USACE ERDC

Moderator: Courtney Chambers
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Sarah Miller: And so our speaker today is Dr. Pam Bailey. She's a research ecologist, botanist and landscape architect in the Environmental Laboratory of the Engineer Research and Development Center based in Vicksburg, Mississippi. Pam has 28 cumulative years of professional work experience in both private and public sectors. She's worked as a landscape architect for private engineering firms and the National Park Service. She's combined that education and experience with a degree in botany to conduct botanical surveys, ecosystem restoration projects, shoreline stabilization projects and monitoring for construction projects for the Corps and for military sponsors. She recently completed her PhD in pollination biology - examining the pollination networks of a rare and endemic plant compared to two more wide spread congeners at Fort Huachuca, Arizona. Currently she's working on the production of a sustainable design manual - Engineering with Nature Using Native Plant Communities which will be distributed Corps wide in FY 14. So look for that.

And again, I welcome everyone to today's program and we will now transition to Dr. Pamela Bailey.

Courtney Chambers: Great, thank you, Sarah. Okay Pam I've made you the host so now you can share your desktop. And just a reminder, participants at this time I'm going into listen only mode. So please ask any questions using your chat feature. Thank you.

Recording: All participants are now in listen only mode.

Courtney Chambers: There we go, okay. Great, it looks good guys.

Dr. Pamela Bailey: Good morning everybody. I'm going to be talking today about monitoring of botanical resources and project planting. So the outline is, I'm going to cover some important points like why bother monitoring? Why is this important? Method to set up monitoring for existing vegetation or plantings - and I used the National Vegetation classification system - and the benefits of using that system.

So the value of conducting botanical monitoring is to provide better understanding of plant communities and the biodiversity and ecological integrity. And identify and maintain the status of threatened and endangered species that occur on Corps' land and also to provide scientifically defensible metrics to assess the projects. And this is particularly important because if you don't have a defensible base then there's no parameter to really determine what you're doing or how the system will respond. So it's really critical to have this information, oops.

So provide defensible scientific data when looking at specific environmental problems such as habitat degradation or losses, invasive species which may become much more prevalent in a particular ecosystem and then affect the entire community, disease and pollution affecting the health - different organisms within the ecosystem, over-exploitation of resources reducing biodiversity, and then climate change also reduces biodiversity and affects the function within ecosystem, as we're learning.

Successful monitoring efforts can include management flexibility, assessment of resources and can help prior actions - scientific data for evaluation in support of management decisions - interagency collaboration with other

partners is absolutely necessary in these budgetary times and becoming more so the norm of how the Corps does business and funding justification.

So, method to establish baseline condition is basically - I used the National Vegetation Classification System. And if you've actually got a baseline that's been conducted using this system - maybe from the NEPA process - it will require particular inventories. That's an opportunity to actually put in place a good baseline. And then you can compare back to back so that you can actually see the change that is occurring within your projects.

If you don't have that or can't do a survey first, then you can also use existing databases from NatureServe or the state heritage programs because they basically house information on plant communities within each state and that data is really invaluable. And I'll get back to talking a little bit more about this as we get into this presentation.

It's also really important to consider the goals of the project. And, then in doing the monitoring, funding has been an issue and now with construction general funds you can actually monitor five years into the future after the completion of a construction project.

So the National Vegetation Classification is accepted as standard approach to be used by many federal agencies including the Corps' level one inventory - is to the National Vegetation Classification subclass level. And here's an example, a little coniferous forest. It started basically as nature conservancy methodology when they were actually acquiring land. It was a way for them to evaluate and determine which properties had more biodiversity and which were more important ecologically for them to obtain. And then as they acquired more and more information the data base got so large that it split to become NatureServe and the same information is held in all the state's

heritage program Web sites. And you can go online and there's a listing state-by-state of this data.

The National Vegetation Classification System units are arranged under a hierarchy based on physinomic characters which provides species and ecological data. And I'm going to be talking about the system and this hierarchy. And the National Vegetation Classification System is designed for classification at many different levels and GIS mapping at multiple scales as well.

So the levels of vegetation classification, the hierarchy is that it starts with largest system and then the physiognomic class, physiognomic subclass formation group, formation alliance and community element which is also referred to as an association. And at a systems level these are various types of systems, the terrestrial aquatics subterranean marine - each system is structurally complete within itself.

And for the physiognomic class and subclass - class example is a forest which is determined by height and percentage of cover of the particular species. Subclass as an example is, Evergreen Forest. And this is where the Corps' level one inventory efforts have been which is more - they've used it more to determine the amount of acres in particular types of subclass so it's more of a GIS type exercise.

The formation group is a combination of climate and the morphology and leaf phenology. And as an example, you can see in this photo is actually a very cold climate sub alpine, evergreen needle leaved forest.

Formation is ecological proofing based on broadly defined environmental factors such as elevation, hydrological regime and additional structural

features such as, crown shape and life form of dominate lower stratum within the forest. But for example, needle leaved evergreen woodland with conical crowns could be considered an example of this formation.

And then the alliance level is actually a uniform group of plant associations sharing one or more diagnostic species and this is equivalent to a cover type which is commonly used by foresters described by a diagnostic species. For example, Tsuga mertensiana, a mountain hemlock forest alliance.

And at the community level, community is a basic unit of vegetation classification. This level is needed for adequate surveys and monitoring efforts because if you're actually doing a planting project - a restoration or mitigation, you need to have specific species. And so this is the level of detail that you actually need.

Composed of individual plant associations and repeating complex of plant associations and community elements are related to a set of environmental factors such as moisture, light, temperature. Those are really the drivers of plants in general. And those are the types of environmental factors that are actually important in community rather than a particular site.

So the community elements may be composed of the complex of plant associations that constitute the functioning ecological unit, these associations always occur together. And the community element - in plant association - are both interchangeably used to refer to the community element. For example, Tsuga mertensiana /Vaccinium delisiam which is a blueberry.

So now I'm going to talk a little bit about the methodology that you would use and there're a number of methods that you can use from plot data, transects,

stand data, which is typically used by foresters. That combines pretty much the top two types of data and then the GIS mapping of plant communities.

So for Plot data, I'm going to talk more at length about that. But for transects, I just want to mention this now that it's a method that you can use by walking on a compass line through forest or upper elevation and at every even interval maybe 100 meters or some even integral you stop, and you look, and you record the dominate species within that site and then you continue along that compass bearing.

So with that type of data what you can actually find out is how the community structure changes with - maybe a change in elevation or just changes over the course of where your transect occurs. So that's a very useful and very different type of data then plot data.

So for plots, I'm going to talk a little at length about plots - actually it is - when you set up a plot, typically use like 10 meter circles or 20 meter circles or square depending on where you're at maybe along a linear quarter such as right paring quarter. It would make more sense to have it be a rectangle shape along the same elevated area along the riverbank.

And then you mark - if it's a circle you mark the center and four radial points with plastic survey tape for high visibility because you may want to go back. Always locate it with GPS - date and sign your forms and on these forms that record the environmental data as well as all the plant data.

Then you can take photos. And then you can take photos actually over a period of time so you can actually see how the site - you can monitor that site and see its change over time. And this is really helpful when you're actually

doing monitoring for an ecosystem restoration or mitigation site. You can really see that development.

And here's an example of some people actually conducting some survey. And in this case, they're actually in a sagebrush land and they've got two levels here. I'm going to talk more about the strata. But they're looking at the herbaceous cover as well as the sagebrush cover.

And then you can see that actually in the distance there are trees scattered throughout the area. And this survey could also include actually all of those as different strata. I'm going to be showing you examples. So this form is something that I've used - and this was from the National Vegetation Classification System, 1988. And I've been using this form.

And they have some other forms particularly adapted for endangered species which has a lot more information about the particular population. And then they also have some different forms for invasive species surveys. So they have a number of different types of forms. But this is a basic one for an overall botanical survey that I like to use.

So as you can see on the very top it has identifiers about the location. And you number the sites, describe where that site is so you can get back there and the GPS survey date - who did the actual survey and then about the site itself. So I always drew a small sketch. That was very helpful - seeing what the situation was like.

More information is useful then seeing something and not putting it down. Then the environmental descriptors are elevation, topographic position landform to physical geology and also the hydrologic modifiers.

And then there's the place for other environmental comments that you many actually feel are important to the site and then there's some information on soils - of texture - the description. And what I used was Munsell color guide to actually help with some of those descriptors and then what the vegetative surface is composed of and the soil drainage.

So for vegetative description, looks at leaf phenology, leaf type the physiognomy class. And then it has a couple of different scales. And the cover scale is actually these numbers 1 through 11 actually indicate, like, ranges percentile cover. Sometimes, because I've just been doing this - and use to doing this, I usually right down some percent. But it's usually like four or five. You know, where do you draw the line? Often five there's breaks in these numbers.

So, you know, sometimes like if it's a five then I just go ahead and put that down rather than 5 to 15 because that is kind of a big difference. So I like to just put down the actually percent cover. You do get used to doing this - the more you do it. So that - especially if you're working with somebody, those presents actually become pretty much standardized between the two of you as you work together.

And then the height class is important because it determines what your primary canopy cover height is verses the other strata within the system. And then the diagnostic species are you dominate that you're finding. And that's important data.

So then there's other notes like animal use evidence, other disturbance by people, or maybe adjacent land uses that might be important or other impacts to the site a transmission line therefore you know there maybe herbicide and

pesticide use. So there's different things like that are important to also note on the data sheet.

And this is the last page, it's basically a listing of all the plants within the plot and all the strata's. So you start with - you usually start with trees. And then go to the shrub component. And if it's a forest with multiple layers, you can do a canopy and a sub-canopy - the same thing with shrubs. And then herbascous cover and you may even have just moss cover. So you can indicate all those various layers.

And I also want to mention that when you're doing this in the herbaceous level, you will actually note the seedlings of trees and shrubs. And why that's important is because that indicates the succession of the site to pick that up and that's really important data for the future.

And then it also has the percent cover. And you also record the amount of trees 10 centimeters and larger in site on that site. And, also note dead trees.

So this is the standard reference for that and you can go to this site. And you can download the different forms and also learn more about the databases and also the standard methodology from this site. And this has been used - as you see - internationally as well as well as nationally.

So now I'm going to move on to looking some various monitoring on different types of projects like this first is a mitigation project. It's one I did at RC Bird, Lock & Dam, in West Virginia. And the plan was on the left side - actually was there at the beginning to set up the plan and then after construction the center picture is - there's live staking there on the shoreline and plantings then a series of years to monitor this site.

I think this was monitored - at that time it was only - I only had three years to monitor this site. So the picture on the right is actually what the site became after about three or four years. And you can see it has a natural zonation of a wetland that you would expect to see when you're outside. And what I mean by that is you can see how the vegetation actually changes with the change in elevation which actually reflects the change of moisture and water in the soils.

And that's what the plants are responding to and you can see from the wetland plants on shore that's up into the higher ground where there's willows and other typical wetland shrub and tree community. So some of the other things that are really important to mention about this is that there's thresholds of acceptance for what can be considered a successful project. Like 80% cover is what we used in this case. And actually that's - from what I understand - kind of high. There's 70% - there's a lot of people use 70% but somewhere in that range is acceptable as being successful in terms of planting.

And then you can also look at such things as native and invasive ratio and when you are actually doing the survey work with your list, you can then go down that list. And if you don't know which is native you can look it up and find which is native, invasive and then that will give you a ratio.

And what I've normally found when I do survey work, is that typically about 30/35% are nonnatives, invasive plants occurring in a plot. And that's kind of a - unfortunately, kind of a standard number that I've found in all different types of environments which is kind of surprising. But anyway it's relatively high. It's about a third of your plot that is actually nonnative and sometimes problematic invasive plants.

So this - here is another example of another mitigation - and this monitoring has lasted for five years. This was agreed upon by Fish and Wildlife with the

Corps and I was lucky to actually start from the very - started this project before anything was constructed unlike RC Byrd. I kind of stepped in after the place had been constructed there and then did the terrestrial mitigation.

There was a whole other component at that location which included a fish factor which I had nothing to do about. But in this case, started from scratch. So I knew what the natural community was. I put that data in from initial survey data into a construction plan and then used that plan as a base to go from and monitor to. So this was a five year monitoring effort.

And this picture on the right is actually - no its probably about maybe seven years after the site's been constructed and there's a lot of trees that are starting to now grow that would be typically found within the area as well as the other components. So it's been a really successful project. And I know the fish and wildlife service was really quite pleased with the result. And when I talked with the person, this summer, about this - they really were impressed with this particular mitigation that the Corps had done. So I was pretty happy to hear about that.

And then I came across this and I think this is pretty interesting. I've never been there in person even though I worked in Arizona. But the Tumamoc Hill in Arizona is the longest plant monitoring program in the country and been going on since 1906. So they have a lot of years of ecological data conducted by the University of Arizona. So this long term data set has allowed scientist to estimate life spans for desert perennials and make advances on how ecosystems behave and the evolutionary processes that are taking place- learn how an ecosystem changes over time. And what they found is the desert wasn't really progressing towards those climax communities as previously believed by scientist as a generally excepted theory.

And so that's really interesting. I know that you can set a system back by a series of fires, manmade impact, et cetera. And then the system will actually recoup and may go off in a different direction.

So it's a really interesting thing to have this long term type of data. And this is why I think this is a really important case study because we don't often have the opportunity for that kind of long term. But our projects last 50 years. So there is - there's some opportunity for a continuation on these projects. Actually go back - like I'm thinking about the lifespan of a particular lock and dam project. So if you had the baseline data and you could go back - you have a five year monitoring period. And then every so often, you revisit that site and see how it developed. And go back to those plots. And it wouldn't even take that long to actually go and do those plots or have somebody else do the plots. And have, you know, continue to keep a record of what's going on with that site. That data is invaluable and how you could share that is to put it back into the natural heritage system databases. Because that way you're adding to a scientific base of data and other people can use that. It's valuable data.

So how do you determine that your project was successful, like I mentioned, it's really important to record. And look at your goals. Use the same consistent methodology throughout the monitoring period. And even better from the original data that you had to your monitoring and then into the future.

Like I mentioned, you can monitor for threatened or endangered species, you can record the biodiversity within the plant communities. That's kind of been one standard way of looking at it. You can also look at percent covered thresholds for species like the native species verses invasive species as indicators.

You can record sessional growth trends in an area as it develops over time. You can look at the different layers which actually are the structure within the system and you can look at the biological integrity creating habitat for the fauna. So the ultimate goal that you're actually trying to achieve is to restore function and natural processes. And I know Craig and Jock have talked about that.

And that's why it's so important to look at the structure and to look at how that site actually developed and to see how it's functioning. So the environmental benefits monitoring applied scientifically defensible system understand how the vegetation is changing in the Corps and how function is restored within the ecosystem. Genetics and species diversity in our projects increases viablity and reduce the project cost. Monitoring a plant community and native plant establishment allows for development of habitat of the native fauna and supports ecological interactions and landscape diversity.

So as an adaptive management scenario which I see as the ability to be flexible like nature, is in a restoration project making a number of species for example, or diverse seed mixes. Some species will do well and others will not - if change in light, change in soil - who knows? Things are - it takes the plant a while to respond. A lot of seeds will come in from natural sources such as wind or water or animals. And so that will add to the diversity. So the whole site itself does shift from what your proposed planting plan. If an invasive plant is introduced then you will have the capability to actually control that, sooner is better. And the area may need to be replanted.

And so here's some additional plant sources of information. As I mentioned, the top two are definitely sites to check out. But some of my other favorites on this list - I like the flora of North America. That's basically a series of economic books on all the plants within North America being written,

currently about a third of the flora has been produced. It's going to be a 30 volume set when it's completed. And that will be completed on into the future. But some of these are online. Like, I think both of the volumes for grasses are online and that's really valuable. And you can go online and look at that. That's a really useful set plus I've been collecting here for the ERDC Library. It's actually setting in my own office at this time. But people can borrow those volumes.

The Missouri Botanical Garden, Tropicos, is a great Web site. If you know either common or Latin name of a plant, you can type it into the site and you can learn a lot of valuable data about a particular species. And then the USDA Plants data base that's an awesome site. It's been in existence a long time. The USDA has done a lot of research on invasive plants and their control as well as other native plants, their ranges and all sorts of other botanical data. So there's so much information here and when you go to the USDA the plant's database you'll end up actually getting directed back to some of these other sites.

So there's a lot of herbarium sites that are really useful if you live in a particular type part of the country, then you can go to a major university that you know has a herbarium and often they're putting their records online. And those records are invaluable. That historic data is really very valuable. And with that I'm pretty much open to questions and you can see my contact information here. So I would like to open it up.

Woman: Great, Thank you Pam. At this time going to return to...

Recording: All participants are now in interactive talk mode.

Courtney Chambers: So that means at this time you ask your question verbally after taking your personal phone off of mute or you can utilize the chat feature. And to do that, you'll go to the tool bar from the top of your screen and select chat. And you'll have that feature available to you.

To kick us off right quick, we already received one question in the chat feature, Pam. But now there's an acronym here and Ellen you may have to speak up and clarify. It says, is the NVCS the FGDC standard. Can you define the acronyms please?

Woman: Sorry (unintelligible).

Woman: It's the Federal Geographic Data Community. And they have a plant standard classification system.

Woman: Okay, so and the NVCS?

Woman: So it's the one that (Pamela) was using.

Woman: Okay. All right, so Pa) are those - is that fall within that standard?

Dr. (Pamela Bailey): The map dating? Yes there's a particular standard. And I'm not a GIS expert. But I know that there is a standard within the mapping that naturally the National Vegetation Classification System has.

Woman: Yes. It's more than mapping for the other its' the classification of the vegetation similar to the National Vegetation Classification System is. So I don't know if they're the same or if there...

Woman: Yes, they're the same.

Woman: Okay that was my question because I want to make sure that, you know, we're kind of using to the Federal Standard these days, so.

Woman: All right.

Courtney Chambers: Okay thanks for confirming that. All right at this time feel to ask any questions you might have of Pam.

Woman: I'll give you a few more minutes. Make sure you take your phone off mute before you ask that way we can hear you. Again, feel free to use that chat feature.

(Linda Nelson): (Pam), this is (Linda Nelson), upstairs. And I have a question for you. I just want to verify. Did you say that it's fairly standard in surveys over many different habitat types about a third or 30 to 35% of the plant species in the survey are invasive plants? Did I hear that correctly?

Dr. (Pam): Yes. Invasives are nonnative - so I mean, when I've done survey work - I've done a lot of survey work in the Pacific North West as well as the East. And not so much of - I've done some work out in Arizona but that was a little different.

But yes it was really quite amazing to assign and look up what plants were native verses nonnative. And it was pretty much consistently - between 30/35 and sometimes higher which was really surprising.

Linda Nelson: Yes, thank you.

Vishere: This is Vishere. I'm sorry, I was having a sidebar. Did you ask me a question?

Courtney Chambers: No ma'am. We didn't.

Woman: Okay, thank you.

Courtney Chambers: All right. Any other questions for Pam?

Pamela Bailey: I also want to mention one other thing, kind of, another secondary response to (Linda)'s question, and that is, that there's a big difference between the number of species and the percent coverage on a plot. And that's an important difference. It's two totally different types of data. So that's just something to be aware of that you can have high number of species. But in a case of a plot that may be highly invaded you may have a high percent cover of one or several species verses the others. And, you know, that is something right there to consider when you doing this work in terms of your success on the site. They're both important. You can't just base it on one depending what your goals for the project are.

Courtney Chambers: Great. Okay we'll do one final call for questions here.

Linda Nelson: This is Linda Nelson again. Just to clarify Pam so when you said you're 30 to 35% that you typically find in your surveys, is that coverage then or a number of species?

Pam Bailey: Coverage.

Linda Nelson: Okay, thank you.

Woman: Which I guess Pam that would be consistent with invasives typically being much more aggressive perhaps and out competing?

Dr. (Pamela Bailey): Right.

Courtney Chambers: Okay. All right well if there aren't any other questions, we'll wrap up today. Pam, thank you very much for taking your time and sharing your expertise with us. And participants, thank you for joining us.

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