Great Plains
Landscape Conservation Cooperative

A strategy to identify science priorities for grasslands: Utilizing a Landscape Conservation Design

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James Broska

GPLCC Science Coordinator

Overview

The Grasslands - Landscape Conservation Design approach outlined in this report is centered on a set of actions and principles that will help resource agencies and stakeholders work collaboratively to identify Great Plains Landscape Conservation Cooperative (GPLCC) landscape goals and management objectives, threats to shared resources, science priorities and conservation opportunities. Landscape conservation design will facilitate coordination among multiple partners, which is essential to define where GPLCC efforts are directed and how regional to local scale projects can be supported by GPLCC resources. This approach will help solidify collaboration of the partners, ensure the relevance of science and research products and reports, and create a mechanism that can be duplicated with other priority resources. Significant tangible benefits include: 1) a collective understanding of threats and opportunities; 2) quantifiable results and metrics to help gauge conservation actions; 3) creation of shared data sets, tools and approaches; and 4) development of consistent management practices and protocols.

Building Collaboration of the GPLCC Partnership

A landscape conservation design approach will only be effective with full engagement of the Steering Committee and partner organizations. Similarly, planning and design for priority species, habitats and other resources will only be effective if State wildlife agencies and other partners with trust resource responsibilities have commitment and significant involvement throughout the process. Leveraging resources among GPLCC partners will be essential for conservation to be successful at a landscape scale. These resources may include staff time and expertise, use of facilities, sharing of data sets, financial contributions or other in-kind support.

The landscape conservation design approach described in this report provides a foundation for long-term landscape conservation in the Great Plains LCC geography. The development of relevant science is dependent on an informed partnership with a common understanding about the status and trends of Great Plains resources, threats to these resources, and opportunities to lead conservation. While this plan and design will not bind partners and stakeholders, it should provide a common vision and context for helping local projects contribute to a larger context and with greater collective effect. Additionally, it will assure that the GPLCC is productively achieving national performance measures that, in part, determine allocation of Department of Interior resources.

Landscape Conservation Design

Landscape Conservation Design (LCD) is an iterative process that provides GPLCC partners a collaborative framework to support biological planning and conservation design at a landscape scale. It provides the means to evaluate current and perceived threats to priority species; develop alternative landscape condition scenarios; create decision support tools that can guide conservation delivery in priority ecoregions; and, guide the prioritization of research, inventory and monitoring projects. Further, it can address key uncertainties and assumptions and, provide information context for local planning decisions, such as documenting rarity, juxtaposition, connectivity and distribution of values and threats.

Part I

Background

At the June, 2013 Great Plains Landscape Conservation Cooperative (GPLCC) meeting, the GPLCC Steering Committee (Committee) set a course for FY2014 centered on determining the role of the GPLCC in supporting functional and sustainable grassland landscapes. The Committee stipulated that near-term grassland science and research priorities should be coordinated with partners and other grassland practitioners to ensure the results from research projects and planning efforts would directly inform conservation delivery. To support accomplishing both short- and long-term grassland conservation needs, the Committee also discussed exploring the use of a LCD approach to plan and prioritize efforts implemented by the GPLCC. In response to this request, the GPLCC Science Coordinator and members of the GPLCC Science Committee, along with GPLCC partners and other grassland practitioners, established the *Grasslands Working Group (Working Group)* with the intent of developing a grassland LCD. The USFWS Office of Science Advisor defines an LCD as *"a partnership-driven activity that results in an assessment of current and anticipated future resource patterns and processes, and a spatially-explicit depiction of a desired future condition. These products guide partners' identification of broad management, restoration, and protection strategies that could be implemented on-the-ground to address identified resource concerns, attain desired future conditions, sustain ecosystem function, and achieve the missions, mandates, and goals of partner agencies, organizations, and Tribes."* The following report describes the course of action being recommended by the *Working Group* to develop an LCD that provides a solid foundation for all GPLCC partners to engage in collaborative conservation planning for grasslands in 2014 and other priorities in future efforts.

At the landscape scale, an LCD can help to establish conservation objectives that support priority species at objective levels. The current conservation estate is described, explicit population goals or carrying capacities can be established for priority species, and primary threats to sustaining system function are identified by respective states and stakeholders. At finer, ecoregional scales, habitat objectives can be established that address limiting factors, and ultimately contribute to achieving landscape objectives. This scaled approach allows multiple biotic and abiotic assessments to be completed to inform and maximize the impact of partners' conservation delivery programs. It is critical that a landscape based LCD be scaled down to ecoregional levels because most conservation delivery occurs at this scale. This approach allows priorities to be established, resources to be allocated, and conservation to be delivered at the most efficient and effective scale while still ensuring accomplishment of the overarching landscape goals. This will ensure that limited GPLCC resources for science needs will be directed to those projects that address key uncertainties and are directly linked to supporting priority species at desired levels while enabling conservation actions.

Recommended Approaches

Implementation of a LCD framework will require a commitment by the GPLCC Steering Committee to formalize expectations and objectives. Additionally, the Steering Committee

would need to set aside the resources and capacity needed to form a Landscape Conservation Design Team (LCDT). The LCD framework would build on current partner's conservation efforts while allowing them to collaborate on addressing long-term, landscape factors such as climate change. The Science Coordinator should serve as an advisor to the LCDT with oversight by the Steering Committee. As a part of this process, the LCDT will coordinate with the GPLCC Data Steward making all data and products publicly available through the LC Map-GPLCC data portal.

Recommendations for action include launching a pilot project focused on one of two different approaches. One approach would be a species focused approach while the other would be a habitat based approach.

Species Focused Approach

A species focused approach would integrate and incorporate the elements of *Strategic Habitat Conservation* (Biological Planning, Conservation Design, Conservation Delivery, Inventory/Monitoring, and Research) and would use specific population objectives and habitat associations to guide the LCD process. The GPLCC would embark on a pilot project focused on one or more priority species that could be used as indicator species to develop the LCD process and guide integration of information and approaches across various scales. Importantly, the selection of species would need to be based on explicit goals and objectives endorsed by the Steering Committee. These species should inform conservation activities that benefit many other species utilizing the same habitats in the Great Plains. Conceptually, a diversity of species would be selected that require grasslands with a diversity of habitats and that could serve as indicators or surrogates to guide conservation for other grassland obligates. These species would be required to have defined population targets and known habitat relations and threat factors. Geographic delineation of species distribution, mapping and modeling would be required. It is speculated that regions with suitable habitat for these species would contain the diversity of ecological niches necessary to support other grassland obligates occurring in the GPLCC landscape. Through landscape conservation design, and delivering conservation projects accordingly, it is hypothesized that these niches would be available for both the indicator planning species and for other associated species. This approach helps the planning process move forward without the need for additional data to develop demographic models for all species.

Habitat Based Approach

With a habitat based approach, a GPLCC-wide assessment of the current state of grassland ecosystems of the Great Plains LCC geography would be initiated that would include explicit delineation of major ecosystems and habitat types. An assessment of the threats to those ecosystems and a delineation of where opportunities for science and research exist would not focus on a single species but would explicitly recognize a suite of resident and migratory species for which habitat becomes a surrogate. The state of the ecosystem assessment would include evaluation of a spatial delineation of a multitude of environmental variables (habitat distributions, land-cover data, species distributions, geology, hydrology, etc.), and, demographic variables (energy infrastructure, land-use data, agricultural data, urban footprint, etc.). Assessment of threats and opportunities inherent in this effort would include determining where the greatest (current and imminent) threats exist, where opportunities for conservation success exist, and providing regional context

for managers, planners and the steering committee to decide which areas should be prioritized, and how these areas fit into the larger framework of landscape conservation. Further, this assessment would be used to better understand the spatial extent of biodiversity, ecological integrity, and ecosystem function of grassland systems in the Great Plains which could also be used to delineate conservation priorities. Another important component of this assessment would be to evaluate the severity of threats relative to extent, duration, reversibility, and potential for secondary impacts of those threats. This assessment could be conducted GPLCC-wide but would be somewhat coarse in scale due to the logistical limitations of a fine-scaled assessment of a region that is over 200 million acres in breadth. However, the baseline information delivered from this effort would help define where and how other regional-scale projects could be supported by GPLCC resources. In fact, a GPLCC-wide assessment could include a more specific, detailed assessment of one or more selected priority areas where detailed local data could be developed, incorporated and used to guide planning and prioritization.

Landscape Conservation Design - Overview

Landscape Conservation Design can be used over large areas to: (1) delineate spatial heterogeneity in biodiversity and landscape processes, (2) define patterns of environmental change at various scales, (3) delimit socio-economic influences, and (4) provide focus by identifying the research and conservation management needs for multiple partners. LCD has been incorporated differently into conservation planning frameworks, such as the U.S. Fish and Wildlife Service's Strategic Habitat Conservation framework, Partners in Flight's Five Elements Process, The Nature Conservancy, various State Wildlife Action Plans and Systematic Conservation Planning (*See References for details*).

Landscape Conservation Design – Steps to Action

The LCD framework outlines the following step-wise process to determine specific science and research priorities, monitoring needs, conservation delivery mechanisms and actions, and the locations of priority conservation areas.

1. Identify a set of Priority Species to act as Indicators (Surrogates)
2. Determine Priority Objective(s)
3. Assess the Current State of the Ecosystem
4. Overlay Data Layers to Create a Conservation Opportunity Assessment
5. Predict the Response of Species or Habitats to Future Land Change
6. Collaboratively Select Sites for Conservation Delivery
7. Implement Conservation Actions by GPLCC Partners
8. Monitor Progress and Assess Effectiveness
9. Reconvene to Determine the Applicability of the Landscape Conservation Design Process to Other Priority Objectives

Landscape Conservation Design – Process

To facilitate development of the LCD, the GPLCC Steering Committee must formalize goals and objectives and should designate a *Landscape Conservation Design Team* to implement the LCD process. Because this process is iterative, it is likely that certain steps

may not always be conducted in the order listed. Also, some steps may take a short period of time while others, such as monitoring progress and assessing effectiveness, may take years to complete or may require further research. The nine actions, or steps, fundamental to the LCD process are outlined in detail below.

1. Identify One or More Priority Species to act as Indicators (Surrogates)

   One or more priority species should be selected to indicators of grassland condition. Species should be selected that represent other species and aspects of the environment and habitats of the Great Plains and meet the explicit goals and objectives defined by the Steering Committee.

2. Determine Priority Objective(s)

   A key step in LCD is for decision-makers to reach agreement on management priorities and objectives. This is imperative to designing a path for achieving conservation across stakeholders' jurisdictional boundaries that encompass the GPLCC landscape. Because this step provides the foundation for all other decisions, it is imperative that key decision-makers on the Steering Committee from each stakeholder group agree on the established priority for the pilot project. In order to come to such consensus, decision support tools like SDM may provide assistance, especially in the case of LCCs that require collaboration from multiple stakeholder groups with different agency-driven priorities. If SDM workshops or other decision support tools are used, involved participants must come prepared to efficiently decipher the common ground amongst LCC partners and prioritize management objectives to most clearly and effectively articulate one pilot project priority.

   Landscape conservation design hinges upon existing partnerships and interagency relationships. Stakeholders must work together to identify common objectives that meet the conservation needs of the partnership. Further, the conservation objectives need to be scientific, measurable, achievable, relevant, and time-based.

3. Assess the Current State of the Ecosystem

   The LCDT should begin biological planning by using Geographic Information Systems (GIS) to map the distribution and contribution of the following land areas:

   a) "Planning priority areas" that have been established as a priority for multiple stakeholders;
   b) The "conservation estate", which is comprised of the existing conservation holdings (including, but not limited to, Federally-managed lands, State-managed lands, private lands managed under easement programs or leases, areas managed under Candidate Conservation Agreements, and The Nature Conservancy's lands);
   c) Unavailable habitat that delineates areas unfeasible for conservation due to development, severe habitat degradation, or jurisdiction; and

d) Potentially available habitat that delineates areas with current or projected societal or economic demands that could limit the feasibility of conserving these lands in the future.

The goal of this step is to better understand the current state of the ecosystem by illustrating where species or habitat conservation aligns with the established priority objective determined above and where opportunities for expansion or new conservation areas may exist. Different LCDT team members may be requested to develop the various data layers independent of one another.

4. Overlay Data Layers to Create a Conservation Opportunity Assessment

By creating an overlay of these map layers, termed a Conservation Opportunity Assessment, the LCDT can identify and prioritize lands based on their contribution to achieving the stated priority goals and objectives. The Conservation Opportunity Assessment should enhance cooperation, reduce redundancy, and assess conservation opportunity and progress.

5. Predict the Response of Species or Habitats to Future Land Change

Population response models and climate change vulnerability models must be overlaid upon the Conservation Opportunity Assessment in order to understand future relationships between land change and the priority species or habitat to which the priority objective relates. The results of this step may rule out the availability of particular land parcels from the Conservation Opportunity Assessment. These results should also help determine which lands will contribute most to accomplishing the priority objective. Further, the results may help determine land management practices that would be most beneficial to furthering the priority objective established in step one.

6. Collaborative Site Selection

When the LCDT has identified and begun to prioritize areas available for future conservation, the decision-makers must be informed of the results and, based on this information, establish a long-term plan for incorporating high priority lands into the conservation estate. Again, decision support tools or SDM may be integrated into this step for partners to determine which lands are the most important for meeting the established priority. Steering Committee members should carry this step forward to set the direction for on-the-ground land managers. At this stage, social scientists could be involved to consider societal and economic constraints outside the purview of biological scientists on the LCDT.

The goal of this site selection process is to develop a landscape design that: (1) capitalizes on conservation success and opportunity as mapped in the conservation estate and potentially available habitat products; (2) identifies additional conservation actions that can be implemented; and (3) develops an agreed upon set of prioritized actions that need to be implemented by the larger partnership to meet the conservation goals.

7. Implement Conservation Actions

   At this stage, the landscape conservation design results must be stepped-down to on-the-ground managers for implementation. Collaboration between the LCDT and multi-agency on-the-ground managers will be crucial to making this happen efficiently and effectively.

8. Monitor Progress and Assess Effectiveness

   Monitoring the results will be integral to assessing the effectiveness of the pilot project and the landscape conservation design's ability to meet the established objectives. A monitoring plan must be followed, and reports should be relayed to the LCDT to determine whether or not the implementation of the design is resulting in enhanced conservation.

9. Reconvene to Determine the Applicability of the Landscape Conservation Design Process to Other Priority Objectives

   After land managers execute the landscape conservation design and report monitoring results to the LCDT, the GPLCC partners should reconvene to determine whether or not the process was effective in achieving the defined objective. Further, they may assess the value of the project in achieving conservation goals in an economically-viable way. If it is determined to be successful and feasible, landscape conservation design should be initiated for additional management priorities.

Part II
Threats and Science Needs Assessment

Threats Assessment

The *GPLCC Grasslands Working Group* developed a set of potential threats known to impact grasslands. This list is an important starting point in understanding threats in relation to potential impacts on different ecoregions and developing strategies that abate those threats. In wildlife conservation, a threat can be defined as a thing or force likely to inflict harm to the resources, or an indication of imminent harm to those resources. A major component of the conservation design element is to develop scenario's that inform natural resource managers about how a threat will influence the landscape capacity to support priority species. Conservation opportunities are also developed as part of this scenario planning process. The threats and opportunities assessment portion of this effort will require spatially describing: 1) priority ecoregions for each of the selected species, 2) where the greatest (current and potential future) threats exist, 3) where opportunities for conservation success exist, and 4) how various areas adjacent to priority ecoregions fit into the larger framework of conservation at the GPLCC landscape scale. Listed below are a set of potential grassland threats known to impact grasslands:

Climate change

Extended drought
Increased extreme precipitation and storm events
Changes in snow run-off and stream-flow timing

Increased temperatures leading to higher evapotranspiration
Changes in phenology
Changes in species composition
Changes in atmospheric composition

Fragmentation

Existing Land Use and Human Influences

Rural road networks
Highways (and similar large, impassible, linear features)
Urban areas; exurban/suburban developments
Agriculture – esp. tilled/cultivated, and/or irrigated

Energy development

Oil and Gas exploration
Wind-farm development
Biofuels development
Transmission line placement
Access road development

Land use changes

Conversion of grasslands to agriculture
Altered fire regimes
Urban development
Land ownership division

Invasive non-native and native species

Shrub encroachment
Graminoids not endemic to short- and mixed-grass prairie
Increase in parasites/pathogens
Changes in species range

Agricultural issues

Unsustainable grazing practices
Crop production practices/erosion issues
Changes in Conservation Reserve Program enrollment, or management practices
Groundwater depletion
Herbicides/pesticides/pollution/runoff

Science Needs Assessment

The *GPLCC Grasslands Working Group* coordinated with partner staff and research biologists to identify common, current science needs and potential research questions. The GPLCC grassland LCD will likely identify additional science needs and should provide a framework to evaluate these and other research questions at local and landscape levels. Listed below are a set of initial science needs and research questions compiled by the *GPLCC Grasslands Working Group:*

Climate

- Research on climate change effects on Great Plains vegetation composition and structure
- Research on climate change effects on phenology of Great Plains species (including vegetation, insects and avian migrants)

Landscape patterns

- Research on how habitat juxtapositions affect wildlife movement, survival, and productivity
- Development of methods to determine rates of grassland loss
- Develop, compare and test habitat connectivity designs that may benefit short and mid-grass prairie fauna, flora, and ecological processes
- Development of threat layers (wind and water erosion, oil and gas development potential, wind development potential, and groundwater quantity and quality)

Wildlife Response, Use Preferences and Behavior

- Research on wildlife response to different types of energy development
- Study wildlife-compatible grazing and stocking rates to recover native grasslands that are also economically feasible for cattle producers
- Research on wildlife response to various livestock utilization rates and grazing systems in native rangeland and CRP (e.g., birds, reptiles and ungulates)
- Clarification of the importance of the shrub component in LPC habitat

Vegetation Management and Restoration

- Need to evaluate different restoration techniques to convert cropland back to native vegetation in the mixed-grass, short-grass and sand sagebrush eco-regions
- Development of a successful native seed harvesting and production operation for regional commercial producers to supply short and mid-grass prairie seeds for restoration
- Develop proper burn scale, period, and frequency techniques for managing and restoring short and mid-grass prairies
- Research on the use of fire as a management tool, especially in drought years
- Research that contributes to the development of new techniques, or improvement in existing techniques, that increase success of restoration efforts including CRP mid-contract management (tilling, reseeding), State Acres for Wildlife Enhancement, and EQIP programs
- Study promotion and conservation of native flora and fauna in short and mid-grass prairies as a response to shrub removal techniques
- Research on adapting grazing systems (rotation, continuous, etc.) and grazing intensities to prevent decline in resiliency during periods of extended drought
- Refinement of the National Landcover Dataset including ground-truthing to accurately map grassland habitat and the condition (species composition)
- Development of methods to use remotely sensed data to determine grassland condition
- Development of cost-effective *monitoring strategies* that can be used for assessing restoration progress (e.g., composition of native forbs and grasses) and success

- Development of cost-effective *monitoring strategies* for assessing changes in composition or structural conditions to inform management actions to maintain existing prairie

Social Context, Economic Reality and Human Dimensions

- Human dimensions study to gain a better understanding of the landowner decision making process relative to conservation practice adoption
- Pilot and test a private landowner cooperative and its benefits for conserving rare animal, plant, and short and mid-grass plant communities
- Development of a landowner's guide to short and mid-grass prairie native grass enhancement and restoration that demonstrates ecological and economic benefits

Timeframe

Although it is difficult to estimate an exact timeframe for the efforts described in this report, it is recommended that the GPLCC landscape assessment be conducted first to establish a baseline for future efforts and help to identify where pilot project(s) could be initiated. With dedicated capacity, this effort could be initiated as soon as staff or resources are mobilized and initial results could be provided within 6 - 12 months. Further, the full LCD iterative process would be set in motion, which would include implementing conservation actions on the ground, monitoring and assessing results, and determining additional science needs to inform future actions and adapt conservation approaches.

References

Fitzgerald, J.A., W.E. Thogmartin, R. Dettmers, T. Jones, C. Rustay, J.M. Ruth, F.R. Thompson III, and T. Will. 2009. Application of models to conservation planning for terrestrial birds in North America, Chapter 22. Pages 593-624. In J.J. Millspaugh and F.R. Thompson, III (editors). Models for planning wildlife conservation in large landscapes. Academic Press: Burlington, MA.

Jones, K. Bruce, et al. "Informing landscape planning and design for sustaining ecosystem services from existing spatial patterns and knowledge." Landscape Ecology (2012): 1-18.

Margules, C.R., and R.L. Pressey. 2000. Systematic conservation planning. Nature 405: 243-253.

Musacchio, L.R. 2011. The grand challenge to operationalize landscape sustainability and the design-in-science paradigm. Landscape Ecology (2011) 26:1-5

Nassauer, J.I., and Opdam, P., 2008. Design in science: extending the landscape ecology paradigm. Landscape Ecology (2008) 23:63-644.

North Carolina Cooperative Fish & Wildlife Research Unit, Alabama Cooperative Fish & Wildlife Research Unit, Atlantic Coast Joint Venture, and U.S. Geological Survey. 2012. Designing Sustainable Landscapes: Data and Publication Downloads. 28 November 2012. http://www.basic.ncsu.edu/dsl/downloads.html#lpd.

North Carolina State University. 2011. Designing Sustainable Landscapes for Bird Conservation in the Eastern United States: Final Report. 26 November 2012. http://www.basic.ncsu.edu/dsl/downloads/MSCGP_NC_M-1-HM_2011_FinalRpt.pdf.

Obermeyer B, Manes R, Kiesecker J, Fargione J, Sochi K (2011) Development by Design: Mitigating Wind Development's Impacts on Wildlife in Kansas. PLoS ONE 6(10): e26698. doi:10.1371/journal.pone.0026698.

U.S. Fish and Wildlife Service. 2008a. Strategic Habitat Conservation Handbook: A Guide to Implementing the Technical Elements of Strategic Habitat Conservation. Available at: http://www.fws.gov/science/doc/SHCTechnicalHandbook.pdf.

Will, T.C., J.M. Ruth, K.V. Rosenberg, D. Krueper, D. Hahn, J. Fitzgerald, R. Dettmers, C.J. Beardmore. 2005. The five elements process: designing optimal landscapes to meet bird conservation objectives. Partners in Flight Technical Series No. 1. Partners in Flight website: http://www.partnersinflight.org/ pubs/ts/01-FiveElements.pdf.