Grazing Ecology: Conservation Benefits of Ruminant Agriculture

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Abstract

Conservation benefits of animal agriculture begin with the role that forages play in soil erosion control and farm conservation planning, but they don't have to end there. Research in Wisconsin and other areas suggests that well-managed grazing can be used to control invasive weeds, restore oak savannas, enhance trout stream habitat, and provide high quality nesting cover for grassland birds. Many plant communities evolved with herbivory and are more productive when grazed. With an increased understanding of the role ruminants play in ecological processes, we can use livestock grazing to help restore healthy functioning of ecosystems in agricultural areas. Well-managed grazing can provide conservation benefits and a reasonable farm income on the same acre. Three key players need to come together to make this happen: the natural resources community, the agricultural research establishment, and farmers themselves. Currently, there are no economic drivers to bring attention and research dollars from the agricultural establishment. The natural resources community is not yet convinced that cattle grazing can be managed to benefit the environment. While there are many farmers with an interest in conservation, there are few with the knowledge and skill set they need to maximize the conservation benefits of managed grazing. I believe that livestock grazing is critical to the long-term sustainability of agriculture in the North Central region. Studying and documenting its potential for enhancing habitat is one way to help safeguard its long-term viability.

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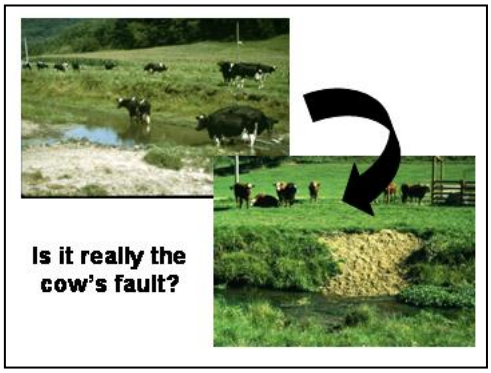
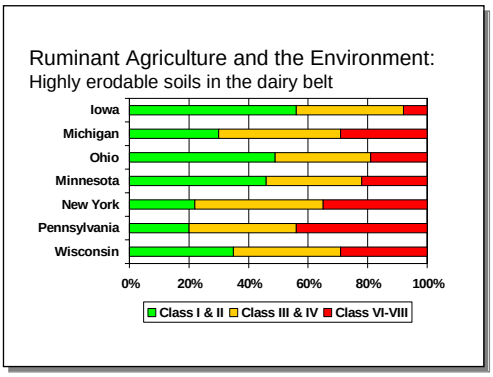
With this presentation, I'd like to highlight some of the conservation opportunities we have when working with grazing systems in the North Central and Northeastern United States. I would also like to point out some challenges we have as well, but I think the benefits of retaining livestock in our farming systems outweigh the risks.

I'll be talking about some work that we have done in Wisconsin, work by my own colleagues and me, as well as other projects in the region. What we did in our research project was to work toward overcoming some of the challenges we face by bringing together not only researchers but also the farmers who need to adopt these systems and the environmentalists who have valid concerns about agriculture's environmental issues. I think we have a great opportunity to bring environmentalists into the grass farming movement, but there are some mindset barriers we need to overcome.

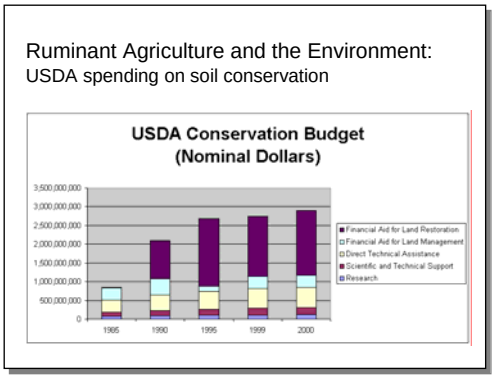
We have been talking a lot today about management. I think everyone that we've heard speak today emphasized the importance of management in keeping livestock agriculture strong and profitable. I would argue that the conventional wisdom on the detrimental aspects of livestock agriculture is a result of poor management. It's certainly not the animals' fault, and it's not a given that livestock agriculture has a negative impact on the environment. The problems we've had are a result of lack of knowledge and lack of attention to management skills. We can do a lot better.



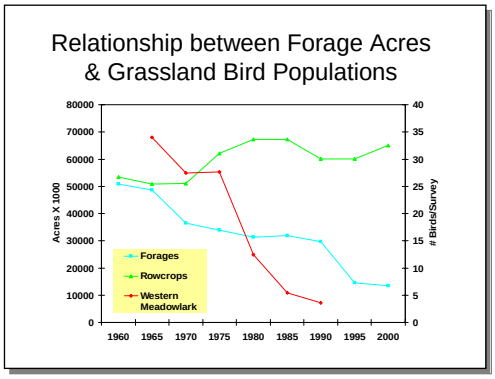


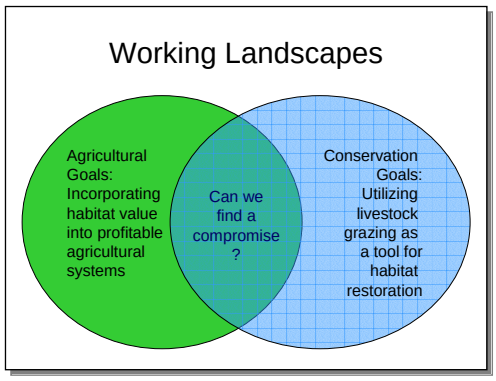
We can also provide evidence that animal agriculture has a key role to play in environmentally sound agriculture in this region. This graph divides agricultural land in the Great Lakes States into prime land with no erosion concerns, and two other categories for which crop agriculture must be restricted because of slope or other erosion potentials. In this region, prime agricultural land is really a very small percentage of the total amount of the land area. A great deal of our farmed land in the region, some 30 to 50%, is highly erodable and needs the protection that perennial forages provide. Our landscape includes 10 to 40% land in classes six through eight, which is basically unsuitable for annual row crops, but can possibly be safely used for pasture.

In other words, if we want to have agriculture in this region, we need a forage-based agricultural system to conserve the soil. We just need to figure out how to manage it properly. Of course, there has also been discussion about how much federal money goes into the farm programs to promote conservation of soils. Forages provide soil conservation benefits at little cost. If conservation is incorporated into the farming system, if you can do conservation and profitable agriculture on the same acre, it is a much easier sell to farmers.



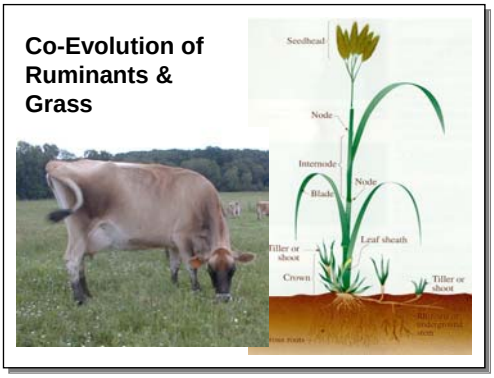
A lot of the work we did looked at wildlife habitat quality of agricultural systems and how we can promote wildlife benefits as well as soil conservation benefits. This graph shows changes in farmland cropping practices over the last forty or so years. Gradually, we've lost a lot of acres of forages in the region, and I have overlaid data showing rapid declines in grassland bird populations over the same period. This happens to be the western meadowlark populations in Wisconsin, but all grassland bird species are experiencing similar declines. You can see there is a parallel with the forage base in this region. Although there are several factors involved in these declines, this correlation tells us that it isn't agriculture in itself that has reduced habitat quality, it's the type of agriculture we are doing. These birds were surviving quite well with the forage-based systems that we had up until the 1960s in this area. Reversing the losses of hay and pasture acres in the region can contribute to habitat quality for these species.

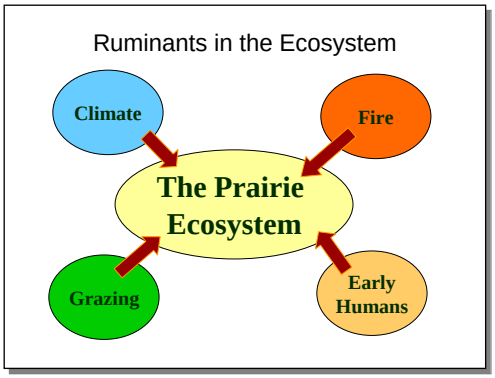




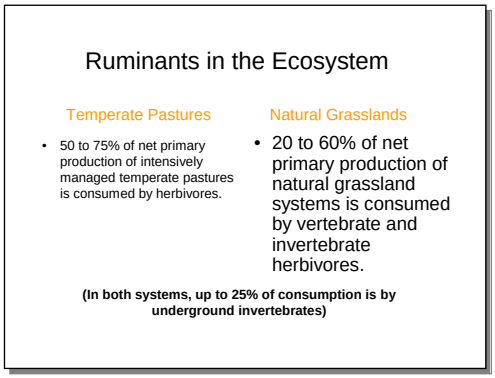
I guess the question I'd like to pose to the group is: Can we create what we call a working landscape that can provide the farmer with a reasonable income while also providing conservation benefits? Can we incorporate habitat quality into a profitable agricultural system? And from the conservationist's perspective, can we use livestock grazing as a tool to improve the habitat for wildlife?

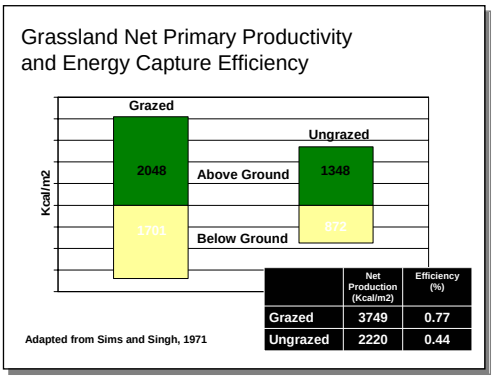
A good place to begin this discussion is to look at agriculture as an ecosystem, which it certainly is. Cows are uniquely adapted to feed themselves by grazing grass, and the grass plant has actually evolved to be grazed. They are both parts of one ecosystem. We can look at the native prairies of North America as a model for our agro-ecosystem. Current research suggests that the prairie was maintained by early Native Americans who managed both fire and grazing for their own purposes and managed to maintain a healthy ecosystem in the process.





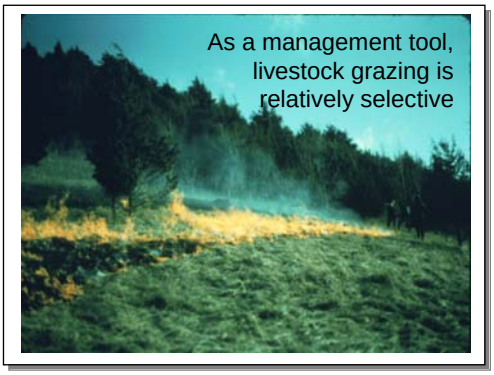
There is evidence that ecosystem processes occur in our temperate pastures that are similar in function to natural grasslands throughout the world. Both temperate pastures and natural grasslands have herbivores consuming a sizeable proportion of the plant biomass produced in any given year. Temperate pastures range from 50 to 75% consumed, while natural grasslands average 20 to 60% consumed by herbivores, including about 25% consumed by underground invertebrates.





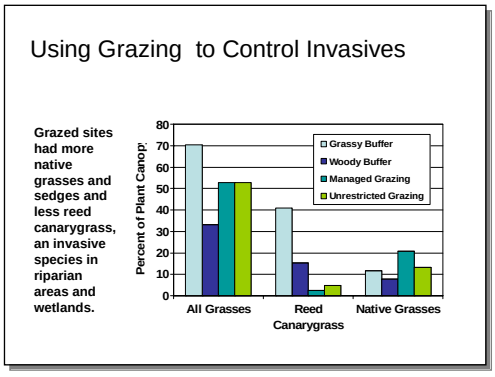
We also find when we look at natural grassland systems that those that are grazed are actually more productive in terms of primary plant production - by 60-70% - than ungrazed, idle grasslands. So grazing plays an important role in renewing those grasses, allowing new growth, and promoting nutrient cycling.

So we can think about grazing as a natural component of healthy grasslands. Then the question becomes, can we manipulate livestock grazing to achieve resource management goals? Can we include it as a tool in the management toolbox? In contrast to fire, the tool of choice for many grassland managers in this region, grazing is relatively selective. It is not necessarily better or worse than other management tools, but can be used to accomplish different objectives.

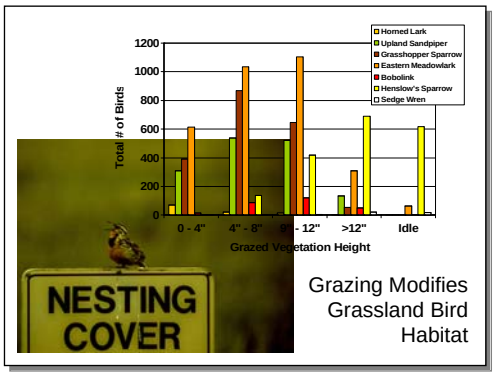


Here's one example of how we might use this tool. One of the things we are looking at is to use grazing to control invasive plants. The species here is reed canary grass, which, if you are a grazier or agronomist, is a productive pasture component. If you are a natural resource person, it is one of the most invasive species we have to deal with in wetlands across the Midwest. Its growth creates a dense mat of vegetation, and where it grows, it tends to smother out many native plant species.

One of the studies that we did looked at grazing along trout streams in southwestern Wisconsin. We studied four treatments: two buffer strip treatments, grassy and woody; a well-managed rotational grazing system; and unrestricted or uncontrolled cattle access. As you can see in the center set of bars the reed canary grass was the dominant species in the grassy buffer strips at 40% of the total compared to fewer than 5% for the grazed sites. The grazed sites had a significantly higher proportion of native sedges and rushes and other grass-like species (over 20% for well-managed grazing versus just over 10% for grassy buffer strips). This was because the cattle preferentially selected the reed canary grass over these other species, giving them a competitive edge.

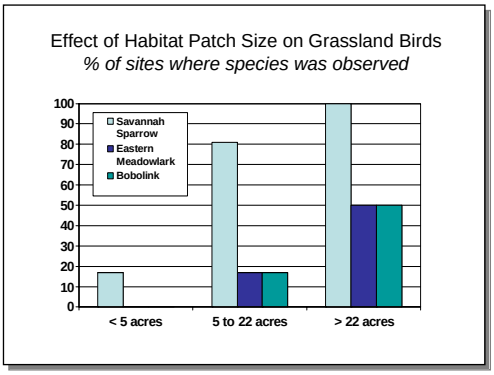


Here's another example of using grazing management to address conservation goals. This one involves restoring habitat structure. Oak savanna was once the most common grassland in Wisconsin; now it is our most endangered ecosystem. For ecosystems like the oak savanna, the structure is one of the defining components of the system. It is characterized by widely scattered large oak trees with shade-tolerant prairie species underneath. Many oak savannas have become overgrown over the decades. A study done by the University of Wisconsin, Wisconsin DNR and several private livestock farmers used Scottish Highland Cattle, a browsing animal, to go into these overgrown oak savannas. We've found that these Highland cattle will actually consume invasive species such as prickly ash and multiflora rose and recreate the habitat structure characteristic of the oak savanna.

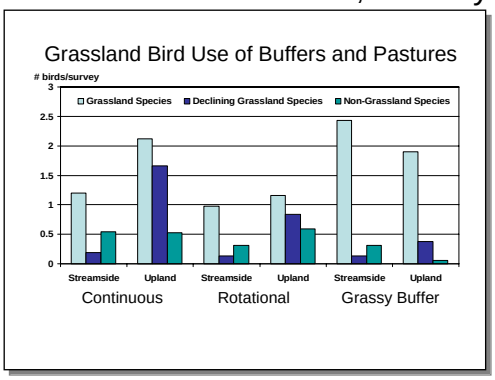


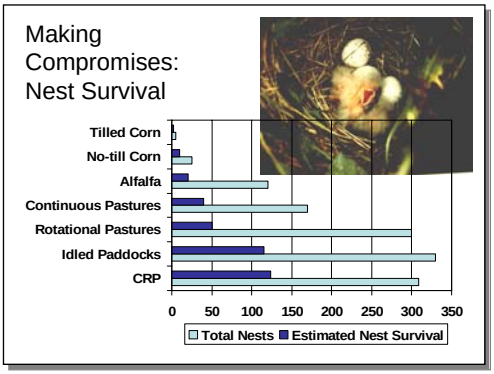
Grazing Modifies Grassland Bird Habitat

Here is one more example of how livestock grazing can create a more favorable habitat structure. These are some data from Missouri. We mentioned grassland birds earlier. This most rapidly declining group of wildlife species in North America is struggling as a result of habitat loss. As we saw in a previous slide, they don't need prairie to survive and their populations were maintained on 'tame' pastures and forages for many decades. They don't really care if they have native plants to nest in; it's the habitat structure they are looking for. If you look across the vegetation heights in this chart, you can see that the majority of these species actually prefer shorter, grazed habitat to unharvested, idle grasslands. As you get up into the taller, idled grasslands like you would find in a CRP field, a lot of those species will drop out. There are a few that need that tall, dense habitat, but most of them are actually adapted to more structurally diverse grassland created by grazing or burning.

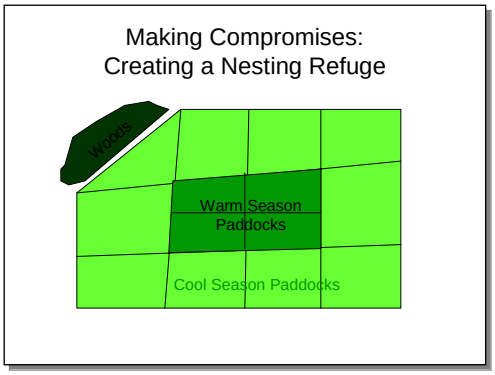


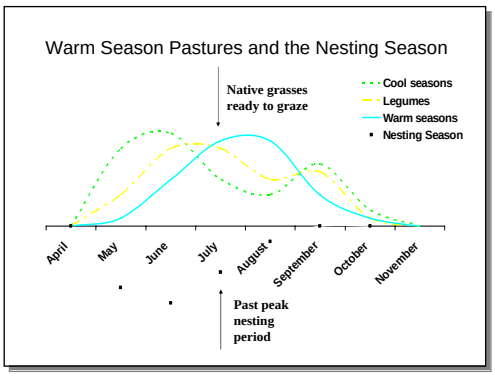
The other issue for a lot of these species is the size of the habitat patch. That is where our grass-based farms can really offer a benefit in providing the acreage of pasture or grassland that these birds need. This graph shows that as the pasture gets bigger, more species and more breeding pairs will be attracted to nest there. We found that, contrary to conventional wisdom, the narrow corridor of habitat created by a buffer strip has little or no value to most of the declining grassland bird species. The usually less than five acre habitats provided by the buffers were populated primarily by red-winged blackbirds, while the declining species were found in the upland areas of pastures adjacent to streams.





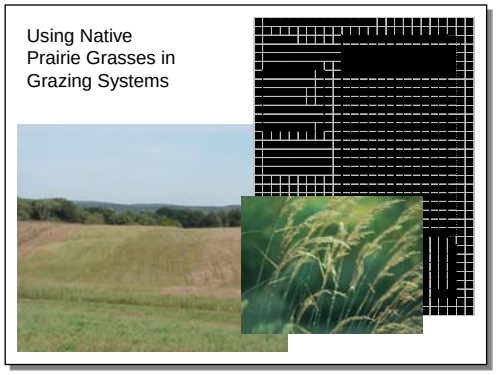
It is clear that grazed pasture can provide appropriate habitat structure for grassland birds. What you need to look at, in addition to providing the appropriate structure and acreage, is management and how it impacts the species that you are working with. Another study that we did to assess the impact of grazing management on grassland bird nest survival found that rotational pastures will attract as many birds as CRP fields, but the nest survival or the number of young produced on those pastures was about half what we got from the idled paddocks because of the trampling and disturbances of the nests. For this project, we used a proposal by one of the farmers we worked with. He wanted to try setting aside some acres in the middle of the pasture system as a 'refuge' during the nesting season.

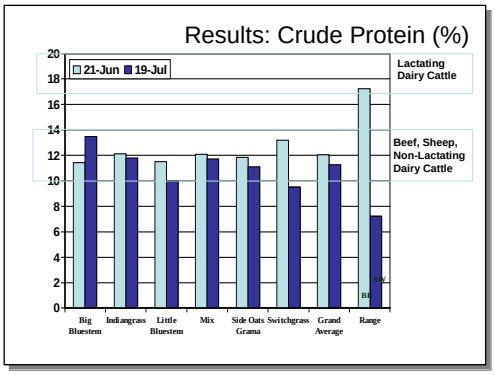




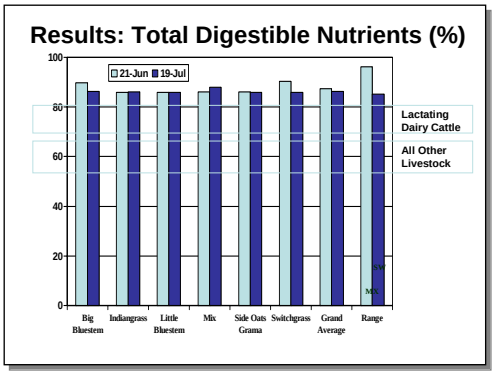
The best forages to use for these refuge areas are the native warm season grass species. The challenge with our cool season pasture systems is that, when these cool season grasses are growing very quickly and we're rotating very rapidly through the paddocks is the same time that most of the birds are nesting. Their peak nesting season occurs when we're returning to each paddock within two to three weeks, too short an interval to allow a full nest cycle from construction to fledging. That is why we see such low nest survival. A refuge or set aside area of native grasses fits with this system. Native grasses mature more slowly and are not really ready to graze until most of the birds are done nesting.

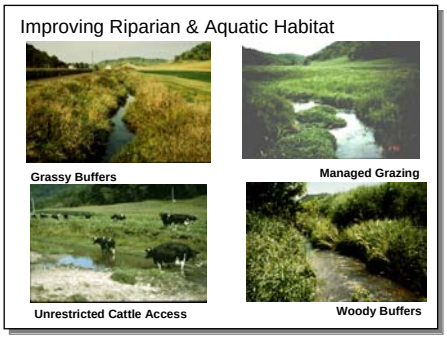
This is an area of on-going research. Jim Pease, a wildlife biologist at Iowa State, is looking at grassland bird response to a native/non-native grass pasture system, and there is some work going on at Michigan State evaluating grazing management strategies with natives. This slide shows a study site in Wisconsin where we have planted strips of the different native species and we are grazing across them to look at both animal preferences as well as the tolerance of each grass species to grazing pressure.





The key to this work is to keep both the conservation and production components in mind as we explore these systems. Our study includes forage nutritional quality evaluation of the warm season grasses. As you can see from this graph, crude protein levels in the grasses vary among species and with grazing timing. We found that, for the most part, warm season grasses have adequate levels of protein for most classes of livestock other than lactating dairy cows. Another nutritional parameter of importance to livestock farmers is total digestible nutrients. For this component, all the species had adequate levels, even for high demand dairy cows.





Another project that I touched on briefly involved looking at well-managed grazing as a potential best management practice in riparian areas. As I mentioned before, we looked at woody and grassy buffer strips, managed grazing, and unrestricted cattle access.

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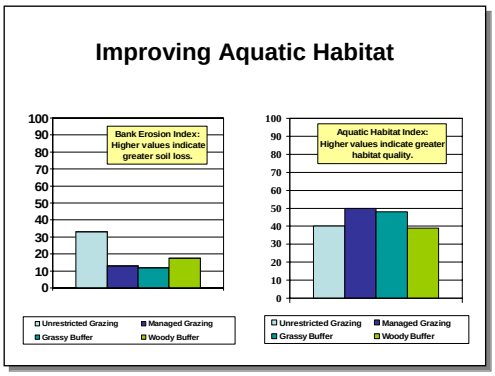
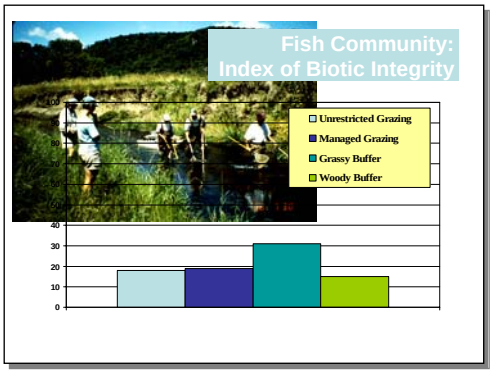
These graphs summarize our findings concerning the physical habitat created by the four treatments. We found that well-managed grazing provided protection from bank erosion equivalent to that of grassy buffer strips and better than woody buffer strips. We also looked at in-stream habitat for fish and again found that managed, rotational grazing created habitat similar to grassy buffer strips and better than woody buffer strips.

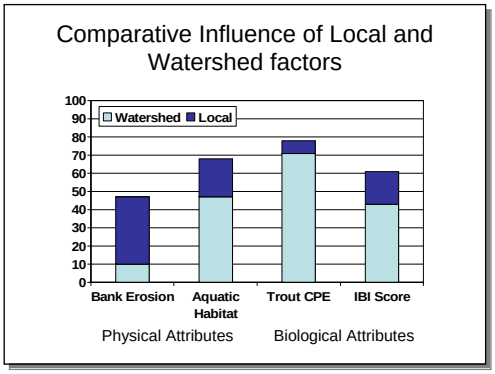




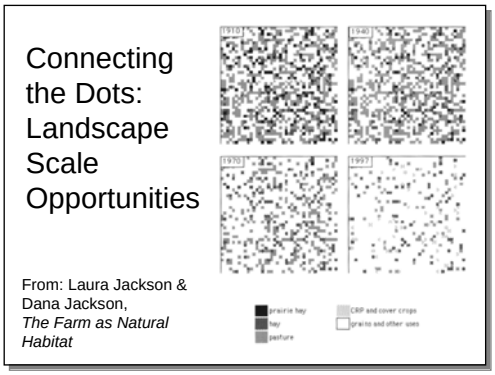
When we looked at the response of the biological community to these habitat treatments, we saw a different response. The Index of Biotic Integrity (IBI) is a numerical scoring system that fishery biologists use to rate aquatic systems in terms of fish community health. As this slide shows, although the managed grazing sites had similar habitat quality to the buffer strips, this didn't translate into similarly healthy fish communities. The grassy buffer strips had significantly healthier fish communities than any of the other treatments. It should be noted though, that even the grassy buffer sites rated only fair (30 on a 100 point scale).

This result is not surprising if you look at the bigger picture of a watershed. The health of the biological community is going to be primarily determined by the overall health of the watershed. We can collect data and analyze it in a way that accounts for treatment versus watershed influences.

Looking at the Big Picture



By collecting data upstream of the treatment sites, we were able to quantify the respective influences that both the treatment and the watershed had. As you can see, the physical attributes (e.g. bank erosion and aquatic habitat) are more readily affected by management, whereas the biological attributes, like the IBI, are more heavily influenced by the health of the entire watershed. We can't expect to improve the overall health of a watershed unless a majority of stream miles are protected with best management practices



In order to provide a significant conservation benefit on agricultural land, we need to think on a landscape scale. Biologists Laura and Dana Jackson have outlined this notion in their recent book titled *The Farm as Natural Habitat*. This slide depicts the notion of the agricultural landscape as a patchwork of habitat types. As long as there are high quality habitat patches in high enough proportions, the ability of the landscape to support wildlife and other conservation values is intact. As the landscape shifted over time, prairie hay and pasture was gradually displaced by row crops and other less beneficial crops. As the high quality patches became smaller and more isolated, their value declined. Only by using the perennial crops associated with livestock-based agricultural systems do we have the potential to reverse this trend without taking substantial acreages out of active agriculture.

Conservation Goals

	Soil Erosion Water Quality	Wildlife Habitat	Ecological Function	Ecosystem Restoration
Necessary Features	Sod Cover, Reduced Ag Chemical Inputs	Habitat Structure Patch size	Energy Flow Mineral Cycling Water Cycling Biodiversity	Plant & Animal Biodiversity
Scale	Field	Field or Farm	Farm or Landscape	Landscape
Appropriate Species	Warm Season or Cool Season Grasses	Warm Season or Cool Season Grasses	A Diverse Array of Plant and Animal Species	Native local ecotypes & species
Compatible with well-managed grazing?	Yes	Yes	Yes	Yes

When we work on conservation and environmental issues, we need to consider our conservation goals. We have a range of potential objectives for each farm or parcel of land. Our options for a goal of controlling soil erosion will be different from those for protecting grassland birds, for example. We'll probably be looking at different landscape scales and possibly different grassland types. Across all the potential conservation goals for agricultural land and/or grassland management, well-managed grazing is not only compatible but may be a valuable tool for maximizing conservation benefits.

It is a matter of developing the proper management approaches and considering grazing behaviors, modifications in stocking rate, rotation length, grazing residual, and seasonal timing. I would like to leave you with the point that while considering conservation goals on private land, we can't lose sight of the fact that the farmer needs to be profitable in order to stay on the land.

Aldo Leopold talked a lot in his writings about a land ethic. I think a land ethic still exists among farmers. We just need to rekindle it and fuel it with good, ecologically sound information. Putting land management knowledge and skills in the hands of a caring farmer is probably the most effective conservation investment we can make. A livestock-based system has the greatest potential for long-term economic, social, and environmental sustainability of agriculture in the region.