Questions & Answers
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1. How does public land grazing of private cattle alter soils necessary for wild horse foods?
   Cattle and horses largely utilize the same forage species, a large part of their diet consists of grasses. On a given area, the key is to allocate the forage needed to meet the requirements of the animals, and still maintain the health and vigor of the plants. Having cattle on public land, in and of itself, will not necessarily be a benefit or a detriment, it depends on the way they are managed. If the management of the cattle grazing is done correctly, it could be used as a tool to improve the health and vigor of the grasses, which would lead to an improvement in the forage needed by horses. But if the cattle are managed incorrectly, it could lead to a reduction in the forage needed by horses.
2. How can we work without ESDs (not all states have them)?
   Ecological Site Descriptions (ESDs) are an excellent tool to inform management of options and potential outcomes like I described in the webinar, but they are just one tool. If you are in more of a western state (those with rangeland), it is possible that the old Range Site Descriptions are still available. Those contain valuable information that can help in making management decisions. In the eastern states, it is likely that Forage Suitability Group descriptions have been developed. Those are a good resources as well. There is an effort to develop ESDs across the nation. It is possible that this work has already been started in your state. I suggest contacting the NRCS State Soil Scientist and inquire as to the status of ESD development in your state. It is possible that draft ESDs may have been developed. They may be willing to share these drafts at some point for “field testing”. Lastly, a lot of the information that we gathered during the development of ESDs came from “seasoned” field experts, so you could find out who those people are, and see if they’d be willing to impart some of that knowledge and experience.
3. Could one of the properties of native prairie grasses to have deeper roots and root die off to feed the plant result in deeper darker soil?
   Certainly the healthy, diverse plant community of a native prairie will result in the optimal levels of organic matter that would be the potential for that ecological site/soil, so yes I believe this is true. When we assess indicator number 9 (soil surface structure and soil organic matter content) of the Rangeland Health Assessment, we reference the Official Series Description (OSD) for that specific soil. That is because all of the physical and biological factors of a site basically have the potential to produce a certain range of the various characteristics, including organic matter. So I believe if you follow all the soil health principles, and supply a healthy, diverse plant community on other types of land uses (i.e., pasture, cropland, etc.), you can expect to have basically or nearly the same amounts/depths of organic matter. Keep in mind a native prairie is very diverse, so the species diversity underground may not be as high on other land uses.
4. Was the continuous pasture dominated by invasive grasses or were there some native species present?
   The inventory we conducted at the study site on the continuous season-long grazed side of the first study site I presented had a total of 13% by weight of native species, made up of five species. So 87% of the composition by weight was non-native species. On the rotationally grazed side, the non-native species made up 12% of the composition by weight, so 88% was native. Neither side has ever been seeded or farmed, so the plant communities on both sides were a result of grazing management.
5. How frequently did the rotation occur at these sites?
   I do not have the specifics, and from what I was told it varies from year to year, as you would expect with adaptive management. Generally, on the first site they graze that

paddock from 1-2 weeks in a given year. Rarely they may do a second grazing event. The second site was being winter grazed at the time we did the sampling, but has been in a growing season rotation in the past. They are in that paddock for 2-3 weeks in the winter would be my guess, not sure about how they grazed it during the growing season. The third site was not grazed that year at all, it was one of his "stockpile" paddocks or drought insurance paddocks, however you want to look at it. The following year he utilized that paddock for about 3 weeks late in the growing season I believe.

6. What amount of rainfall was used for the infiltration rate figures?
   We basically use the method described on page 7 of the Soil Quality Test Kit Guide minus the respiration test (https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050956.pdf). It describes putting one inch of water on to "pre-wet" the soil, then the second inch is what you time and use for comparisons.
7. Which of these DSP's is the best indicator of soil health?
   I believe you mean which soil characteristic is the best indicator of soil health? From the dynamic soil property study we have conducted so far, it would seem that infiltration is the most sensitive indicator we looked at, but remember we selected these sites intentionally with extremes in mind from a management/plant community standpoint. The infiltration test only reflects a part of one aspect of the ecological processes on a site, that being the hydrology, and as those who have done infiltration tests can attest, it can be highly variable between points. In the presentation, I listed five characteristics that were consistent in our dynamic soil property study and were most closely related to soil health, but I also mentioned that there are 12 other indicators that address the biotic integrity, the soil and site stability, and the hydrologic function attributes of the system. All 17 of these indicators should be evaluated to assess how all the ecological processes are functioning on a site, and to relate back to all of the principles of soil health.
8. What impact would rotational grazing of warm season and cool season multi-species cover crops have on soil structure and biology? Cover crops are no-till seeded into the ground beneath the residue remaining after the previous cover crops are grazed, trampled and terminated with glyphosate.
   I'm not sure if I understand this question exactly, but I will attempt to address what I think you are asking. Basically, you should be careful to not negate the benefit of the cover crops by overgrazing them. So similar to how you allocate a portion of the standing vegetation to the cattle in a pasture or range setting, you would want to do the same with the cover crops. Just a ballpark figure I would say leave roughly 1,000 to 2,000 lbs./acre standing in the field after grazing, depending on your objectives. That may sound like a lot, but that amounts to roughly 5-8 inches of height.
9. What is the best tool to use in the field to determine when you are nearing or have reached 50%? I'm looking for a specific test/protocol.
   I think the best tool is the one that the person using it will be able/willing to use repeatedly, and not get "worn out" because it is too much work. That may not be the most accurate tool, depending on the person's interest and/or experience. There are a number of ways to measure utilization. For many producers, I think the landscape appearance method is probably the most suited. I think my favorite for ease of use but still using measurements and somewhat reducing bias is the key species method. Another decent way to do it is to just use a grazing stick (or a yard stick) and measure the height going in and occasionally while they graze until you've roughly hit the mark, keeping in mind that 50% of the height does not equal 50% by weight. The landscape appearance and key species methods are described in the Utilization Studies and Residual Measurements Interagency Technical Reference at the following web site: (https://efotg.sc.egov.usda.gov/references/public/NM/range92a6_interagn-

UtilizStudies1.pdf).

10. Is there any reference for % leaf volume removed and % root growth stoppage?
    I put all of my references in the slide notes, not realizing those wouldn't be printed in the PDF. If anyone is interested in a print-out that includes those notes, feel free to contact me (stanley.boltz@sd.usda.gov). The reference I used for that was: Crider, Franklin Jacob. 1955. Root-growth stoppage resulting from defoliation of grass. No. 1102. U.S. Department of Agriculture. The graphics came from "Grass: The Stockman's Crop" by Harland E. Dietz, Sunshine Unlimited, Inc.
11. You and your participants may be interested in a recent book: The Serengeti Rules by Sean Carroll. It deals with regulation of biological and ecological processes.
12. I wonder how the mycorrhizal status of the plants would impact root dynamics.
    There is work being done by Dr. Michael Lehman at the Agricultural Research Service in Brookings, South Dakota, where he is identifying species groups of mycorrhizal fungi under different management scenarios/plant communities. What I have seen of his results is that the species groups of mycorrhizal fungi are higher in number and much more diverse under native prairie versus cropland. Overall I would guess that a more diverse soil biological community would result in higher functioning of the plant roots.
13. I've heard people mention leave 4-6 inches for rotational grazing. Based on what you've said is that too static a control point as amount of forage varies from year to year?
    While that could be used as a general "rule-of-thumb", I would agree that is probably too simplistic in the long run. Some grass species need a taller residual height to remain healthy, and every year is different. Ecological sites that produce more in general will have plants that have the leaves higher up the stem, so 4-6 inches would only leave stalks in some cases. Incidentally, that 4-6 inches we sometimes use as a rule of thumb for grass health just so happens to be about the same height at which cattle performance will start to diminish if it is taken any lower.
14. Why limit brassicas?
    Brassicas in general, but specifically rape have characteristics that can sometimes cause problems with cattle if they don't have other forage types in their diet. In my experience, if you intend to graze cattle on cover crops, it seems to work best to include a fairly significant amount of grass in the mix. Just a week ago I heard someone talk about a producer who lost two heifers to what he called "bloat" that were on cover crops fairly high in Brassicas.
15. Cover crops also help to sequester carbon?
    Any practices that build organic matter would be sequestering carbon I would think. But you need to consider all the soil health principles, and not just focus on one, like cover crops. It takes a system of practices to have a substantial impact on soil health in my mind, which takes into account all of the soil health principles.
16. NRCS has a harvest efficiency of 20-35% so are cattle really efficient versus feeding?
    What you are referring to is that the standard harvest efficiency when calculating the available animal unit months (AUMs – just a reference to production available to the animal) is 25%. What this means is that you first factor in the take half-leave half, or you leave 50% for plant health. So of the remaining 50% that is either eaten or destroyed in some fashion, cattle on average will get half of that into their belly in simple grazing systems. So half of that 50% is 25%, which gets labeled as the harvest efficiency. So what happens to the other 25%? Insects or other herbivores are two of the biggest factors, the other is waste, defecation on the forage (which prevents grazing), etc. If you were to just estimate that half of that 25% was waste, and the other half consumed by other critters, you would end up with about 12% waste with cattle grazing. If you look at the estimated percent waste of cattle eating hay free choice that is put on the ground, which is a common practice when feeding large herds, the waste is

roughly the same. So in effect you have the same wastage in both systems, although your wastage would be somewhat less if feeding in a bunk or bale feeder. But in a system where the cattle are harvesting the feed, there is really no cost to that, other than the herd health costs, which you would have in both systems, and the opportunity cost of the land, which again you'd likely have in both systems, or pay for through the purchase of feed. But in a scenario where you feed the cattle, you have fairly significant costs of labor, equipment, fuel, etc. So grazing cattle is overall much more efficient in terms of costs and such versus feeding cattle. In addition, the 25% harvest efficiency is a very conservative number used for simple grazing systems. With more intensive grazing management, it is not uncommon to increase that efficiency to 35-40% from the literature I've seen. The wastage in that type of system would probably be approaching the wastage in a bunk feeding system I would guess.

17. With the dramatic differences in infiltration and the fact much grazing land has been overgrazed for decades, over the last 150 years and into the future what is this doing to our groundwater recharge?
    I would have to guess that it results in diminished groundwater quantity. On a local scale, I have heard ranchers talk about the differences on their places versus neighbors who are not managing as well. After a heavy rain, the neighbors dams will fill up quickly, but it takes their dams a week or more to fill up. However, their dams will stay full longer, and the neighbors dry up quicker. So I think there are effects even on a local scale. But for every minute longer it takes to get that second inch in the ground, that means more water running off the site, going somewhere else, and not being stored or utilized on that property. I have an article written in 1889 by a local farmer in Eastern Nebraska, and after 30 years of conventional farming in his area, he wrote about how all the springs dried up and the perennial streams became ephemeral.
18. With winter grazing, what about impacts to soil due to saturated soil conditions?
    In areas where this is more of a concern, it would be prudent to have a backup plan. I would guess there are times of the year when this is more expected to occur, so maybe have some pasture/range with good soil health that you can move the cattle to for brief periods (assuming you meant winter grazing on cropland). Some of this can't be avoided, but I mention pasture/range with good soil health, because fairly brief periods of hoof impact will generally not be detrimental to a grass covered site with good soil health. Clayey grasslands in particular have sometimes been targeted as areas of concern for this issue, but if you have clays with shrink-swell potential, I think they will readily correct themselves if the soil health is in good shape. At times, hoof impact may even stimulate a positive response from some plant species (e.g., western wheatgrass).
19. Wouldn't we want to be careful on bale or swath grazing on native range?
    I completely agree, I mention bale or swath grazing mostly in terms of hayland or cropland. If bale grazing were to be done on pastureland, I would recommend moving the feeding sites around the field. Bale and swath grazing add/concentrate nutrients in smaller areas, and this can be detrimental to rangeland, at least temporarily.
20. How "clean" do you need to keep the water and what role does good cover play in that?
    There are a number of studies that show cleaner water, typically from a man-made (not earthen) tank result in fairly substantial increases in gains in cattle, and that if given the choice, cattle will normally choose to drink out of a man-made tank. If a well (or other water source) and pipeline are not an option, and your only water source is earthen stock dams, I would recommend fencing the dam out and piping the water to a tank. If for some reason that is not an option, I recommend limiting access to the stock dam in some form or fashion, so if at all possible cattle only go in to drink and then get back out. In whatever system you employ, certainly the water in a stock dam will be cleaner with better grazing management, which typically means optimal amounts of cover.

21. How about tools for other states?
    A number of states have developed their own feed/forage & animal balancing tools usually incorporating some fashion of grazing planning as well, so you may want to contact the NRCS State Grazing Specialist or their equivalent to see what may be available. One program I am aware of that was used in multiple states was C-Graze, although I don't know of its current availability. For NRCS planners, I believe the next generation of "Toolkit" will include grazing planning software. From a drought planning standpoint, quite a few of the more western states have developed a Drought Calculator for their state, including North Dakota. Again, contact the NRCS State Office to determine availability. For monitoring purposes, the Monitoring Manual for Grassland, Shrubland and Savannah Ecosystems is an excellent resource, and there is an Access database program called DIMA which incorporates many of the methods described in that publication, as well as the methods used in the NRCS Grazingland National Resource Inventory study. Interpreting Indicators of Rangeland Health, Version 4, is available (https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044253.pdf) and covers the methods for doing a rangeland health assessment. I would recommend attending a training session on this topic. For Ecological Site Descriptions, please see my response to the question asking about availability of those documents.
22. Would NRCS have information about grasses in New Mexico/Arizona?
    Yes, I believe they would. If you live in either of those states, I would recommend stopping by the local USDA Service Center and inquiring there, or contact the NRCS State Office in either state (http://www.nm.nrcs.usda.gov/ or http://www.az.nrcs.usda.gov). Other sources of information about grasses are likely the land grant universities, Extension, USDI Bureau of Land Management, USDA Forest Service, and others.
23. Also would NCRS have guidance on repairing soil health?
    Yes, if you live in a U.S. state or territory, visit or call the local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app). A good resource to start with if you live in the United States or not would be the National Soils Health home page: https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/