble is that it's kind of human nature for us to assume the problem's already been defined, that the problem is clear, and then we move straight into alternatives. I'll talk in a later module about how people do, in fact, make decisions, the psychology of decision making and the traps that we get into as human decision makers.

One of those traps is that we jump right to alternatives. So we think, well, we've got a problem, so we say, what are we going to do? We jump right to the alternatives.

But as Sarah talked to you in a previous module, decision analysis is about values-focused thinking. It's about focusing on objectives first. And so, part of the idea of setting up the problem in the first place is

to think about the context of the decision that you've got and allow yourself to proceed into the rest of the Proact sequence in the right kind of way.

Problem definition is really the foundation of structured decision making, and it really is one of the hardest steps in the process, as you'll see. But, as Jimi Hendrix said, "Castles made of sand slip into the sea, eventually." And so, what we want to do is build a firm foundation before we get into the meat of the decision analysis.

And again, this goes back to the acknowledgement that decisions are values-driven. Problems are not simply technical or scientific. The problems we have as management agencies are not simply technical problems or scientific problems. I think we often say, well, let's just do what the science says.

But really, decisions also reflect societal value. They reflect the scientific, the economic, the political, the cultural values, the legal issues, all of that wrapped together. And a well-defined problem statement might take multiple attempts to craft. It may need to be constructed from working on the problem.

So one of the things we'll emphasize throughout this course is that decision analysis, the process of analyzing the decision, ought to be iterative. There ought to be opportunities to go back and look at the earlier stages to make sure you did them right. Often, the insights you need about a problem statement don't arise until you've started to define the objectives, or developed alternatives, or thinking about the consequences. And so, having the flexibility in the development of decision analysis to go back, particularly to the problem statement, is important.

All right. I'm going to talk about five different steps in problem definition. First, I'm going to talk about defining problems as decisions. Second, I'll talk about solving the right problem. Third, I'll talk about careful framing of the problem. Fourth, how to develop a problem statement. And then the fifth step really is what I just mentioned about having the opportunity to revise problem statements and the problem definition as needed.

So, let's look at the first step. The first step is to really understand that the problems we face-- the management problems we face-- are actually decisions. What we're talking about are decisions. Well, what is a decision?

Interestingly, in the decision analysis literature, there's a number of attempts to define what a decision is. One definition is that a decision is an outcome of a cognitive process leading to the selection of a

course of action among several alternatives. That sounds awfully wordy to me, but it gets at what we're after.

Another definition that I really like was one that was coined early on, and it defines a decision as an irrevocable allocation of resources. That's a powerful definition, an irrevocable allocation of resources. So the idea is a decision is when we've implemented something, when we've taken some resources and said, we're going to dedicate them to this particular direction.

We've chosen an alternative, and we're taking that course, and we can't go back. Sometimes those resources that we're allocating are money. Sometimes it's time. Time's an interesting resource that once we allocate it, we can't get it back.

But this definition is helpful, because it also tells us what kinds of things are not decisions. Interestingly, planning processes. We all go through planning processes. How many of us have gone through a five-year plan for our particular institution only to have that plan sit on the shelf for a long period of time?

So ask yourself, is a planning process itself a decision? Have we irrevocably allocated resources? Have we chosen an action, and are we committed to that action? Planning processes often lead to decisions. We hope that planning processes are going to lead to decisions, but they're not always decisions themselves.

Another example of something that's not a decision-- and I think this is an important one for us to note as conservation managers-- is prioritization exercises. A lot of folks want to go through prioritization exercises. Think of it. People will say, we need to prioritize the invasive species on our tract of land. We need to prioritize the endangered species or the threatened species, and which ones are most important to address? We need to prioritize some research projects. What research should be undertaken, or what priority would we give, what ranking would we give to a number of research topics?

But note that a prioritization process itself isn't any irrevocable commitment to action. All it is is a list. The decision that comes out of a prioritization process is what you do with that list.

So if you have a list of invasive species, how are you going to use that to allocate resources? Are you just going to start at the top of the list and say, well, we'll spend whatever it takes to address that first one. And then if there's any money left, we'll address the second. And if there's money left, we'll go to the third. Is that how you're going to allocate resources? That's the decision. The decision is what

happens to that prioritized list.

So, I caution people when they're doing prioritization exercises to make sure they think about that next step. When does a prioritized list become a decision?

Are budgeting exercises decisions? In some sense it is. A budget is an allocation of resources. But it's only a decision if you actually carry out that budget, if you actually allocate the resources the way the budget is crafted. Anyway, the point is, I'm trying to give you a sense of a decision as being an irrevocable allocation of resources.

I think it was Paul Barrett, one of my colleagues, that found this particular picture here. And the question is, is there in an irrevocable decision that's about to be made? I think this is a funny picture. Who's making a decision here, and if this dog attacks this skunk, is that going to be irrevocable? When is the decision point occurring?

So, problems are decisions. One of the early steps we can take in trying to figure out what the decision is that is at the heart of what we're doing is to try to turn problem statements into decision statements. So, let's look at a couple examples.

In your personal life, you might have a problem that you might state as something like, my son is acting up. That's the issue that you're faced with. That's the thing that you think needs to be solved. But it's not a decision.

The decision is something about what would you do about it? So the decision statement might be something more like, how can we improve my son's anti-social behavior? We're getting a little more specific here about how your son is acting up, and what we're focusing on is how can I allocate resources, my time or my efforts? What steps can I take to help my son in that situation?

A work example. The problem might be we face competing interests between the public and conservation goals we have for wetland bird populations and habitat. So there's a conflict between wetland bird populations, wetland habitat, and other interests that the public may have. Say, use of those wetland areas for hunting, or for recreation, or for development. So we have some competing interests. That's the problem. That's what brings us to the table to want to face or solve something.

What's the decision that's at the heart of that? Well, the decision might be something like, how do we

optimize management of wetland habitat for bird populations given multiple and competing objectives on other scales? So, we're really looking at what is the decision, what is the allocation of resources, what is the commitment to action that we're trying to choose? And that's the heart of identifying a decision.

One of the important parts about problem framing is making sure you're solving the right problem. What's interesting to me about problem framing is often how hard it is. How hard it is to really identify the decision at hand.

Well, first we should probably talk about intractable problems. Sometimes the problem that we think we need to solve is, in fact, intractable. In other words, it's already been decided, or it's out of our control, or it would require a greater level of investment than is available. More time, more personnel, more budget than we have available. So sometimes we're looking at problems that really we can't do anything about.

And if that's what we think our problem is, and if that's what we think the decision is, failure's pretty probable, because we don't have control over what's happening. In those cases, what we really need to do is redefine the problem to the part of it that's within our ability to solve, to really identify the piece that we can do something about. And that really is the operational piece that we want to analyze and pursue.

One of the things we can do in thinking about problem framing and making sure we're solving the right problem-- and this is a question I always ask first. Whenever anybody calls me up and says, Mike, we've got this decision, this conservation decision, that we're working on. We're having some trouble with it. Could you help us? My first question is, OK, who's the decision maker?

Now, this is a surprising question, because usually you would think that it's obvious who the decision maker is. But a lot of times, and I think particularly in the kind of agencies that we work in, it's hard to know who the decision maker is. And sometimes asking who the decision maker is helps you identify what decision and what problem you're faced with. So who is ultimately responsible for this decision? Surprisingly difficult question.

There's several scenarios, I think, that we can talk about, and it's useful to try to think about which of these is operating in your case. We can have a single decision maker. There's cases where there is

one person, or perhaps one committee, that is making the decision, and everybody knows who that is. It could be a regional director, or it could be a field office supervisor. Maybe it's the director, maybe it's the secretary.

Maybe it is a FACA committee that's been set up to advise the government on something, and they've been endowed with the responsibility to make a recommendation, at least, about this decision. So maybe there's a single point, a single decision maker, whether that's a person or a body that's making the decision. That's easy case, if you can identify who that person is.

Sometimes there are multiple decision makers. Sometimes what you have is multiple agencies or multiple entities that are co-managing a resource. This happens an awful lot with our state management and tribal management partners. So you have a federal agency, maybe multiple federal agencies each with their own regulatory jurisdiction. And you have some state agencies, each with their own regulatory jurisdiction. And you may have some tribal entities, and they're sovereign nations, and they have their own decision making jurisdiction.

And it may be that you've got multiple decision makers that are coming together to make a decision jointly, perhaps. And maybe they've agreed to try to seek some decision jointly, or maybe they haven't agreed to that. In that case, it's really quite useful to recognize who those multiple decision makers are and what the regulatory authority is or what the decision making authority of each of them is. And there's techniques you have to use that are different in a multiple decision maker case than in a single decision maker case. But at the problem framing stage, it's just important to recognize who has the authority for making the decision.

There's a third case that's pretty common in the federal government. I think it's probably common in state governments, and maybe it's common in NGOs as well. And that is the notion of a delegated authority. And speaking from the standpoint of Department Of Interior-- in most cases, a regulatory or legal framework-- the statute identifies the Secretary Of Interior as the decision maker. The Secretary Of Interior, say, under the Migratory Bird Treaty Act is the decision maker for whether to authorize various kinds of activities that may impact migratory bird populations, for example.

But it's rare for the Secretary to be the actual decision maker on that. Usually that authority is delegated to a Bureau Director-- Bureau Of Land Management, the Fish and Wildlife Service, what have you. And even then, it's often that the Bureau Director is not the person that's going to make a decision. They'll

delegate that authority to a Regional Director, and the Regional Director could in turn delegate that authority to a Field Office Supervisor.

And so, it may be that we don't actually know who in the end is going to be the decision maker. The analysis of the decision may start out at the field office level, but perhaps the regional office is going to get involved, and the Regional Director wants to be part of it. And so, maybe that shifts up to the Regional Director. And maybe if it's a big enough issue, it shifts up to the Director. And if it's a big enough issue, maybe it does go up to the Secretary. We often don't know when we start a decision analysis, when we start thinking through a problem statement, who is going to end up being the decision maker for it.

Well, in those kind of settings, I think what is important at the problem framing stage is to understand that structure, that agency structure, and to think about what the possibilities are about how that's going to occur. And I think probably what we have to do in those kind of settings is make a guess at who the decision maker's going to be, and make sure that they're aware of what's going on in part of the analysis that you're doing.

A final comment about who is the decision maker. We have a responsibility to involve stakeholders in our decisions. In the Department Of Interior, we talk about collaborative conservation. We talk about the importance of involving the public in the decision making that we do. We have legal mandates to involve the public in decision making.

We know there's stakeholders in all of land management and population management decisions that we make. There are stakeholders. There are people that are affected. There are NGOs that are affected. There's people that care about this.

It's important to make a distinction between stakeholders and decision makers. Stakeholders are not decision makers. They don't hold the regulatory authority for making the decision. They're not going to be the ones accountable when the decision is made, but they're affected by the decision, and we may very much want to have their input into the decision. So in those cases, we need to think about how stakeholders will be involved in the decision analysis, how their input may be brought into it, and how we'll communicate the nature of the decision to them.

The third step in problem definition is framing the problem, and here's where we get into a lot of really

interesting questions that help us diagnose the nature of the decision. And so, in some ways, I think of problem framing as diagnosis. I actually like this idea of diagnosis through how to decision analysis. What we're really trying to do with a particular decision is diagnose the nature of that decision and diagnose the tools that can help us move through and remove the impediments to making that decision.

So I've got a whole bunch of questions here that I like to include in conversations with people when we're trying to figure out what is the nature of the decision that we're talking about. One thing we can ask is the trigger. What is the trigger? What triggered the problem? Why are we here today? Why does the decision need to be made? What brought us to this point? Sometimes that really helps us identify the nature of the decision.

Second, what's the action that needs to be taken? This is the heart of decision framing, is to identify what is the decision at hand? What action needs to be taken? What action needs to be taken now? What might need to be taken later?

And I think it's useful to note that not taking an action is often a decision as well. So sometimes we think, well, we can just delay, and maybe we'll make the decision later. But that's a decision we're making that has consequences often. To delay is often a decision that has consequences. So we should think about that.

Some of the other questions we can ask in thinking about a decision, what's the frequency and timing of the decision? When and how often will the decision be made? Are there are other decisions linked to this one? That's an important question, this idea of linked decisions. We do have decisions that are made repeatedly through time.

And I'll talk about adaptive management in the last module in this course. Adaptive management is an example of linked decisions, that we make a similar decision year after year after year, or month after month after month. And so, what we do now affects what we can do in the future.

It's important to understand linked decisions. If the decision we're making today affects some decision we have to make in the future, and that affects something else, we should understand the connections between those. And for whatever decision we make, we need to understand when it has to be made and perhaps how often.

Another aspect we can ask about, another part of framing the problem, is the scope of the decision.

How large, broad, complicated is the decision that we're talking about? Are we talking about something that's really just focusing on wetland birds, but only in one particular impounded wetland?

Or are we talking about all the wetland birds at a refuge? Or are we talking about the wetland birds in a region and how they're connected across refuges, and connected to private land, private wetlands, that's held in areas nearby? Or are we talking about something that's national in scope, and is about wetland birds and how we're managing those nationally? The scope is important to convey in framing a problem.

Another aspect of problem framing is constraints that are acting. Are there legal, financial, political constraints that act? Is there some minimum performance we have to achieve that's regulated in some kind of way?

And then it's important to ask are these constraints perceived or are they real? A lot of the times, one of the impediments we have in making a decision is there's a lot of perceived constraints that we think narrow down the kind of things we can do. And so we think in a very, very narrow way, a very prescriptive way, about solutions. But if those aren't real constraints, if they're only perceived, then we've unnecessarily constricted our creative process in finding a solution. So thinking hard about constraints is an important part of framing the problem.

And then we need to think about uncertainty. What degree of uncertainty is present? Do we have to grapple with it, or can it be ignored?

Anyway, what I've given you here is a long laundry list of questions to ask yourself at the problem framing stage. And what we like to do, what I recommend and others that I work with, is to write down a problem statement-- maybe it's a paragraph long-- that describes the nature of the decision and what you're really trying to address. And in that problem statement, try to build in these elements that we've talked about.

Who is the decision maker? When does the decision have to be made? What is the nature of the decision? What's the scope of it? Are there constraints? Those kind of questions. Because what you're trying to do is really get a sense of what it is you're after.

One of the useful things to do in problem framing early on is to try to identify the kind of problem, the class of problem, that you're working with. This is kind of the idea of diagnosis I was talking about

earlier. As a decision analyst, when I'm talking to somebody initially about a decision, in the back of my head I'm trying to think through, OK, what are the tools that I'm going to use? What are the approaches from decision analysis that are going to be valuable? And I do that by thinking about the problem class.

And one of the ways that I think about a problem class is by thinking about a couple dimensions of how problems might be classified. One of the dimensions is whether it's essentially a single objective problem or a multiple objective problem. That is, is there really only one thing that I'm trying to optimize here, and I just don't know how to optimize it? Or is it that there's a whole bunch of competing objectives, and I need to figure out a way to balance those?

There's different tools that you would use in those two settings. Now in truth, I think all our problems are multiple objective problems. But sometimes one of the objectives is so dominant that we could largely focus on that single objective and treat the other ones as constraints or as secondary considerations.

The second axis we can think about decision classes on is uncertainty. Now, we're always faced with uncertainty, but the question is does it really plague us in the decision? Is our decision impeded by uncertainty or not? And if it's not, if we understand the science well enough that we can make pretty good predictions about what would happen under our different actions, then we can proceed as if there really isn't uncertainty. And we'll use some techniques that are appropriate in that setting. If the uncertainty that we have, either because we're uncertain about what's going to happen or we're uncertain about how the system works, if that's really key to the decision, then we'll use a different set of techniques.

And so, you put these two considerations together, the multiple objective versus single objective and the uncertainty versus no uncertainty, and we end up with four classes of problems. And so, let me just briefly talk about those.

In the first case, if there's a single objective and there's no uncertainty, then what we're talking about is some techniques that really are just about optimization. Single objective, no uncertainty, what we're really looking at is optimization.

And there's a lot of tools for this. There's graphing tools, graphing optimization tools. There's linear programming. Anyway, were in the realm of management science. Given a certain objective, what is the right thing to do? And we'll go through a few of those tools in one of the later modules.

More commonly, even if we have a single objective, we're faced with uncertainty. And the question there is how do we make a decision in the face of uncertainty? This is where decision analysis really began. Decision analysis began in economics in, let's say, the '30s, '40s, '50s.

And people were thinking about, well, we need to make economic decisions, but we don't know what the inflation rate is going to be, or we don't know how the stock price of this company's going to change over the next year or two. We're faced with uncertainty. How do we make decisions in the face of that uncertainty? So there's a whole body of analytical tools that are geared towards helping people make decisions in the face of uncertainty.

One of those is decision trees. That's sort of a classic technique from the field of decision analysis for this class of problem. But anyway, the point here at the problem framing stage is to recognize if this might be the kind of problem you're working on.

In the third quadrant here of this chart, we're thinking about problems that have multiple objectives, but not a lot of uncertainty. So, where the issue really is the trade-off among objectives. And so, there's a number of tools. This is a really rich set of tools-- multiple attribute, it's called multiple criteria decision analysis or multiple attribute trade-off tools. We're going to do a module later in this course particularly on this and go into this in a lot of detail.

Actually, Sarah and I and our colleagues have found that this set of tools, the multiple objective tools, are really some of the most useful ones, because so much of the conservation management that we're doing is really a difficult balance among important objectives that compete with each other and that can't all be achieved. And so, we need tools to do that. And so, part of the toolbox is this multiple objective trade-off set of tools.

And then in the last quadrant here, we have multiple objective problems that are plagued by uncertainty. And here, we really use the same multiple objective tools, but we use variable inputs. We do sensitivity analysis. We really try to analyze the role of uncertainty in affecting that multiple objective analysis. And so, we use the same multiple objective tools, but we have to add in and some additional tools to deal with the uncertainty.

So the point here at the problem framing stage is to begin to understand that there's different kinds of decisions. And we can start to put them in bins, and that helps us know how to approach the problem,

how to frame the problem, how to analyze the problem, and what tools we'll likely use.