Center for Grassland Studies

E-mail: grassland@unl.edu
www.grassland.unl.edu

Phone: (402) 472-4101
Fax: (402) 472-4104

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Biodiversity Maintenance with the Healthy Farm Index

by John Quinn and James Brandle, School of Natural Resources, UNL
Ron Johnson, Department of Forestry and Natural Resources, Clemson University

In the Summer 2009 issue of this newsletter we wrote about the Healthy Farm Index (HFI) and ecosystem services provided in agroecosystems. The HFI addresses biodiversity maintenance decisions on individual fields and farms with the ultimate goal of understanding the driving forces, tradeoffs, and relationships to improve the effectiveness of whole farm management for biodiversity and ecosystem services. Building on the last article, we will discuss how the Healthy Farm Index is applied, using a University of Nebraska–Lincoln research farm as an example, and further examine farmland biodiversity, emphasizing the importance of managing for diversity in agroecosystems.

State and Function

We have designed the HFI to differentiate between farmland biodiversity state and function to allow for better consideration of the multiple objectives the landowner may want to consider. State refers to the status or well-being of biodiversity on the farm. The state of biodiversity at a location can be considered an indicator of ecosystem health. Function is the role or benefit that biodiversity provides to the farm and surrounding environment. Rather than establishing an objective to increase biodiversity broadly, the Healthy Farm Index allows a farmer to focus biodiversity maintenance efforts on one group of species or a single ecosystem at a time.

Biodiversity state can be measured at genetic, species, and ecosystem levels for both **planned** and **associated** biodiversity.

UNL ARDC Agroforestry Research Farm

Planned biodiversity – Crops, livestock, or landscape elements such as windbreaks that a farmer maintains on a farm.

Associated biodiversity – Species and ecosystems that interact with farm systems but are not typically managed for as part of a farm operation.

Including indicators in the HFI that represent different measures of biodiversity increases the value of the assessment process and limits information lost. The value of considering multiple measures of biodiversity state emerges when a landowner is able to recognize more closely where they score high and where they can improve biodiversity conservation on their farm. Because the index includes different indicators of biodiversity, it is easy to identify actions that address how an area of interest can be improved. For example, if a farmer was interested in improving the planned species diversity on their farm, they could include cover crops with increased frequency or add an additional crop into their rotation. Because the index addresses multiple measures of biodiversity, the farmer will be able to observe subsequent changes in other biodiversity measures. Building on the previous example, cover crops might improve bird habitat, thus increasing the abundance of local species of interest.

The cyclical process of annual assessment adds additional value to the Healthy Farm Index. The ability to reassess the next year, looking at both planned and associated biodiversity states, will allow farmers and researchers to better understand the con-

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sequences of their actions on multiple measures of biodiversity. Given the increased information available and a better understanding of tradeoffs, the farmer can weigh the costs and benefits of managing for biodiversity. Additionally, we can begin to better understand how these changes in biodiversity state will influence biodiversity function and ecosystem services.

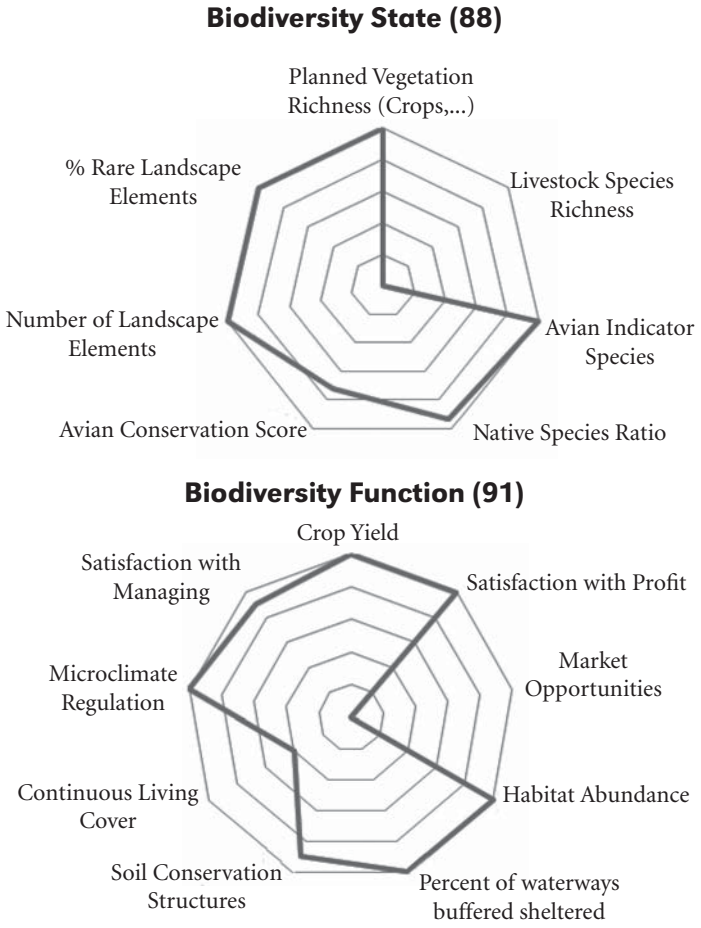
Ecosystem services, the benefits that people receive from nature, are provided by biodiversity. With the Healthy Farm Index, we are seeking to include ecosystem services as part of the assessment and decision making process, and ultimately to communicate their value to farmers and decision makers at local and national levels. Observation of natural systems and replicated field trials demonstrate that increasing biodiversity improves many ecosystem services. In managing for biodiversity, however, particularly on farms with multiple functions, the goal is not just to increase biodiversity, but rather to maintain a level biodiversity that benefits the farm system. Ideally, a farm would have a variety of species and ecosystems that provide beneficial functions such as insect pest suppression and water filtration. It is challenging and resource intensive to manage a farm or an ecosystem in the absence of biodiversity. A farm without appropriate biodiversity may substitute for some services using inputs but will lack resilience when the inputs fail or are unavailable.

Demonstration of Healthy Farm Index

To demonstrate the Healthy Farm Index, we have assessed one of the University of Nebraska–Lincoln's research farms. The UNL Agricultural Research and Development Center (ARDC) agroforestry research site, located north of Lincoln, is 450 acres managed around a replicated windbreak system that has supported 30 years of research. The primary rotation within the windbreaks is wheat, followed by corn and then soybean. In 2008, 45 acres within one windbreak system were certified organic. The site has been home to many research projects addressing ecosystem services including microclimate regulation and biological control. Avian point counts have identified 65 bird species using the farm. The farm was assessed using the Healthy Farm Index based on the management of the farm in 2009. The farm scores near 90 for both biodiversity state and function, as the figure in the right column depicts.

The high scores received by the ARDC agroforestry farm reflect the value of biodiversity to farm health. As mentioned earlier, the farm has a three-crop rotation. Additionally, cover crops and alfalfa are part of the farm operation. One component missing from the agroforestry site is an active livestock component as part of the management system. The farm does have a full assemblage of rare and common grassland and shrubland indicator species. However, as a result of the abundance of woody cover and less grassland, its conservation value for grassland birds, a group in need of conservation, is reduced.

This past year's corn yields were 10% above average, normal for soybean, and 10% below normal for wheat. At year's end, the farm manager was very satisfied with the farm profit and satisfied with the farm management system. The farm does not currently capture other sources of income from the farm, but has had an active woody floral program in the past. A high percentage of the farm is available as habitat to local species, and much of the farm



is protected from soil erosion and excessive evapotranspiration by planned ecosystem features. Additionally, wide buffers protect the waterway running through the property. The recent increased use of cover crops will improve nutrient cycling, which is a supporting ecosystem service that we are planning to include in the HFI.

Discussion / Conclusion

The UNL ARDC agroforestry site is a unique farm. Its planned landscape diversity is greater than most farms. The success of the operation, however, demonstrates the value of biodiversity as part of a farm system. Assessment of the farm also demonstrates that the HFI is not limited to organic farm systems and is a valuable tool for any farm type. Using the results provided by the Healthy Farm Index, a landowner can better consider the steps needed to address individual objectives and concerns related to biodiversity maintenance. To ensure future success, the assessment process with the HFI should not stop at one review. Assessment can become an annual process that allows for a better understanding of tradeoffs and synergies between objectives over time. By identifying one or two measures of interest with the stated objective to improve them gradually each year, the farmer can slowly manage and assess the state and function of biodiversity on their farm, improving health and function of the farm and neighboring ecosystems.

For more information on the integration of biodiversity maintenance into farm management with the Healthy Farm Index, please visit http://hfi.unl.edu.