**ERDC EL**
**Moderator: Courtney Chambers**
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**1:00PM CT**

Pam Bailey: Good afternoon. I'm Dr. Pam Bailey and as Courtney explained through the nice introduction, I will be talking about Part two of the book – The design manual: Engineering with Nature Using Native Plant Communities.

Courtney Chambers: Pam right quick -- this is Courtney -- if I could interrupt you. If you could try to position yourself a little closer to your speakerphone. You're a little bit distant. Thanks.

Pam Bailey: Yes. So the book was published last year in December and disseminated through the Corps PAO Offices and hopefully made it through the district to planning, design, and also operations and maintenance personnel.

It is written so it can have a wide readership by many people with different professions and hopefully they'll find something of interest and useful in their own work.

I just want to review from last week: the sustainable uses of native grasses. They can provide wildlife, habitats, migration routes along the river ways and lake shores that the Corps manages, protect water quality and water supply, production of oxygen and protection of air quality, their ability to regulate temperatures and nutrient cycling, the reduction of sedimentation and erosion into the waterways, and many different commercial uses.

The importance of a botanical survey is to establish a scientific defensible baseline. Once you understand what plant communities you have in the project area you can use this information for mitigation or restoration projects, and continue by monitoring using that same methodology. Here's an

efficiency and therefore cost effectiveness, by using the same system to do three processes.

Native plants established on an area, will reduce the maintenance cost because of their own abilities to self-repair, and go into a floral succession since they are adapted to the site.

I'm going to describe the National Vegetation Classification System methodology. And there are a number of agencies that utilize this classification system. It was signed as an MOU in 1999 by the Ecological Society of America, The Nature Conservancy, and US Geological Survey.

There is an entire mapping component, which defines the areas of all vegetative communities. In some places it's much more detailed than in others, te databases are now held at either NatureServe, or at the National Heritage Network within each state,.

You can find this data online – at the State's DNR Heritage Programs. It's really amazing what you can find out online. So much work has been done in the field to record this data across the country.

– As I mentioned there is an efficiency built in by using the National Vegetation Classification System for each step, and once the botanical plant communities are surveyed and known, they really do provide a scientific basis that is defensible. Without knowing what you have, you really cannot do a mitigation or restoration planting, but by knowing what you have, it can really guide you through the establishment of planting for projects.

The National Vegetation Classification System is based on floristic taxonomic units of plant communities that are crucial to habitat delineation at

the alliance level and community association type. The beauty of the system is that it places a local inventory effort into conservation priorities at a much larger scale -- either national or global context . That's how the Nature Conservancy initially used this system in terms of acquiring their lands and acquiring valuable lands in terms of the botanical and other natural resources.

Now I want to describe a little bit about the methodology that I use which is a combination of plots and transect data. I usually use a 20 meter square or circle to set up the plot. I prefer the circular plots, and that's just marked with flagging when you're on the site.

Within the plot, you actually record all species, starting with trees -- the canopy -- to the sub-trees -- large shrubs, mid-sized shrubs, and smaller shrubs. And sometimes that shrub layer will be the dominant or actually will be the only canopy that's on the site without trees, for example in a shrub steppe land such as a sage brush steppe in the Pacific Northwest. You record all the herbaceous layer, recording all the species within that layer, including small shrub and tree seedlings. This will indicate the sucessional trends of the plot.

After you record all the species, then you go back and give it an estimate percent cover in the plot. Once you're out there estimating, you kind of develop this ability to really define what kind of percent cover each species actually occurs within the plot. This information will tell you the dominant plants within the plot. That's really important information, because in a restoration project it's really that list of the dominants that you want to have in the planting to establish back onto a site of similar nature. This is a critical part of it.

The other thing that you do is also measure all trees that are greater than ten centimeters DBH -- and DBH is four feet off the ground height. You wrap a DBH tape around the tree trunk and get the measurement. That's important to tell about the maturity of the forest that you're looking at and relative age of the dominant trees on site.

The plot information can be combined it with the transect data. A transect is basically a line across an area; you can walk on a compass bearing and every hundred feet or hundred meters -- whatever your uniform stations are, you record all the dominant plants within a 10 meter radius view from where you're standing.

So you stop at a station, do a listing of the dominant plants, walk a hundred meters or a hundred feet -- whatever your uniform stationing is -- and then do the next listing, and so on through the site from the start point to the finish point. This is actually very quick because you're only recording the dominant plants at each station. Why this is important compared to plots, and why it's different is, you can see changes in the plant community up an elevation gradient or across a moisture gradient. That's really important data, particularly when the application might be for mapping purposes, or to understand how the communities relate to each other, and how they blend into each other.

So by using these two methods together, you can really get a complete floristic picture of an area.

The stand data is more of a forestry term and it's a standard way that foresters would pick up their data. I mentioned the GIS mapping component can be based on the transect data, with the plots actually supplying the detail about

the plant communities. The mapping is within the National Spatial Data Infrastructure utilizing the NVCS.

The National Vegetation Classification System is arranged as a hierarchy based on physiognomic characteristics of the dominant vegetation. There are four physiognomic and two vegetative levels to the system, and it's designed for classification mapping at difference scales.

The structural uniformity is assessed by evaluating all layers of vegetation -- from the herbaceous to the shrub and tree components -- and there's an assessment of general uniformity by examining the consistency of species composition.

To understand the different levels; there is the system level -- the physiognomic class level, physiognomic subclass, formation group, formation, the alliance, and community elements, and I'm going to explain each of these levels.

So the first, the system level, is like a type of system like terrestrial, aquatic, subterranean, or marine system. – Everybody understands this, they are a big, structurally complete system within itself.

The physiognomic class and subclass, for example in this picture is an evergreen forest, determined by height and percentage of cover. And then there's a subclass, which by the way is what the Corps' level one inventory data., which is the example shown as an evergreen forest. So it's just got another descriptor such as "evergreen", or "deciduous" forest, or it can be a shrub steppe land or desert - are examples of subclass.

And then you have formation group that's a combination of climate, leaf morphology, and leaf phenology -- like in this example, evergreen, needle-leaved forest. You can see that it's a much colder type of community and what it is composed of.

Formation is ecological grouping based on broadly defined environmental factors such as elevation, hydrologic regime, and additional structural factors such as shape and life form of the dominant lower strata, like in this example is needle leaf, evergreen, forest with conical cones.

Next, the alliance level is an uniform group of plant associations sharing one of more diagnostic species. This is actually equivalent to the term "cover type", which the Society of American Foresters use to describe this level. I It is described by a diagnostic species, like in this example, the hemlock, Tsuga mertensiana. The Community level is the most basic unit of vegetational classification, and it's composed of individual plant associations, and the repeating complex of plant associations within the landscape. Community elements of the National Vegetation Classification System are related to a set of environmental factors, such as rainfall or aspect. And this is important because the factors such as moisture, , light , and temperature, are what drive plant growth.

And so it's the environmental factors that determine where you'll find these communities, not necessarily this particular mountainside. If you have mountainside with same aspect, temperature, and moisture you'll find similar communities across the landscape in those types of locations. So that's how all the levels as defined in the NVCS tie together.

And the other thing that I just kind of wanted to mention about the NVCS is it's based on scientific data so you cannot really combine plant communities

because it is easier, and is missing the point to think that you can blend them together because it may seem more efficient - it doesn't really work that way. Although the plant communities grade into each other in the environment, they are still separate communities that mergeinto one another. I If you wanted to do a restoration, the appropriate plant community will be based on your scientific findings. You need the attention to detail to find out what the plant community is, what the dominants within that specific community are, and pay attention to where they occur in terms of environmental factors such as aspect, rainfall and microclimate.

The community may be composed of complex plant associations that constitute a functioning ecological unit if the associations always occur together. Community element and plant association are both used interchangeable to refer to the community element. For example, Tsuga mertensiana, vaccinium delisiosum (Hemlock and Blueberry)-- which is the picture that was in the prior slide. This slide is the standard reference for the National Vegetation Classification System. These people have further developed this system into an international classification system, and they've continued to do more work to define plant communities internationally.

So, now I'm going to shift gears and I'm going to be talking about how to incorporate this survey data into your mitigation and/or restoration- project. As I mentioned, from the baseline data, you can plant the dominant species -- or maybe even some of the other plants in your plot -- into the plans in the design phase and replicate what's going on within those native plant communities.

You can look at similar number of species to achieve the biodiversity and definitely get the dominant plants back onto the site. That will really go a

long way in terms of reestablishing a successful planting which is based on the plant community in the project area.

You can also use the NVCS to monitor for any Rare, threatened or endangered species populations, or to monitor and treat invasive species. And you can also use the NVCS to monitor the success of the plantings after construction.

With construction the site conditions will change. For example if you have a site where the topography has been altered significantly, and has very different soils, you can actually use stockpiled soil and bring it back to the area to try to get back to a similar condition. If you pay attention to the aspect, rainfall, temperature and to the hydrology, which are factors critical in determining which types of plants that are there You can really succeed in a good planting by paying attention to where those plants are coming from and trying to put them back onto similar aspect, and if you can, with similar soil. That will go a long way in to jumpstarting your plant community restoration and have it go towards a floral succession.

The main point of doing this is to restore function to that site and also to create a more sustainable landscape within the build environment -- one that will take care of itself, will self-repair, and be more resilient to disturbances. And you can restore connectivity through the site to other green areas, green buffer strips and corridors to create a green infrastructure.

These photos are from Dyess Air Force Base, where I did a project with Dr. Rich Fischer; we planted many miles of stream channel through the Base.. Some areas had of the channel had concrete bottom of concrete, but others were soil. I walked the entire corridor to be planted and found a lot of

herbaceous flowers- there were probably 50 different species in my walk through the site.

We were going to start by grading off the surface, but with the abundance of flowering plants already present–we decided to leave them and interplant with containerized native shrubs and trees.

This picture is a couple years later; you can see some of the trees that were planted at the bottom of the channel. I haven't been back to the site since it was completed, but I would really think that the tree cover would be quite dense, creating a nice green buffer area along the drainage ways. That's just one example of a planting that has become a successful project.

Some of the techniques of site preparation. As I mentioned, you can stockpile the topsoil. That will really go a long way in helping to replant the kind of communities that were growing on it. The fertilization and lime treatments as determined by a a soil test, will need to be done to correct any soil deficiencies, for the purposes of your planting.

There are different seed mixes, these can include herbaceous, shrub, and tree seeds. And these offer a really good, cost-effective way of planting large areas. If you have a budget for a planting project, like the one at Dyess, you can buy containerized trees and shrubs.

At Dyess Air Force Base the seed mix itself was used to repair the eroded areas and thin vegetated areas. You can either seed into those thin areas with a seed mix and leave existing plants in place, or just inter-seed and introduce more species into the area. Or you can do this mosaic seeding, which is like a patchwork of seeding mixes creating a diversity which sometimes results in an edge effect as it develops.

There's a lot to know about seed treatments, which is to mimic the natural temperature and seasonal cycle of seeds. There are many different seed treatments, and you can read about this in the book. You need to pay attention to the kind of natural processes that the particular plant species depend on for germination to occur.

I mentioned, that you can plant either containerized plants or seed mixes and really have a nice approach to a restoration project. And you can actually seed quite a bit of area with seed mixes much more cost effectively, than planting all containerized plants.

Here are some sources to obtain native plant materials. There's been quite a bit of development within native seed companies and native plant nurseries. The NRCS Plant Materials Centers also can offer an alternative for growing plants and seedmixes on a contract basis. I love that organization and have worked with a couple of these Plant Material Centers across the country -- including for at the Dyess project, (in the pictures), and also one in West Virginia. They do excellent work.

The Plant Material Centers are based in different ecological areas across the country featuring 26 centers in the US– You can work with a plant material specialist to seek plant technologies that restore and sustain healthy ecosystems. They're really concerned about conserving and enhancing the environment, providing critical wildlife habitat, and supporting the human environment.

They are instrumental in evaluating plants for conservation, and they make these materials available to commercial growers so that those plant materials can get out into the public. The NRCS Plant Material Centers are small in

comparison to a lot of other agencies, sometimes with only three to four people working out of one plant material center. Each center has a huge regional state areas that they can provide services in. I've done a project with them where I've gone into an area to be bull-dozed, harvested plants, given the plants (via an MOU) to the NRCS Plant Materials Center in Alderson, West Virginia. They grew the plants for a couple years, and after the project site was constructed and was ready to be planted, the plants were delivered back onto the site. The original genetic stock was re-introduced back onto that site. They also developed and provided a seed mix that was planted at the site. .

For a reasonable price, you can arrange to have work done by them -- either growing, and in some cases they'll come out and actually do the planting as well. So, they are a great resource to know about.

You can also do hand collecting of seed and storing the native seed in seed banks for future use. Handcollecting seed was done by the St. Paul District fora really nice restoration project of a sand prairie. This is another case study in the book. They had volunteers hand collect seed from adjacent sand prairie that the Nature Conservancy owned,and then seeded the area on Corps land to achieve a similar type of planting to establish a sand prairie.

Soil stockpiling is also really important -- and you need to cover it, to keep it viable, so when you spread it back, therewill be latent seed propagules within that top soil that can be used to revegetate the site.

Native plant rescues and local harvesting are also good ways to get people involved. I have a nice example of doing a harvest at Marmet;

So, before the bulldozers arrived, volunteers harvested as many plants as they could get in vehicles. They took them to their school and planted a wetland and constructed a nature trail. These projects became part of their science curriculum in their school system at different grade levels.

There's all sorts of things that you can do to obtain plant materials and have really successful projects.

So some of the conservation techniques...after surveying the existing plant communities, you can replicate native plant communities in the reference area to the extent possible, and achieve biodiversity by planting a similar number of species within the specific community. By doing this, you'll really achieve genetic diversity by propagation of a number of individuals in the existing plant population. That's really critical because that way, you don't have a bunch of clones from one parent. And that's particularly important if you're actually producing your plants from tissue culture or vegetative propagation of roots.

So if you do have a number of individuals of a particular plant species, then you can actually maintain a healthy population and allow for genetic diversity. That's important because it offers resiliency and health to the population that is being re-established. You can read more about maintaining genetic diversity and integrity in this technical note by Dr. Ed Perkins I think the tech note is available through the EL Lab Web site.

Further sources of information include many good databases. I really like the USDA Plants Database. It's excellent and is always expanding. On it you will find a lot of information about plants. As I also mentioned, the Natural Heritage Databases and programs that are offered through the state's DNR websites. The Plant Conservation Alliance is a group composed of federal

agency partners as well as over 200 plant organizations; they're the group in this country that are primarily responsible for the native plant conservation.

There's also the Extension Service.–They will conduct soil testing, and also have the Master Gardener's Program.Everybody that takes that program has to do a project,so in that, there's a lot of potential to actually partner with volunteers from this group on projects.

Also, the Garden Clubs of America,they're not just a bunch of old ladies that love plants, but rather quite active in terms of plant education and conservation as well.

And then, botanical gardens and arboreta at universities are incredibly important for not only maintaining threatened and rare plant species, but also providing education to the public. Like for example, many arboretums have electronic collections. available on their websites - that's incredibly important for any botanist out there. I use these to confirm unknown plant species.Many arboretums and public gardens are scanning their records and specimen sheets to be online.

Missouri Botanical Garden has a great electronic collection called TROPICOS - . Just an amazing resource!

There are all kinds of resources available on-line.

And then you can do workshops with groups, such as Boy Scouts of America, which are pictured here. They were really quite interested in this biotechnical planting workshop that we did at a lake shore in Kansas. You can do it with schools -- as I mentioned, and other civic organizations.

So to conclude, the Corps' have many plant resources, which we really need to appreciate and protect. They're valuable resources and they provide the fabric for ecological interactions. The National Vegetation Classification System is an incredibly important tool for resource management and hopefully people will consider using this approach when they start looking at their plant data. You can apply it through-out the process within planning, design and monitoring after the construction of a project as I mentioned.

So, for a free download of the book you can go to this Web site and download the whole copy, or you can go to the Engineering with Nature Portal and on this page you can go to the RD tab. That page will bring up a list on the left hand side which lists publications, you can find the publication there and download it.Soon we will launch a web on the EWN Web site about this book and we'll have an active link on the webpage as well.

So with that, I'd really like to thank (Dr. Todd Bridges) and Miss (Cynthia Banks) for establishing the Engineering with Nature initiative. I would suggest if you have time look around the EWN website because there's many really interesting projectsand interesting things that people are doing in partnerships across the country.
And I would also like to continue by thanking Ms Banks for providing the funding through DOTS for this book and the webinar series.

So with that, I'd like to open it to questions.

Courtney Chambers: Wonderful, thank you very much, Pam. Let me unmute the phone lines.

Recording: All participants are now in interactive talk mode.

Courtney Chambers: All right, at this time you're invited to unmute your phone line and ask a question to Pam, or you can utilize the chat feature. And I notice we have received a few questions in chat, from a few others. Just one second.

Pam, we had the question how do you protect your site from a non-native invasive species like Chinese Tallow from adjacent areas?

Pam Bailey: Well, the invasive plant species are always a tough problem. Some people in this lab have a lot more experience in dealing with these tough invasives. But there are a number of ways to treat invasives. You can either do it chemically, or mechanically by removing the material, or biologically. At ERDC there are researchers here that are specialist in this aspect - their careers are involved in research to control invasive plants or animals.

You can actually pinpoint those invasives by doing a survey, and if the invasive species is not way out of control yet, you can actually harvest those, get those plants out as soon as they were found to keep them from spreading. If it's a small spot, you can clean them up because the earlier you can tackle that problem, the better it is in terms of success and more likely that you can stop it.

If it's a wide spread problem --- there's many that are -- then it becomes much more expensive and time consuming to treat those problems. PMIS is a data base produced by ERDC, and is available.

Courtney Chambers: Very good, thanks Pam. And we can work to - I can see if I can get the link to the PMIS, the Plant Management Information System, and that's a web-based resource that we could provide here in just a minute.

There was another question. Does the Corps engage in mitigating trans genes spreading from GMOs to wild species? Is there awareness at a general level that this could be a current or future problem? Do you have any familiarity with that, Pam?

Pam Bailey: I don't know how widespread that knowledge is through the Corps. It really is a real concern for agricultural entities. I don't think that there's too much work being done in this agency on that problem, mainly because of many other priorities being the focus of the Corps mission. The USDA and public gardens, such as the Missouri Botanical Garden, are working on this problem. It's a definite concern and an issue that the scientific community is well aware of.

Courtney Chambers: All right, thanks Pam. Ok that's all the chat questions I've received up to this point. So if you have another question for Pam, feel free to ask away. Don't be shy. Just remember to take your phone off of mute or again, you can continue to submit questions to the chat box.

All right, well I'll give you a few more minutes to think. You'll notice in the chat box there I sent a message that has a link to the Plant Management Information System that Pam mentioned. And that was developed here in the Environmental Laboratory. And it just provides help identifying and then presenting some control options for different noxious invasive plants.

Pam Bailey: Yes, it's a really good resource.

Cynthia: Courtney, this is Cynthia. I just wanted to also add that Pam mentioned that we have some subject matter experts in the Environmental Lab, and I would suggest if anyone wanted to reach out to us to do that through (Dr. Tim Lewis). His branch is the branch that handles those types of challenges.

Courtney Chambers: Very good, thanks for that Cynthia. I received another question in the chat box. Well, it's related to if these presentations are going to be available to listen at a later date. And that is - the answer is yes. We recorded both the part one, today's session, and we will also be recording next week's part three presentation. And those presentations will be posted on the Engineering with Nature web page as well as the DOTS web pages. IS that correct, (Cynthia)?

Cynthia: Yes that's correct.

Courtney Chambers: Ok yes and so we welcome you to access those, share them with anybody you'd like to. We'll have a video recording of what you watched on your screen with the audio, as a part of that. We'll also have a transcript and a PDF of the slides themselves for you to reference.

Any other questions this afternoon?

Pam Bailey: Well I hope that everybody will actually tune in for the last part of this webinar series, which will be on a series of case studies in which you will see the application of the concepts presented in the first and second webinars.

Courtney Chambers: Very good, Pam. Thank you for sharing with us again today. And we'll look forward to part three. Participants, thank you also for joining us for part two of this special series. Again, our final session will be next Wednesday, April 15 at the same time. And it'll be the same call in information.

But please also watch for additional information on these presentations and future DOTS Webinars from Cynthia Banks here at the ERDC Environmental Laboratory. Thank you all very much and have a great afternoon.

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