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Moderator: Courtney Chambers
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(Courtney Chambers): At this time I'd like to give you today's speaker on Performance Risk and Economic Benefits Assessment, Dr. Lisa Wainger is a Research Associate Professor of Environmental Economics at the University of Maryland Center for Environmental Science. Her primary research interest is developing integrated, ecological and economic analysis tools to communicate changes and ecological conditions in terms of socioeconomic impacts. Her work emphasizes the special variability of ecosystem service benefit and applies that understand to create decision/support tools for prioritizing restoration and preservation. These tools which analyze risk and economic efficiency have been applied nationally and internationally to issues of agro ecosystem management, endangered species, wetland mitigation, preserving habitat for rare species and water quality. She currently serves as a special economics advisor to the U.S. EPA Office of Research and Development and serves on the executive board of the Scientific Technical Advisory Committee to the Chesapeake Bay program. She has served on numerous other advisory panels for the White House Council on Environmental Quality, U.S. Army Corps of Engineers and the National Fish and Wildlife Foundation among others. She received her Bachelors in Earth Science for the University of California Santa Cruz and her PhD in Ecological and Environmental Economics at the University of Maryland College Park with support from the McArthur Fellowship.

More information about Dr. Wainger can be found in her bio posted on the Learning Exchange which also has a link to her lab page where you can read more about her work. And at that same site we'll have the rest of today's meeting documents available as well.

We're very happy to have you with us today Dr. Wainger. At this time I'm going to give you the presenter rights and we can begin.

Lisa Wainger: Well thank you (Courtney) that was a very thorough introduction. I appreciate that. And - I'm getting an echo.

(Courtney Chambers): Yes, are you on speaker by chance?

Lisa Wainger: I have a headset on.

(Courtney Chambers): That's better right now. I don't know what the initial echo was.

Lisa Wainger: Okay so here we are and I, you know, one of the great benefits of a webinar is that I don't have to see all the confused looks in the audience but - so I will - no, seriously I will encourage you to ask any clarifying questions as I go since I'm not exactly clear on folks background.

But let me tell you a little bit about why I'm here today really. And that's because some of you may have heard, we're working on a framework that will be proposed for the Corps to use assessing ecosystem goods and services. That is still in development and under review at the moment so this is not that talk. But what this talk is, is some of the ecological and economic concepts that we're bringing to the framework and hopefully that will give you some insights into where the framework might be useful.

And the idea here is that we're really trying to develop tools that will be appropriate for planning at the district level. So a lot of times it's a matter of looking at the big picture and what the current research suggests and then finding ways to make the track-able.

So you'll get a little mix of that here today. So let me just dive in - uh-oh. (Courtney) I'm not - I don't seem to have control over the slides. Did my presenter rights go away?

(Courtney Chambers): Let's see. No you're listed as presenter. Can you click that arrow first with your mouse and then see if the.

Lisa Wainger: Okay, good. So this is the overall model of what we're trying to do with the framework. So I'll give you a little intro on the framework but then I'll just switch to the discussion of the more general concept.

So the idea here is that we're starting with some kind of project activity -- restoration is really what we're thinking of mostly -- but in the end this may be generalized to any kind of project activity. And we're trying to get from that left hand side of some project activity to the right hand side which is a metric of social benefits generally measured in dollars. But in between there are a lot of connections we have to make.

So the first thing we need to establish is if we're going to do a particular activity, change a channels geometry or plant a specific tree -- that we understand what kind of ecological outcome we're going to get from that. And we call that the response function. That being either a stressor response function or a restoration response function that lets us know how the system's likely to respond to that particular activity. And I'll give you some examples later.

The ecological outcome can be measured in lots of different ways but that's generally going to be some ecosystem process or structure that is an indicator of ecosystem goods and services.

So the next step in that relationship is understanding, okay, if we planted red riparian buffers and we got bank stability what does that mean in terms of an ecosystem good or service? And here's where we have to define what we mean by ecosystem good or service. So what's the difference? The difference in this system is going to be that ecosystem goods and services are defined as the socially valued aspects or outputs of ecosystems that depend on self-regulating or managed ecosystem structures and processes. That's the official definition.

What we're really saying with that is that they should be the things that people are immediately using or can understand the benefits of with little explanation. And so we're often trying to translate both physical processes as well as aspects of user preferences to be able to generate a measure of an ecosystem, good or service. And so we've lumped those two -- both the ecological and the economic considerations into this eco-service production function. Now those are different. In a sense we're just establishing demand at that point but there are people who would want to use that service in that form at that location that's separate from the next link which is actually being able to understand the benefit of damage avoided function of how people would value a change in an ecosystem good or service.

So I'll be covering more of this throughout the talk but that's the overall framework. But what this is really trying to say -- in addition to the fact that there are a lot of steps to getting to the economic values -- the other point is that you can still work with these other endpoints -- these other boxes -- to generate useful outcomes that suggest benefits even when you can't get to dollars. Because we won't always have all the information we need to make all these links.

So the connection between the - I'm going to abbreviate ecosystem goods and services as EGS throughout this. The idea is that this would really integrate with the six step planning process and be compatible with smart planning.

So I'm assuming most people on the call are familiar with the six step planning process which is shown here in the first row. So how does EGS fit in?

I think there's a very easy link in the first step of problems and opportunities to EGS because that initial scoping stage is without - with just a little bit more effort is going to generate any potential changes to ecosystem goods and services.

It starts to diverge a little bit when we get to inventory and forecasting when we want to - at this point start forecasting without project changes. That suggests that even though we may have scoped out a lot of potential changes in ecosystem goods and services we're going to want to narrow down to the most important ones, the most significant changes in order to move forward with any time consuming modeling because the idea is to be cost effective in the implementation of EGS. So there's a screening process that goes on there where you really decide which ones you're going to try to quantitatively analyze. So that happens, you know, between problems and opportunities and inventory and forecast.

Then we get to a much more significant bifurcation where as you actually go into plan formulation you're going to need to differentiate which ecosystem, goods and services are appropriate for plan formulation.

And there are other members of the group - I probably should have mentioned early on the rest of the folks that are working with me. So from (ERDC) we

have (Elizabeth Murray) and (Al Cofranceso), (Glen) - (Glen)'s name I'm forgetting momentarily.

Courtney Chambers: Rhett

Lisa Wainger: Thank you. And (Glen) and (Al) are not responsible for the details at this point. Things are still in review but (Elizabeth Murrary) at ERDC and Janet Cushing at IWR are helping lead this project. And then there are a host of other folks that are joining in that - including (Denise Reed) and recently retired (Lynn Martin) who have really gone through and evaluated which EGS are appropriate for plan formulation and things like that.

So they'll be other reports that will come out that will describe these things.

But anyway, at this bifurcation point of when we're formulating plans we would only use any ecosystem goods and services that represent core mission goals. And then there would be an analogous modeling of these EGS as you would other types of benefits.

If the ecosystem goods and services are not appropriate for plan form they may still be added at the end once a plan is selected one can evaluate what the other potential EGS benefits might be. So this is the concept of how it fits in. Again, all this is in draft and we welcome comments on these things as we move forward.

Okay, so that's that. That's a little bit about the framework is get across some key concepts and bring to bear some recent research that may help support good decision making about restoration options.

So there really are kind of three main things that I'll talk about today and one is this ability to really make that link between ecological features and processes and the beneficial outcomes to people. Often times that involves some complex modeling so we're trying to figure out where the options are that are going to be easy and robust to do. And so we're looking for these robust models that can really make the links between things like bank stability and recreational fishing outcome. And identifying what's available to make those kinds of links. We're looking at outcome metrics that reflect user needs and preferences. So, for example, if we think that our project is going to enhance stream base flow and we would like to suggest that that's going to product and ecosystem service or irrigation water -- we'd really need to be sure that the water was sufficient and the timing was appropriate in order to really say that we have generated that ecosystem good or service or the potential for it.

So as part of that we're looking to apply monetization of these benefits only where it makes sense -- certainly within a cost effectiveness framework you can have compelling benefit metrics that are not monetary values and those may be easier to get and more useful in a lot of circumstances.

One of the other issues that - one of the other main issues that comes up is the ability to really measure changes in EGS due to the project. So a lot of tools that are available try to look at all the ecosystem, goods and services that are generated by a certain land cover. But they're not necessarily getting inside some of the quality changes that occur as a result of restoration. So we really need to fill in tools to look at those changes.

And then something that we hope to bring in is also that we will consider restoration probability a success. And I'll get into that and a lot more soon.

But basically we're looking at, you know, how successful is restoration at generating the outcomes that we're seeking.

So starting with that last point first. Why do we need to consider performance risk? And that really comes down to - this is really a decision support concept or a decision science concept that really integrates both ecology and economics in that people don't value risky things equally.

So a simple way to think of it is just that that old saying, a bird in the hand is worth two in the bush. And that just - that's it. You're willing to accept a lower payout if you have a sure thing versus - and if something's risky you're going to want a higher payout to be wanting to take that risk. So maybe you'd have to go up to four birds in the bush is worth one in the hand or something like that. So what we're trying to do with these performance risk measures is figure out when risks are worth taking because the benefits are sufficiently high.

And so what I'll talk about today are two ways to incorporate risk that I've used in projects. And one is the approach of just screening out high risk projects which is useful if you can't quantify the risks. And the other one is using outcome probabilities to deflate benefits in proportion to risk. And then that way we can view the options on a more equal playing field.

So here's what that looks like just so you have a clear understanding. If we were doing a return on investment analysis and we wanted to use these risk adjusted benefits -- these are also called expected benefits -- meaning we've weighted the benefits by the probability that we will succeed.

So the equation is something like this -- the change in benefits which is the difference between the no action scenario and the actions that you're proposing. That would be your change in benefits. But you know you don't

have 100% probability of success so the benefits are going to be deflated essentially and then you're going to compare that to your cost.

So just in an equation if you have an estimate that you can generate 1 million in benefits -- remember from our proposed restoration but you think you only have a 75% chance of achieving that your risk adjusted benefits are 750,000. And then you're going to compare that to your costs to get your return on investment. This is a simplification you can actually - this can be more complex than this but at heart this is essentially what we're doing. We're deflating riskier things more than less risky things so that we can see where the potential benefits are and how to compare them across more and less risky alternatives.

So what do we need to bring if we actually want to try to assess performance risk? Well the very first thing we have to do is to define success because if we think we can achieve our goals with say a certain percentage of native and a certain percentage of invasive species than we haven't - we're not necessarily unsuccessful because there's some percentage of invasive species in our wetlands -- depends on what we're aiming for.

Can performance risk across ecosystem goods and services be differentiated? So this is kind of a key question in that we'd like to be able to say, well I may not be able to do that service with certainty but I think I could hold sediment with very high certainty and that would generate some habitat. So we'd have different ways of measuring risk across the services ideally.

Then there's this question of what locations and techniques have the greatest returns to effort. And here we're getting into some of the work that's been done in restoration ecology to look at what's been successful.

And then finally do site outcomes induce benefits downstream or off site? So this really relates back to how we define success in that one might have limited capacity to generate benefits on site. But a given site might contribute to a goal of say, improving outcomes in a receiving water body. So that is another way we might need to look at things to assess performance risk.

So let's take that first issue of how do we define success in restoration? And this one comes from a NOAA document on wetland restoration. And this is pretty typical of the kind of definition of success you'll find. The process of reestablishing a self-sustaining habitat that in time can come to closely resemble a natural condition in terms of structure and function -- so it really sets out this ideal that we are trying to recreate a reference condition usually from a lightly impacted site or un-impacted site.

And then when we go to judge the success of our projects we often find something like this. So this is a wetland assessment score that was conducted on California mitigation sites. And so what that graph on the left is showing is the distributions of wetland assessment scores for mitigation sites in red and reference sites in green.

And, you know, we see this a lot. I'm sure there's folks on the phone familiar with these sorts of things where, you know, you can do well with restoration but still fail to achieve what the reference condition looks like. And so, in a lot of ways, one might say these mitigation sites have failed and I believe (unintelligible) essentially makes that case in his paper because there - so many of the mitigation sites are sub-optimal. The reference sites are optimal, therefore we've failed.

But the question we're trying to get at is if we deconstruct some of the different services of wetlands do we see a different result? So this is the

holistic - the wetland has to function like the natural system. That may not be possible in all locations but does that mean we haven't succeed at all in any of the surfaces?

And that's what we - of course, this is very difficult to do, I'm sure the ecologists on the phone will speak to that. But this is the goal. And I think there are some ways we can approach this.

So this is the ideal here representing - this graphic representing a stressor gradient from left to right so un-impacted on the left and highly impacted on the right. And what we expect to find if we could generate these response functions and as we do generate these response functions we find different shapes responding to that stress. And that's where we would need some understanding to be able to tease apart the different services.

So can we get these functions? Well - and how do we use them once we get them? So there - I think there is quite a lot of work going on in these sorts of relationships right now and we'll be watching closely to see what we can bring in.

In this graph - I've now reversed the x-axis from the previous slide just to confuse you. So on the left hand side is high impact. On the right hand side is impact. And this slide is really just suggesting that we need to use these restoration response functions to target our effort where we can generate the greatest return. Because if we have a certain amount of effort we're going to apply so let's say we do a project that removes 10% of the stress from a project. In a highly impacted site we may see minimal return but at other locations or in other types of settings we may find that that same amount of effort can generate a higher return.

And we really want to understand these non-linearities where they exist in the system. Because it's often the case that a more moderately impacted system can generate higher returns. But that varies, again by the type of service that you're looking at. But understanding these non-lineraities is really critical to being able to target effectively.

So we've gone to the literature to see what has been done recently in restoration ecology to understand what we know about targeting restoration to be effective. And, you know, this is some of the bad news basically that the landscapes of enclosing watershed in general really restrain habitat restoration goals. You know, particularly ones that are geared towards restoring the full complexity, the full diversity of habitat, you know, species and their habitat.

So in - for streams and aquatic habitats there seems to be a growing consensus that, you know, somewhere around 15% impervious cover you see minimal stream bio diversity improvements from in stream habitat manipulation.

Perhaps - I think this one - the next result is somewhat more surprising. In wetland habitat we see almost the same result. That wetlands - you can predict the condition of wetlands just by looking at the enclosing watershed -- suggesting that they also are very constrained by their setting even though they're not as integrative as a stream necessarily, they still are integrating landscape processes, so that's - like I said, that's the bad news, but the good news, I guess, if you want to think of it that way, is that there's also cases where heavily impacted sites do have high returns to efforts, and I'm showing you a Chesapeake Bay watershed here.

I do a lot of work in the Chesapeake Bay so that you can see a lot of examples, and what we found here is that if you - the graph on the left is showing you as the percent of the watershed in crop land goes from 0 to

100%, that you do see this non-linear response in your ability to change the nitrogen run-off. Now I know water quality is not a major Corps concern, but it's certainly something that comes up a lot when we're doing stream restoration. You know, what is the potential to improve some of these nutrient cycling processes. So in this case we did find that highly impacted sites had a particularly good response to even minimal recurring buffers and wetland restoration, and that what that suggests is that when you look at a landscape scale, so that on the right hand side, the dark areas are showing where you can achieve the greatest habitat improvements in the Bay from a nitrogen reduction at that location, so even though in these heavily agricultural weather sheds, we may see a limited response locally, they are very cost-effective for achieving a restoration goal in the Bay.

So this is where some of those off-site benefits can come in and be used to assess ecosystem services. So just to sum up that literature review, what we essentially find is that this graph is showing watershed land conversion on the X axis, and here, I'll use my little pointer - hydrologic alteration on this axis, meaning things like dams and channelizations, and what we see is that if you really want to restore vital habitat, you are somewhat constrained to this less impacted zone, meaning that it's likely you're only going to be successful at restoring habitat when you have - I'll put on the examples here - when you have a single stressor situation, and you can remove that single stressor and you can restore habitat.

On the other hand, in more impacted landscape settings, it doesn't mean you can't improve a lot with restoration, but it means that you're more likely to be in a case where you're going to be unable to restore specific functions like sediment retention or you know, nutrient retention, and that you could be successful, but that it's the choice of which ecosystem services you can restore. It's going to vary. We've really been talking more about functions at

this point and probably confusing the issue here. But I always think of the functions as leading inextricably to the services, so I tend to use those terms somewhat interchangeably, even though that's not really how we think of them.

Okay, so that's that, so just in words, this return on investment targeting of projects needs to be based on what the specific goals are for that project. Restoring scarce habitat with a site-based approach, that's compared to a watershed approach, only appears probable under limited conditions, so single stressor conditions I spoke of. And then degraded sites may have limited ability to provide onsite benefits, but can still contribute to watersheds and regional goals to the restoration of specific functions that can contribute to a broader goal. Okay, all right, so now I'm going to get into some case studies. All right, folks, now is a good time to ask any clarifying questions if folks have that. Otherwise, I'll just keep foraging ahead.

So you can - people can type that in the chat. I'll keep an eye out, so I'll just keep talking. So now I have two examples, one where we did a qualitative risk analysis and one where we did a quantitative. So the qualitative was the Chesapeake Bay mid-islands - Mid-Bay Islands case study, which I was working with the Baltimore district, and the port of Baltimore at this time, and we were - this was the reconnaissance study where we looked at all the potential mid-Bay Island sites.

And for those who aren't familiar, these were dredged placement material as well as wetland restoration sites, so the red is showing the distribution throughout the whole Bay of all the sites we considered, and we worked with the Bay environmental working group, which was representatives of all the resource agencies that have some interest, and they generated an environmental scoring criteria that was a blend of many metrics, a weighted

sum of many metrics, that they used to judge the potential benefits and as well as potential harms of any restoration site, of any dredge material placement sites.

So this is what they were using for their environmental scoring. And I was brought in after this had been developed to try to provide information that could be used to judge the effects on these scores, so what we did - so this is a plot, a cost-effectiveness plot based on that metric, and the benefits are on the X axis. The costs of the project are on the Y axis, and this is showing - so there's alternative versions of each option, so that's why you have these clouds of scores, because they're representing the same location in many cases, but with different options.

And so what we found when we initially put all the options in this kind of table is that we had 14,000 options across - with a wide array of cost benefit ratios. And just to make sure everyone's on the same page, what we're looking for with this plot is we want to be in the lower right quadrant as much as possible, which is - we call the efficient frontier, which is basically the maximum cost-effectiveness you can be and thinking that anything outside that frontier is on the table, and you're in the area of high benefits and low costs.

And so we applied that screening to each type of project, and this is what resulted from that, and so we haven't thrown any options out yet. We've just picked the most cost-effective options, and that took us way down to 590 options, and then we wanted to consider risks. So in this case folks considered both technical and logistical risks as well as legal and political risks, so technical risks being, well, this is a new technique, you know, we don't know exactly what we should expect, versus oh, this is routinely applied and we know what we're doing, and that's low risk.

Legal and political risk was generated because some of the options the Corps looked at were locally illegal. I'm sure folks are aware of how that can happen, and then there were also just some types of dredge material placements that were likely to generate public opposition, and what the group decided to do was screen out everything that had high risk, and what that ends up doing to our list of options was to dramatically reduce what was available as an option for restoration and dredge material placement.

So you know, it's quite significant that we're now down to 50 suites from almost 600 in the previous slide, but what's really dramatic is that we lost the most cost-effective alternative. Now there's plenty of good reasons to screen out things, particularly that's going to get you into a legal quagmire, but I think you know, this suggests that there is a need sometimes to think beyond just screening out everything that's high risk and look deeper at what the probabilities of negative outcomes are to really understand whether you might be able to bring some of those more cost effective alternatives back on the table.

So that's the next case study. I had to have you go to a non-aquatic case study for this. I hope you'll forgive me. I've done a lot of work with invasive species, and that's where I've been able to get some of the better data on risk of probability of - well, let's just say probability of successful restoration. So - and I have a couple examples, but I'm going to stick with the most recent one, which is a study we did for the national park service. They send money to remove non-native invasive plants, and they wanted some good measures of what they were getting back for that investment.

So we came up with a way to quantitatively assess the variety of ecosystems, goods, and services, and it's really based on this idea that what

you're trying to capture is how many users or beneficiaries you have as well as how much enjoyment they're getting for their visit to that park, so it's broken down into, you know, an assessment of how many people are using the service, do - are the sites particularly good at providing that service. Does the landscape connectivity enhance the service?

So if you're going birding in a part of the park that's right next to a wildlife preserve, you're probably going to have better birding. And substitutability and rarity is getting at this idea that well, all else equal, scarce things are going to be more valuable, so we're looking at how rare and scarce these recreational and non-use services are. And so we did this in a very quantitative way, so I know I'm kind of rushing through a lot of details here, but I just wanted to give you a general sense of what we did.

First, so this is Antitum National Battlefield Park for any in Maryland, if any folks have been there before. This is a map of how we distributed the users based on the data we got from the park and various use indicators, let's say. So that's telling us where people are going in the park, and I should mention that the reason why we're so interested in the spatial distribution is because they were making decisions within a park of where to treat the invasive species and wanting to know what the benefits were for given strategies.

So we looked at where the users were. We looked at what benefits we thought they were getting from the uses in various locations, so what we're really getting at here for the - if there's any economists on the line, that this is a spatial benefit transfer. For the non-economists, all you really need to know is that this benefit multiplier is based on the idea, if I just plopped someone down in the park at this location, would there be greater or lesser benefits

from that location, based on user preferences, and we had a variety of data to represent user preferences by location.

Then the benefit transfer part comes when we use existing economic studies to look at how people have valued different services. In this case we were looking at historic and cultural services, so we had literature specific to that use of a park, and what we did was we used those - the benefit multipliers to create a distribution of value centered on the mean based on the literature review that we did, which is again, probably more detail than people can take in if you're not already familiar with these techniques, but it's just a way to judge the relative value by location.

And then finally we multiply the users by the benefits to get this value. Now this is just an intermediate value that we're going to use to assess what the maximum possible benefits are under a no weeds condition, as is not truly representing the value of that ecosystem service at this point, but it does suggest the annual flow of benefits. Okay, so then, now we have to look at the - compare that to the with- and without-project conditions.

So in this graph we're showing both invasive species and cover and time on the X axis, because we're expecting the species to spread through time if they're not treated, and then we have the percent of the benefits that's achieved, so we're starting out under a no-weeds scenario, because a lot of the treatment is really aimed at preventing what are relatively modest infestations from spreading, and so the no-action scenario is that you'll have a decline in benefits over time, and this represents what I referred to earlier as the damage function that we have to work very hard to get these.

And this is one of the more dramatic damage functions because the service we're looking at is wildlife viewing benefits. There were other services where

that line is relatively flat, because the invasive species were not actually very damaging to those services, but this was one of the ones where there was a big response, and what we assume is that with our treatment, first we assume that it works perfectly, that through time we're going to prevent invasive spread and therefore the benefits stay at 100% through time.

We pick a planning horizon, 20 years, over which to integrate the benefits, and then our benefits are represented by that golden triangle there that shows, you know, the difference between the - with project, without project, and how we have achieved a benefit, a wildlife viewing benefit. But for those of you who've worked with invasive species, you know that that's not a very realistic assumption in most cases. Established infestations can be very difficult to get rid of permanently, so what I did is I engaged some landscape ecologists who had data on invasive species spread, and had them look at what the risk factors were by location of invasive species spread.

And so this represents maps of the probability of reinfestation, which they conceived as the main threat to restoration success that there were going to be seeds continuing to arrive at the site and would they they establish, and that was going to be a function of how many seeds got there and how conducive it was to their growth, so that's - these risk metrics then became the way that we displayed the benefits in this study.

So back to that chart of the benefits, if we now assume that our risk management trajectory is not - doesn't keep us at 100% benefits, but those benefits decline over time, then now we have a smaller triangle of benefits, and that represents our risk weighted benefits for this project, so these are some of the ways that we've come up with to actually deflate benefits based on that probability of success.

Now I realize, you know, these can be pretty complicated, and district planners don't necessarily have a lot of time to do these kinds of complex analyses, so we're really working toward this idea that we're going to pull in tools developed by others and come up with some simple ways to apply these approaches. One thing we've done, so for the park service we actually delivered a Web tool that would allow us to - would allow them, rather, to put in their different restoration strategies and come back with a benefit cost ratio and assessment of the benefits and the costs, and that was based on a huge effort to input their data and a lot of things.

But in the end it's a very usable tool, so that's one approach. Other things we've done, worked on some air force bases to look at more simple metrics of whether ecosystem services were - what their trends were, and so here's an example clipped out of a much larger table of some different resources, in this case water supply, water discharge. This is in an arid region where water discharge was important, and looked at basically capacity versus usage as a way to generate this color coding of sort of resources that are being sustained versus resources that might be degraded.

And the actual full range of options is here where you have - and you're going to - each of these bins gets redefined depending on what type of resource you're looking at, but essentially you can compare trends in use versus trends in supply and come up with some of these risk ratings, and these go both ways. Where you may need water to support say wetland restoration and you may need to look at that risk, as well as your project activities may be influencing other ecosystem services, so they both need this for the use in your restoration as well as the outputs of your restoration.

Anyway, so those are just some of the examples. I'll just sum up now, some of the examples of ways to simplify, and we certainly have a lot of other

ideas. The return on investment analysis is served by functional metrics that go beyond measures of naturalness and consider these non-linear responses. So here's a case where we're really wanting to understand what we're getting from restoration, even if we don't achieve referenced conditions, but also recognizing that more degraded systems can be more difficult to restore and that we may be looking for options where we have more moderate degradation in order to generate high responses.

Let's see. I've lost my mouse. There we go. Ecosystem service benefit metrics that depend on ecological quality and user preferences. I spoke about how many ecosystem service metrics are just based on a land cover mass, and so that often will not represent the difference between a project that just enhances the quality of a land cover, an existing land cover, so here's where we really are looking for approaches that represent ecological qualities and their relationship to user preferences.

So you know, what do the users like? What do they need, and is what we're doing there in order to be able to really represent ecosystem business services? Damage functions - these are critical for informing the no action base line. There are a lot of cases where you can be staving off harm, but if you're just assuming that future conditions are the same as current conditions, you're missing that representation of benefits, but these are really tricky and we know that more research is needed to really understand a lot of those damage functions for ecosystem services.

And then these performance risk adjustments, we hope will promote good restoration choices and goals. So when we use performance risk, it's clear that the site outcomes will reflect landscape constraints, so there you have an option of if you have a particular goal you're trying to meet, you can look for a particular site that's more likely to produce that goal, or if you have a site

you're going to restore, you can look at, well, we have these constraints. How do we design for those constraints to get the most out of our site?

Avoiding risk may severely restrict the management options. So I showed that example where when we just eliminated all risky options, we lost some of the most cost effective ones. We suspect there are times when the benefits - the potential benefits outweigh the risks, and we'd like to be able to quantify that more so that that can be considered in project selection. And then that quantification of risk can really suggest which risks are worth taking, if we can get good measures of those, which is a challenge, but is a fun challenge to try to do.

So where are we going? I think I have one more slide of where we're headed next. No? No, that's it. Okay, so thank you very much for listening, and I'll take any questions that you have.

Courtney Chambers: All right, thank you very much, Lisa. At this time if you'd like to ask a question please remember to take your phone off of mute or feel free to utilize the chat feature, and remember to send your message to everyone if you don't mind. Thanks. Any questions out there? I'll try not to rush you.

Woman: Hi. This is - I just, I guess personally I would say that this is such a high level overview and covered so much stuff that it's hard to think about good questions to ask. I mean, I think it's a great introduction, but I think to really understand it, it would take more.

Lisa Wainger: Understood, thank you for that feedback. Well, I will say that we do have a report in draft that has a lot more specifics about the framework that is being circulated among a small group, but will soon be circulated among a broader

group, and I'm very interested to get people's feedback on how practical they think it is.

Courtney Chambers: That sounds very good. Do you know what the timeline is on that outcome, Lisa?

Lisa Wainger: You know, I would need to check with the folks at the Corps, because I think there's kind of a staged review process, so I know we're planning to have a certain group do a review within the next month or so. I don't know when it's going to get distributed more widely than that, so...

Courtney Chambers: Okay. We'll stay tuned. I'm sure this will be probably heavily integrated into the new planning. Is that correct, the smart planning?

Lisa Wainger: Yes, so we've had some discussions about whether it's still appropriate to represent the steps in the six step planning process, and what I'm gathering - you know, everyone's very aware of the shorter time frame there is to do things, and here we are potentially adding on more requirements, but I think, you know, the idea here is that ecosystem goods and services would only be used in the places where it can really help.

I can't speak for the Corps obviously, but I think the point is not to overly complicate the existing process and make it tougher to meet the new shortened deadlines, but it does appear that the six step planning process is still the mean of how the planning is done even under the new smart planning framework, so that's where we've kept that six step planning process. It's apparently still there, so...

Woman: Okay, thank you. Any other questions or comments? Sorry, Lisa.

Lisa Wainger: No, that's okay. I was just going to reassure folks that we are really aware that the system needs to be scalable to project size, you know, what's called right-sizing, I gather, of analyses. So there are tools that are really aimed at screening and judging magnitude and - you know, relative magnitude and direction of changes as well as this more complex stuff about how to actually measure and quantify some of those changes.

And we also as part of the project are developing a database of tools that may be useful, so again, this talk wasn't really intended to represent the framework. It was more to get folks' brains going on some certain approaches or lessons or something that's coming out of this analysis that may help think about restoration planning in a more general way. You know, I know folks have a lot of methods thrown at them all the time.

It's not intended to be more work, but the idea is that there are some - you know, some good basic rules that can help, such as that idea about the non-linear responses as opposed to assuming a linear response in restoration benefits that all these kinds of concepts may be useful when thinking about ecosystem goods and services or other types of benefits as well.

Courtney Chambers: Okay, thank you. Lisa, I just received a message from (Craig) that asked have you looked into integrating cost risks with performance risk?

Lisa Wainger: Yes, that's a good question. I often refer to the contingencies that are put in as an example of a simple way to put in performance risks, the cost contingencies. We have to think about that. Our effort has been really focused on benefits, so we haven't spent a lot of time on that, but I'm certainly aware of how that's been approached, and I think it's a useful model, so...

(Jason): Hi, Lisa, this is (Jason) in Rock Island district. I had a question for you regarding some of the non-market goods, and I know in the presentation you mentioned that you don't always get - want to get the monetary equivalents, but it seems that there's some efforts in play with earth economics and their service database and some other - maybe TNC and others that are coming up with ways of looking at valuing non-market goods. How do you see that playing in terms of combining non-market goods along with those goods that we're very good at quantifying in the Corps of the market goods?

Lisa Wainger: Yes, that question really brings up a lot of different issues, so let's take a couple of them. It's a good question. So we - you know, it's well recognized that we just have a lot of trouble putting dollar values on what we call the non-use services, things like people just want to know if species are going to exist for their grandkids, or that ecosystems are healthy. People actually can be fooled. People say they value knowing ecosystems are healthy.

So there are some studies that have been done. We're well aware of these tools that are being developed. The issue that comes up a lot is that marginal effect in terms of these dollar values are not necessarily associated with changes in quality, you know, so a wetland full of invasive species comes out the same as a wetland that's pristine in these systems, not always but often, because the quality factors aren't there to relate the dollars to those features.

So we're definitely keeping an eye on all that research. As I said we have this database of the models that are being developed, but we've - I think you know, it's going to have to be assessed whether these tools are really effective at judging the effects of projects and whether they're going to be acceptable in terms of the Corps' needs for quantifying benefits.

The other question that comes up is whether - so I hear sometimes from the Corps folks that if we can monetize it, it should go under NED. If we're not in NED, if we're in ER, we should stay with non-monetary metrics. And again, you folks should debate this without me. I'm - I don't know enough about it, but I see a sort of hesitancy to put dollar values on because of that confounding effect, and also I - it's quite possible that these quality differences might be better represented through metrics besides the dollar values, that those may just sort of obscure some of the benefits in that sense of because you can represent the quality differences.

(Jason): Yes, yes, great, thank you.

Courtney Chambers: All right, anyone else have questions today? Oh, Lisa, I know. If you don't mind, if you would type your contact information in the chat feature for everyone to reference in case they had any follow up questions, they could get in touch with you.

Lisa Wainger: I will do that right now.

Courtney Chambers: Thank you.

Lisa Wainger: Thank you to all for joining in today, and I do welcome further questions and comments.

Courtney Chambers: Oh, you know what? We do have another one right here. It was sent to me privately. It says in the examples provided, have data - oh, the examples provided have data associated with risk- If there are no readily available data, this step could take time and money to incorporate. Also, I can see instances where the risk would be high and potentially halt the project, for example,

dam removal to restore salmon on a system with small hydro. The hydro benefit is there, but risk overturning fish may be low.

That's more of a statement I suppose.

Lisa Wainger: Yes, and as I said, I know that some of these issues are aspirational at this point, but I think what we'd be looking for, and we actually do have some suggestions in this framework document of some simple ways to look at risks that would reduce the time, but I bring up these more robust, quantitative approaches just with the idea that you know, if we collect - you know, the - my goal, you know, is to promote the idea that if we collect better data about restoration, we may eventually be able to do a better job of seeing what's working and what isn't, but that's a wish for this year.

In the meantime, I think there's some things that would help us understand relative risk between sites, and yes, I mean, it is - I think it's appropriate that if a project's being conducted to restore habitat and the data suggests it won't restore habitat, than either you know, either stopping the project or changing the goals of the project might be appropriate at that point if we're trying to maximize benefit for dollars spent, so yes, I agree with the statement that it could halt the project, but I think that's part of the issue of being able to tease apart what's going to be effective and what isn't, so...

Courtney Chambers: All right. Okay. Well, thank you, Lisa. I'm going to go ahead and send the link where we post the Webinar files, and you can also access archived files there if you'd like to peruse those topics. Lisa, thank you very much for sharing with us today, and thank you, participants, also for joining us.

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