

Module 7A provides guidance on how reference sheets are developed. The instructors are Mike Pellant, Jeff Herrick, Pat Shaver and Dave Pike.

I think we'll start off with a little power point presentation that we have and components that will be associated with this power point presentation will be that we will talk generally about reference sheet development and then we're going to move into some specific things that will be associated with one of the indicators and that is the functional / structural groups here and we will spend a lot of time on this when we go through the actual development of the reference sheet because that is the one piece of information in developing the reference sheet that will be the most helpful to you in sort of lining things up and getting ready to go in preparing a reference sheet for yourselves. So, we'll go through the criteria for the groups, we'll look at the inappropriate groups, we'll try to prioritize those groups and then look into some issues associated with trying to lump and split those groups so that you can refine your functional structural groups more and then go into the actual description that would go onto the reference sheet. Then, we'll talk about a couple of other indicators and then we're going to follow that up with a small group discussion and some exercises that you'll get to do at the end of the broadcast. On the reference sheet development, one of the things that we have with this is that the first thing that you will need to do would be to determine whether you actually have a reference sheet that is available for that ecological site that you would go out on. So, like Mike had already talked to you about, one of the first steps that you would take would be to go to the evaluation site and

begin to determine what ecological site you're on and based on that ecological site, then, you're going to come back and follow-up to determine if you actually have a reference sheet that is available. Where are you going to go to get a reference sheet? The first place that you're going to look is with the Natural Resources Conservation Service and determine with them if they've already setup a reference sheet for this ecological site, sometimes they're associated with the ecological site descriptions, in the future, at least, they will be on the Web site that they will have for each ecological site descriptions, but, in many cases, you may end up having to develop this reference sheet yourself, it may not exist and so, you will draft your first reference sheet associated with this technique. So, how are you going to draft that, what kinds of things will you need to do in order to be able to draft that? Well, first, you're going to need to pull together a group of experts to be able to do that and that group of experts should have pretty good knowledge of the ecological site that you're going to be examining. They're going to include people of multiple disciplines, hopefully, you will include also people from other agencies as well because, remember, many of these ecological sites don't fall just on your lands that you're working on, but, they're also going to fall on private land, they will fall on forest service land and so forth and so make sure that you try and include as many of those other agencies as possible. The other people that you can use in the group are academics, the academics will often times have some good research information that they can pull together and you can use for helping out with the development of the reference sheet and don't forget the fact that the people that have lived on

that ground for a long period of time. In many of these cases, it'll be ranchers, who have been there for a long period of time, their familiar with those areas, they've seen these areas go through wet spells and dry spells and they can often times provide you some good feedback on the information associated with what that site looks like under a drought situation or under an above normal precipitation year and then if possible try and pull together some of the nongovernmental organization folks, those people, who would be the interested parties associated with each of those ecological sites. Next, you're going to compile all the resources that would be necessary to help you and help these experts in being able to pull together the information that you would put into a reference sheet when you develop one. The ecological site descriptions, the soil survey, various topographic maps, photos, both air photos and photographs that could be photo points from the location can be very helpful when you're developing some information associated with the reference sheet and then if there are particular scientific publications that one can use that would be specific to that ecological site, that's often times very helpful as well. So, one of the things that I said was that when we go into the development of a reference sheet, we've done a number of these and we often times start off with indicator number 12 which is the functional / structural groups worksheet. When you're developing the reference sheet for an ecological site, indicator number 12 is the one that we typically go to first. Why do we begin here? We begin here because most of you are often times most familiar with the dominant plants that are going to be on those areas and actually lays the groundwork for understanding the other

indicators that will be used for the reference sheet development and for your evaluations as well. Why do we use functional / structural groups as opposed to using species? That is a question that's often times asked of us and the best reason is that several of the species that would be included in a functional / structural group can fluctuate or that reference area and the fact that you have increases or decreases of a single species or a couple of species that fall into the same group is probably not as important as it would be to actually lose that group all together on that site and so, we actually look at the numbers of species within the structural/ functional groups and then we also look at the dominance of those species and then the groups themselves on the site. So, it's important to understand what species you have within the group and then it's important to be able to pay attention to what groups you actually have that you're working with. So, when we go into the development of the functional / structural groups, what criteria's do we actually use? We actually split these into 2 main groups. First, we look at the functional groups; these are the ones that the group itself has some particular function within the ecosystem or the ecological site in which they occur, look at the life history of the plants and the phenology of the plants, group them into annuals and perennials, those that are early season growth forms versus late season growth forms in many locations can be extremely important. RELATED TO THAT OFTEN TIMES IS THE PHOTOSYNTHETIC PATHWAY. Those of you who are familiar with it from a botany background can remember that the C3 plants are your cool season plants; they're also generally the ones that are earlier in their growth form. The C4 plants are the warm season plants

and they tend to grow later in the growing season, Cam plants in some locations many times in the desert region can be important too, so, don't forget to consider those as well as you're going through this process. Another important functional group are the nitrogen fixing species. Those species are the ones that are going to be actually fixing nitrogen within the soil and they may only be represented by 1 or 2 species, but those species can in fact be quite important in many locations, so, don't ignore the fact that they may not be dominant on the site, those can be an important functional group within that particular ecosystem. Now, we'll switch over to talk about structural groups. This is one that most people are quite easily capable of being able to put those plant species into. Generally, it's growth form that we look at, the trees, the shrub, forb, grasses, those succulent species that are on those areas; we can sometimes group the species into those types of growth forms. Within a particular growth form, you might find it helpful to actually look at tall species or tall groups versus short groups, this can be very important for many wildlife species as well. The rooting form of the species can be helpful as well, taproots versus fibrous roots for many forbs is a good group that you can look at. In many ecological sites, the clonal form of that plant, is it a bunch grass or is it a rhizomatous grass, they have different functions within that ecosystem within that ecological site and so if you were to lose the rhizomatous grasses out of the system that could be extremely important in terms of the soil and site stability of that particular location and then lastly, don't forget that in the functional / structural groups, we also include the biological soil crusts, these become a very important component and a group that often times gets ignored

because they're sitting on the soil surface as opposed to growing above the ground. Now, in going through this process, we often times run into questions about, well, shouldn't I have a group that relates to those species that are important to a certain animal preference. We try and stay away from using palatability or some sort of a value associated with a plant species in grouping plants into functional / structural groups for the purposes of the interpreting indicators of rangeland health. Many, in the same respect, we don't go around grouping plants into various foliage color groups or flower groups, flower color groups, those can be important to the insects around the area, but they may not be important really in trying to deal with the level of detail that we're dealing with, with interpreting indicators of rangeland health and lastly, it's the origin of the species. Once again, this could be extremely important when you're talking about the management of a particular area you may want to manage for native plants, but, in terms of the structural / functional groups, those natives and introduced species may fall into a particular structural / functional group, so, don't actually setup a group itself that is associated with natives versus introduced species. We'll address that under another indicator.

Well, once we've talked about the groups that are actually available then, we need to be able to prioritize how we will use these in trying to decide what the final set of groups would be. Generally, how we prioritize these when we try to lead a group through the process for this particular indicator is to initially start off with the structure of those growth forms, what species fall into what particular

growth form, trees, shrubs, grasses and then we often times look at those and if there is a clear distinction between some tall shrub versus short shrub, you may find that that's an important component you want to split out, the same thing with tall grasses versus short grasses, they may be important for some ecological function along the line. Then, get into functional categories, annual versus perennial, photosynthetic pathways, if they're important in your area. I worked a lot of times in the great basin, we don't have a lot of warm season grasses, so, it's not unusual for us to go through and only talk about grasses as a general group, we may split them into tall and short, but, we probably would not have a group for warm season grasses because they just don't exist in many of our systems. There is a crossing of the great planes, however, and that becomes a very important group to be able to capture, then, nitrogen fixing plants and then lastly talking about the phenology. So, that gives you an idea of some suggestive priorities, none of these are hard-rules, we often times use these as just a rule of thumb to go through and try to sort through the structural / functional groups that we have available. That then gets us into the next category which is to look at all of the groups that we've talked about and then make a decision as to whether we have to lump some groups or if we need to split some groups. We look at the different types of plant communities that we find within the reference state as well as the alternative state that Jeff talked with the state-and-transition models. We want to make sure that as we're putting together these functional / structural groups that we have represented the major groups within that site, those would be the groups that would be dominating that site under the reference

state or any of the other alternative states so that we can make sure that we understand when they should dominate and when they should be a minor component within that system. We also want to find out when we may have some structural / functional groups that would never dominate a site. When we have that as a situation, we want to at least consider whether we want to lump that group with another group that might be a larger group, but, remember that in some cases when you have a group that we would anticipate would never dominate the site, we may want to retain some of those just because they're an important component within that ecological site. Many of our great basin ecosystems, forbs are never a real major component within the system; they will generally never dominate that site. However, you want to make sure that you've contained that component within the ecological site and on those ecosystems as a whole; so, we want to make sure that that's a subdominant group that is also included and retain that. Lastly, then talking about the different groups that we would have and what we would want to lump with what. Generally, we consider the single species functional / structural groups ones that we would generally lump into another group, but, we do have a major exception here and that exception would be those structural / functional groups that might be dominated by one particular species and in those cases if that structural / functional group would in fact dominate that site in any of those types of situations, then, we want to try and retain that particular group as a structural / functional group that we would use in our reference sheet as we develop it. To try to help you then in putting together the narrative for the reference sheet description, we've

developed some general rules of thumb based on the composition of the structural / functional group within the ecological site. We would consider those plant groups that are dominant to be those that represent roughly about 40% or higher of the composition of the ecological site. The subdominant group would be those that would be 11 to 40% and the minor group would be those that would be less than 11%. We described these groups so that we can then move ahead and look at the change in dominance that might occur within this system and we'd like to know which of these groups would fall in the dominant category, codominant, or subdominant category and then the minor component and then as you actually described the narrative for this particular indicator, we want to make sure that you understand which ones will change under what situation because we need to capture that. As an example, within the great basin ecosystem, we recognized that we have a dominance of shrubs on that site and under situations that have occurred after fire, we can have a dominance of perennial grasses. We can have that switch back and forth, we want to make sure that we actually capture that when we're writing up this particular narrative for the structural / functional groups so that we understand under what situation each of these groups can in fact dominate that site. Well, that gives you a little bit of an overview of structural / functional groups and we actually spend quite a bit of time on that, but, there are other indicators, 16 other ones that you would need to go through and describe. Once you've talked about the different kinds of groups, you've probably gotten a good idea, you've looked at photographs and at that point probably read the ecological site descriptions and being able to move

then to indicator 15 which is annual production and this is generally where we lead a group down to the next indicator would be the annual production indicator which would be indicator 15. We want to make sure that we capture the range of the pounds per acre that production, both under what you expect to occur under a drought situation and then also in those kinds of situations where you would have wet or high production years, so, make sure that in this particular indicator run between a low level of production to a high level of production that you would anticipate would occur within that reference state. Then, going on to the other 15 indicators after those 2, we can really leave that up to you, it's your choice as to which indicator you move to next after that and we'll go through a little bit of an example and show you what we do on that as we go through our little side discussion that we will have on reference sheet development.

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