

## US Fish and Wildlife Service | Developing Alternatives \_part 1\_

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Welcome back. This is Module D, Developing Alternatives. And before we start, I want to acknowledge that this module was developed by Angela Matz, Mitch Eaton, Paul Barrett, and myself.

Now, in the last module, Module C, my colleague, Mike, talked about objectives. And so, we know a little bit now about how to determine where is it that we want to go, what do we care about? In this module, we're going to talk about alternatives. So what are our options for getting where we want to go? What are the things that we can do to change the state of the system that we care about?

Now, one of the pitfalls of natural human decision making is that we have a tendency to focus first on alternatives when making decisions, rather than focusing first on objectives. So we focus on our options, rather than on what we want to achieve. And so, what are the potential downsides of this?

Well, we tend to limit ourselves to a smaller set of alternatives when we first think about alternatives. It doesn't encourage us to be creative and to think broadly about our options. We also might anchor on the first suggested alternative if we first think about alternatives, rather than about where is it that we want to go. So in this module, what we're going to talk about is some tips and some hints about how to develop once we know where we want to go, once we understand our objectives. A broad and good array of alternatives.

Now, developing alternatives is really a creative process, and the best option that we can choose has to be in the set of options that we consider, of course. So it's really a creative process, but we have some hints and some tips here about developing a good set of alternative actions. So alternatives, again, are created only after we decide where we want to go. We know our objectives now, and now we're focused on what we might do to actually achieve those objectives.

So let's start by thinking about an example. So, we have some problem, something that we're concerned about. So for example, many rare herptiles-- reptiles or amphibians-- are killed during capture for the pet trade.

We're not very happy with this situation, so we might develop an objective. We would like to eliminate mortality during capture of herps for the pet trade. And we would then develop a measurable attribute.

We might want to avoid any capture mortality within two years of implementing our new management plan, for example.

So then, we need to develop a set of alternatives. Well, one alternative might be to ban the sale of herps. So we have one alternative. But we might imagine that there are different alternatives that we could consider in addition to that first alternative that we talked about, to completely ban the sale of herps.

So this is where we get into this sort of creativity of developing alternatives. One good and important tip is to don't automatically limit our list of considered alternatives to those that are perceived to be practical or perceived to be things that we sort of know how to do. Instead, think about the widest range of possible alternatives.

And don't let any preconceived ideas or constraints about what's practical necessarily be overly limiting at the outset. We can evaluate alternatives later. But first, it's useful to be as creative as possible in thinking about the alternatives. So we can think of this initial process in developing alternatives as sort of a brainstorming. Let's just let our imaginations work a little bit, so that we can develop a broad array of options that we can then evaluate later.

A really good example of this use of creativity to develop alternatives is the reintroduction of migratory whooping cranes in North America. Now, this is a project that I actually work on, and so I have a little bit of familiarity with it. And I never cease to be amazed whenever I see migratory whooping cranes doing their first southward migration behind a human-driven ultralight. So these cranes are raised at Patuxent Wildlife Research Center in Maryland where I work, and then they're trained to follow people, costumed people, who ultimately will climb into these ultralights and fly those cranes from Wisconsin to Florida.

So obviously, this wasn't a very obvious approach to developing a new migratory flock of whooping cranes, but some creativity allowed us to develop a new option. And it's probably important to mention that this alternative, or this method for moving birds around, was actually initially developed by some artists, some Canadian artists. So creativity is important in this process. Again, don't let your preconceived ideas necessarily shut down possibilities before you can explore them.

So, a set of good alternatives require a couple of different characteristics. One is they should be distinctive. So our different alternative should have different kinds of outcomes. They should be discreet

from each other, so that we don't have some infinite number of possible alternatives, necessarily, and to aid us in learning about which alternative is best. So we have distinctive sets of alternatives that have distinctive outcomes in terms of our objectives.

The good alternatives require iteration. They require us to go through this sort of creative process of developing our alternatives, say, maybe multiple times. We might need to go through the brainstorming process multiple times to build on initial ideas about what's possible, and to expand on those ideas about what's possible, until we develop a really good set of alternatives that we can evaluate.

Developing good alternatives also requires communication. This is a really good point in the decision process, to seek input from others, to go to other disciplines and see if other people have developed ways to solve the problems that you're facing. To talk at length with stakeholders. Stakeholders often have very interesting and novel ideas about alternatives that might be available for solving the problem that you're trying to solve. So, let's talk now about some approaches to generating alternatives that have these kinds of characteristics.

So let's talk about this first approach to developing a good set of alternatives. Focus on the fundamental objectives. And again, this idea is that we should brainstorm and start by thinking creatively. Rather than shutting down people's ideas, allow them to stand for a little bit, and realize that you can always evaluate the alternatives, and you will evaluate the alternatives, later.

One of the great methods that's used in brainstorming is to first work independently. Allow people, say, on a team to work independently to develop their ideas, brainstorm ideas about alternatives, and then come together as a group to discuss those. And that way, we don't get too much into groupthink, and we allow for a little bit more creativity.

Integrate all the knowledge we have. What are our fundamental objectives in terms of political realities, technological realities? What are the scientific issues that we're dealing with? What are the economic issues that we're dealing with? Identify assumptions and challenge constraints.

So what are the assumptions about how our system works? Are those good assumptions? If we challenge those assumptions or let go of those assumptions, would that allow us to think about a wider set of alternatives?

Are the constraints that we have really, in fact, true constraints? So for example, we might think that we

can only spend a certain amount of money a year on buying land, for example, or protecting land. But maybe there are grants available if we will only apply for them. So, challenge the constraints that we have about the system that we're working in.

And give everyone on the team a time and a place to think, and make sure everyone is heard. Again, this is a part of the really effective process of brainstorming.

Address conflicting objectives. So once we've focused on fundamental objectives, and done everything we can to challenge the constraints and allow for a lot of brainstorming, we might then start thinking about what of our different objectives that we've identified actually conflict with each other? And then, a way to generate alternatives given those potential conflicts is to imagine the best possible consequence for each of those objectives, and create one alternative to get to that best possible consequence.

And then create a set of hybrid alternatives that try to meet more than one objective at the same time. Ask yourself questions like, what is a really great option, and why? And what is a really terrible option, and why? What do we like and what do we want to avoid? And those questions will help us, again, be creative in developing some alternatives.

So let's go back to our rare herp example and our concern that rare herps are killed during capture. So, we have some objectives. We'd like to eliminate capture mortality, but we recognize that we actually have another objective. It's important to us to maintain the pet industry.

So the first alternative that we developed, which was to ban the sale of herps entirely, does fairly good on the first objective, to eliminate capture mortality, but it doesn't do so well on the second objective, which is to maintain the pet industry. We recognize we have some conflicting objectives, and that might help us to be creative in developing new alternatives.

So, we might think about another alternative, which is to certify captive-bred suppliers in methods that are used to capture herps to be sure that those suppliers who are trained are going to be the only people that are licensed to, say, trade in wild collected herps. And that by using that method, we can meet our second objective, to maintain the pet industry, while still eliminating or certainly reducing capture mortality.

So again, this idea that we might take next is to challenge the constraints that we have that are perceived to be real constraints, whether they in fact really are constraints. Especially when there are

very few apparent alternatives, this is a really useful way to develop a greater set of alternatives. Identify those constraints that people involved in the problem have. What do they think is absolutely not possible or absolutely must be done?

And don't anchor on an initial set of options, but ask if this wasn't really a constraint, what else could we do? Or if this was really an option, what else could we do? And again, allow some creativity. Develop the alternatives before evaluating, before assessing, their feasibility and their efficacy. There will be plenty of time to do that evaluation step later. But this is, again, a way to become more creative, expand the set of options, expand the scope and the scale of the options that are available, by challenging the constraints that are perceived to be real, but actually may not be real.

Again, one example, are the financial constraints that are perceived real constraints, or could you partner with, say, another management agency to bring in more resources? Let's talk about an example problem for this. Say we have a problem of an endangered bird that we need to translocate to additional islands in order to preserve the bird in the long term. And our problem is, to which of those different, available islands should we translocate the bird?

Well, we might, in that case, have a perceived constraint. We might think that introducing predators on, say, island A, makes it unsuitable as an option for translocation. But what if we considered challenging that constraint? What if we said, well, what if it was possible to put the bird on island A, and then we would realize that maybe a new alternative is to do a combination of predator control and translocation to island A? So by challenging those constraints and developing a way for getting around those constraints, we've developed a new alternative.

OK, now let's talk about visualization, again, as a way to help us develop a broad and useful array of alternatives that we can then later evaluate. It can be really powerful to develop diagrams to help us think about management alternatives. Now, in this first process, when we're just generating alternatives, we're using diagrams only to do that, to develop the alternatives, rather than to actually evaluate or predict the effects of the alternatives on our objectives. That process will come later. But this just might be a useful, visual way to generate alternatives.

So, let's go and look at an example of that. So an example of this process of using a diagram to help us develop a set of creative and good alternatives, we can talk about this issue of crane nest failure at Necedah National Wildlife Refuge. We talked a little bit earlier in this module about how ultralight-led

migrations have been used to reintroduce migratory whooping cranes to Wisconsin. Now, that population of migratory whooping cranes nests on and around Necedah National Wildlife Refuge in Central Wisconsin.

Things are going quite well with that reintroduction, except there has been pretty substantial nest failure by the cranes in the population. And a couple years ago, a group of us got together to think about that problem. And one of the things that came out of our discussions was a diagram of the crane nest failure issue at Necedah National Wildlife Refuge. And we can use this diagram to illustrate the process of how a diagram can be useful in developing alternatives.

If we start at the far right side of this diagram, we have some shorthand for our fundamental objective. It says "population status," and what that means is we want to have a self-sustaining population of whooping cranes in that migratory population.

We also have a couple of means objectives just to the left of that fundamental objective that we think are really critical for ultimately achieving the fundamental objective. So, the mortality rate is important to keep that low in order to have a self-sustaining population, and it's also important to keep the nest failure rate low in order to have a self-sustaining population.

Now, just to the left of those means objectives, we see some of the factors that our group of experts thought were important in influencing those mortality rate and nest failure rate pieces of this puzzle. So for example, the energetic condition of birds influences mortality rate. It also might influence the infertility rate, which ultimately also then influences the nest failure rate.

Energetic condition might influence whether birds abandon the nest, and abandonment seems to be the biggest cause of nest failure. Predation of nests is going to certainly impact nest failure rate, and so might be flooding. And so on.

And by developing an understanding of what the causes and what the factors are that influence our objectives, we can work backwards to the point where we're identifying factors that we can actually have an impact on. So for example, we might think that by using an insecticide, we could actually reduce harassment of birds by black flies. Now, harassment of birds by biting black flies has been a leading hypothesized cause of abandonment of nests by nesting birds. Well, what if we could reduce black fly harassment? We might do that by using insecticide to reduce black fly population.

Maybe we could move the reintroduction site or, say, use supplemental feeding to change the energetic conditions of the birds. Maybe we could use some techniques for changing the habitat, the aquatic vegetation, to change the invertebrates available, which would be a food source, which would then ultimately change the energetic condition of the birds. Again, which links back to mortality rate, nest failure rate, and population status. Maybe we could use some other method like, say, drawing down the impounded wetlands on the refuge to change the habitat, change the food sources, change the energetic condition, and so on.

The process of diagramming what we think our objectives are and what factors influence our objectives can help us to see how we can have an effect, and what actions we can use to have an effect, on the system. And we'll use influence diagrams later on in the Consequences Module, which I'll come to next-- Module E-- to talk more about how we use these kind of models to help us, at least initially, develop a sense of how we might make predictions, so how we might actually evaluate alternatives. But here, primarily what we're doing is we're using these diagrams to really just help us brainstorm how we might have an impact on the system that we care about.

OK, now let's talk about some other methods for formulating alternatives. So we've talked a little bit about some creative approaches to brainstorming, challenging constraints, using diagrams to visualize possible alternatives. Now, let's talk actually a little bit about the forms that alternatives can take. And we're going to talk a little bit about the concepts of portfolios and strategies.

So, a portfolio is where we have an alternative, a single alternative, that is actually a combination of like elements arranged in sets. So, they could be discrete or continuous kinds of actions. So for example, a set of research projects might be you could choose different research projects, say, to fund, and those are discrete options. You either fund research project A, or B, or A and B.

We also might think of funding allocations as continuous actions. We can give any number from zero to our entire budget to each one of those different research projects. But that is sort of a continuous action in some sense, so I think this will become more clear as we go through some examples.

So the combination of the actions-- A, or B, or A and B-- actually now represents a single alternative, and we would evaluate that alternative as a single alternative. For example, we might ask ourselves, what stock should we buy if we have \$20,000?

Well, alternative one is to buy 50 shares of stock A. Say, \$400 per share is the cost of stock A.

Alternative two might be to buy 100 shares of stock B, because stock B only cost \$200 per share. So we have two alternatives

But in fact, if we were creative in developing portfolio-type alternatives, we could develop a larger set.

Say, four alternatives. Alternative one might be to buy 40 shares of stock A, and we would still have money left over to buy 20 shares of stock B. Or we could buy 30 shares of stock A and 40 shares of stock B. Or 20 shares of stock A and 60 shares of stock B.

The point is, there's a lot more alternatives available than spending all of our money on stock A or all of our money on stock B. And so this is how we develop portfolio-type alternatives. And this allows us to have a lot more flexibility in developing alternatives in cases where we have a decision problem like this, where we can say allocate funding to a number of different things, or effort to a number of different things, or time.

So, let's look at an example for invasive species removal. We have four different invasive species that we would rather not have, say, on our refuge. And the cost of removing each of those target species, we have an estimate for the cost of that. We can combine. We could say, for example, combine actions to remove not just A or not just B, but A and B.

Now, the new cost of that action might not be simply the sum of costs of those actions independently, because maybe the work that we do to remove target species A might also contribute to the removal of target species B. And also, the benefit that we get-- the amount of area treated, for example, the acres restored-- might not be exactly equal to the sum of the individual components. So we might have to actually develop some more sophisticated predictive models.

But here again, the point is let's be creative in developing alternatives. It doesn't need to be just A or just B. It could be actually a combination of both, or including other target species as well. So that's another example of developing portfolios of actions.

Now, we might use our constraints to recognize that we don't want to actually evaluate all of those different alternatives. So for example, we might have some constraint-- our manager, or maybe there's some legal reason that we absolutely have to eliminate species B. So any alternative portfolio that doesn't include species B we would eliminate from further consideration.

Also, we might have a situation where we recognize that the budget that we have is only \$25,000 or less. And so, anything that costs more than that we're really not going to be able to consider as an alternative. So we could use our constraints to narrow down the larger set of portfolios so that we would end up, say in this case, with a slightly smaller set, but certainly a more creative and larger set than simply remove A, remove B, remove C, or remove D. We've developed using this portfolios, recognizing that we can fund portfolios to develop a larger set of alternatives. And we also, then, might eliminate the alternative that includes A, B, C, and D simply because it's too expensive.

So, the portfolio benefits might be greater than the sum of the parts, and the costs might be less than the sum of the parts. But again, the idea that our constraints might limit the number of possible portfolios that we could consider because of cost or other considerations.

A variation of the portfolio-type approach to developing alternatives is a strategy approach to developing alternatives. So here, instead of combining multiple like elements, we're actually combining multiple unlike elements to develop strategies. So what we might do is we might list the management options under each of the number of elements or themes, and then select a coherent set among those to be one strategy.

So for example, we might, if we think about the whooping crane example, with the influence diagrams that we built, we might think that they were vegetation management types of actions, and there were actions that were designed to reduce black fly populations. We might actually select a couple of different of those kinds of actions to make one alternative. So we might do draw downs and black fly treatment, for example, and that would be a strategy.

Let's look at another example for recovery of an endangered species. Let's look at one of these strategy tables. We have different themes. We have one team that is about habitat protection. We have a theme that's about predator control. We have a theme that's about enhancing the population of the species in some way. And we might have another theme that's about the intensity or level of monitoring that we're going to do to, say, reduce uncertainty that we have.

So we might then choose one action from each of these themes to actually develop a single alternative. So for example, we might say that one of our strategies-- we'll call it "Maintain The Existing Population." That's the name of our strategy. And it might involve the status quo in terms of habitat for protection and predator control, and also the enhancement of the population. We're not going to do anything, but

it also might involve, say, enhanced and more intensive monitoring to reduce our uncertainty.

We might have another strategy that we call, say, the "On The Go" strategy. And we might then take from the habitat protection theme development of corridors. Or from the predator control theme, we might have increased harvest of our predators. We might take from the enhanced population theme the translocation option, and then some basic monitoring.

And those different elements, bundled together, make one alternative, and so on. We can develop multiple alternatives in this way. But the alternatives, these strategy-based alternatives, are combinations of different kinds of actions into a single bundled package of actions, which we'll call a strategy. We've talked about different ways of helping us to brainstorm and be creative in the development of a set of alternative actions.

Once we've developed an initial set of alternatives, it can be really worthwhile to go back and revisit our objectives. After we've thought, now, a bit more about our alternatives, we can maybe more usefully think about our objectives. We could ask ourselves questions like, have we really, properly separated the fundamental and the means objectives, as Mike Runge talked to you about in the last module? Can we in some way clarify the statement of objectives to more accurately characterize what we really care about?

Can we identify if actually some additional objectives exist? It might be that some member of our team, when some alternative was suggested, had some objection to that alternative, and it might be because there was some additional objective that that team member had but didn't realize it before. So the process of developing alternatives can actually help us clarify what our objectives are. So it's useful at this point to go back, revisit our objectives, and go through those two steps again to be sure that we've been pretty thorough in understanding both our objectives and our alternatives.

A couple other additional tips for creating a good and creative, and reasonably large, set of alternatives, so that we know that at least there's some good solution in the different alternatives that we're considering. It's probably a useful idea to keep in your head that the first list of alternatives that you consider may be unnecessarily narrow. We need to challenge the constraints, see if we can think more broadly. Some alternatives might be obvious, but sometimes alternatives are not obvious.

The idea of re-introducing migratory whooping cranes using ultralight-led migration probably wasn't

obvious to a lot of people until it was proposed. Don't stop looking for alternatives. The process of decision making is iterative. If another alternative occurs to you after you've gone through this step, and you're, say, building models, don't be afraid to come back and add it in if it seems like it might be viable.

And again, be wary of shutting down the brainstorming and the creativity in developing alternatives. Create first and evaluate later.

Good alternatives address the future, not the past. So just because we've always been doing something, that isn't necessarily a reason to only consider continuing to do it. Good alternatives are unique, so they should, again, be somewhat different in the impacts that they have. They're creative and encompass a pretty broad range of actions. We want to give ourselves choices.

They certainly have to be legally reasonable, politically reasonable, and financially reasonable, although sometimes people use those as ways to shut down alternatives before they can really be evaluated. So again, don't be too hasty in eliminating alternatives because of perceived constraints. Be sure that they really are real constraints before you eliminate alternatives.

Alternatives have to actually be implementable by the decision maker. The decision maker has to have the power to make that alternative a reality before we really consider whether it's a useful alternative to evaluate. And alternatives ultimately should address all the objectives. We ought not to have an objective that we don't have any alternative that seems to help us get to that objective. So thinking about the broad array of objectives that we have is important in developing our set of alternatives.

Consider also alternatives that are an ongoing process. So for example, an alternative that we think we'll repeat multiple different times through, say, some larger time horizon. Maybe instead of building a reserve all at once, we'll buy one piece of land this year, one piece of land next year, one piece of land in five years. So some alternatives might be an ongoing process, and that might be a way to get things done that wouldn't be feasible in the short term.

You might consider alternatives that delay the decision and gather more information, but those alternatives ought to be evaluated just like any other alternative. If we're going to delay the decision, we have to recognize that that may have different kinds of impacts on our objectives, the things that we care about. We'll talk about the particular case of gathering more information-- Mike Runge will talk about that in the last module in this course in particular.

And that is all we have for the module on creating alternatives, and thank you for participating in this. And the next step is to think about, once we know where we want to go-- we know our objectives, and we know our options for getting there-- how do we evaluate the consequences of taking different alternative actions?