

# Applying the Sage-Grouse Fence Collision Risk Tool to Reduce Bird Strikes

## Summary Findings

- Fence collisions by sage-grouse can be widespread, and a proven fence-marking method is now available to reduce strikes by up to 83 percent.
- Science also suggests that collisions are highly variable, so practitioners implementing the NRCS Sage Grouse Initiative (SGI) desired a targeting tool to prioritize their fence-marking efforts in areas of highest strike risk.
- The Conservation Effects Assessment Project (CEAP) responded by supporting development of a spatial targeting tool for practitioners that used a dataset from a rigorous study in Idaho to fit collision-risk models to all known sage-grouse lekking areas in 10 western states.
- The resulting product maps relative collision risk as a function of terrain ruggedness and distance to nearest lek, providing practitioners with a simple decision-support tool for use in geographic information systems (GIS). Findings indicate that only a small proportion of the landscape (6–14 percent) is predicted to pose a relatively high collision risk (more than one collision over a lekking season).
- This Conservation Insight informs practitioners on proper use of the new targeting tool to efficiently reduce fence strike risks, maximizing our return on investment and freeing up resources to achieve additional benefits.



## Background

Bird collision with human structures is common, and European science reports cite grouse among the most common infrastructure-collision victims (e.g., Bevanger and Brøseth 2000). New studies document the susceptibility of North American prairie-grouse to collision with fences (Patten et al. 2005, Stevens et al. 2012a). Fence collision was attributed to 40 percent of mortality for lesser prairie-chickens in Oklahoma (Wolfe et al. 2007), and fence-collision rates of 0.64 strikes/mile were reported for sage-grouse in Idaho (fig. 1; Stevens 2011).

A proven fence-marking method is now available to reduce strikes by up to 83 percent (fig. 2; Stevens et al. 2012a, b). Findings show that sage-grouse collision is highly variable spatially, suggesting that targeting marking efforts as a function of risk enables cost-effective implementation of conservation actions. Thus, small but targeted investments could potentially alleviate much of the breeding season fence-collision risk in lekking areas, freeing up resources to achieve additional conservation benefits in other areas. Reducing fence collisions alone will not recover sage-grouse populations, but alleviating collision risk as part of an inte-

grated conservation strategy reduces the need to list the species under the Federal Endangered Species Act (USFWS 2010a).

## The Idaho Study

Fence collisions and marking efforts are documented in unpublished reports, but the first replicated and published study was completed across four areas in central Idaho (Stevens et al. 2012a).

Scientists in this study monitored high-risk fences near leks during the breeding season and documented sage-grouse fence strikes before and after marking in a before-after control-impact design. Further analysis revealed that terrain ruggedness and distance from the lek were primary factors associated with fence collision risk across the landscape (fig. 3; Stevens et al. in press). Markers reduced collisions by 83 percent, or six-fold, over unmarked fences (Stevens et al. 2012a). These findings validate the application of fence markers to substantially reduce fence collisions, and suggest that this relatively inexpensive practice could be applied with a high likelihood of success if targeted in the right places.

**Figure 1.** Dead sage-grouse following collision with a fence.



PHOTO BY JEREMY R. ROBERTS

***Terrain ruggedness and distance from the lek were primary factors associated with fence collision risk across the landscape. Markers reduced collisions by 83 percent, or six-fold, over unmarked fences.***

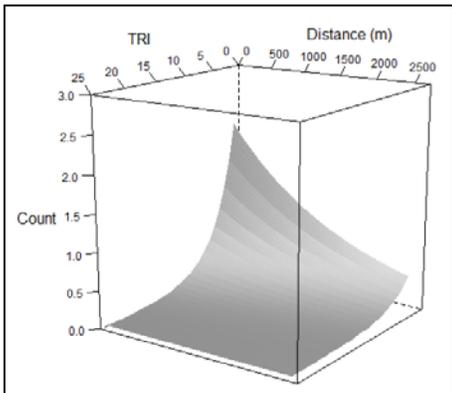
## CEAP Science Partnership

The Idaho study has spurred fence-marking efforts on public and private lands across 11 western states. However, sage-grouse occupy approximately 186 million acres, and practitio-

**Figure 2.** Installation of a fence marker.



**Figure 3.** Count of sage-grouse collisions as a function of terrain ruggedness (TRI) and distance to the nearest lek



**Table 1.** Amount of the landscape within 3 kilometers of leks in each State predicted to be “high risk” for strikes if fences are present (>1 collision over the lekking season). Modified from Stevens et al. in press

State	Area	
	Percent	Acres
Idaho	14.4	529,258
South Dakota	13.1	17,132
California	11.4	37,814
Montana	11.2	1,150,595
Oregon	10.9	225,619
Wyoming	9.2	730,861
Nevada	8.5	266,275
Washington	7.5	11,651
North Dakota	7.3	9,795
Utah	6.3	70,128

ners desire spatially-explicit targeting tools to maximize their return on conservation investments.

Since 2010, the Conservation Effects Assessment Project (CEAP) has helped support science-based outcome reporting and development of technical tools to enhance delivery of the NRCS Sage Grouse Initiative (SGI). CEAP contracted with scientists at the Universities of Idaho and Montana to create a spatial game plan to guide practitioner efforts by fitting collision-risk models developed in Idaho (Stevens et al. 2012a, b) to all known sage-grouse lekking areas in 10 western States (Stevens et al. in press). This CEAP partnership work resulted in the development of the Fence Collision Risk Tool, which maps potential fence collision risk in breeding habitats across the West (Stevens et al. in press).

**Fence Collision Risk Tool**

The Fence Collision Risk Tool was produced using modeling that maps collision risk within 3 kilometers of known leks as a function of terrain ruggedness and distance to nearest lek across 10 western States. The model uses State wildlife agency lek data through 2007 (active only) at 30-meter resolution. Findings indicate that a relatively small proportion of the landscape (6 to 14 per-

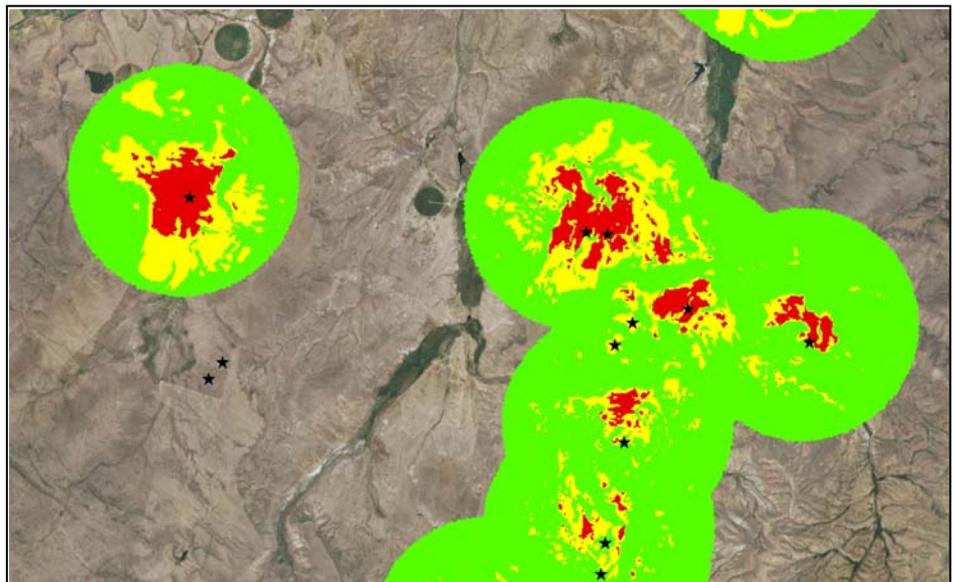
cent) is at high collision risk, where more than one collision per lekking season is expected (table 1).

Published research to date is limited to breeding habitats. Unpublished reports suggest sage-grouse fence collisions are also important in other seasonal habitats including late brood rearing and winter concentration areas, but that could not be incorporated into the tool at this time.

The Fence Collision Risk Tool, focused on breeding habitats, consists of raster files that can be applied by conservation practitioners in a GIS setting to prioritize efforts to reduce fence collisions around leks (fig. 4). The projection for all the data is USGS Albers that is specially designed for the conterminous 48 States and provides continuity across the data. All rasters are in an ERDAS Imagine (img) format. The naming convention is standard where “collision.img” are the continuous rasters and “collision\_class.img” are the three class rasters with predefined colors (low risk=green, moderate risk=yellow, high risk=red) that display automatically when added to ArcMap.

For conservation planners, the classified raster data are the most useful for prioritizing fence collision risk reduction efforts. Particular emphasis is warranted in

**Figure 4.** Sample of classified rasters from the Fence Collision Risk Tool. Practitioners should also overlay current State wildlife agency lek location data (stars) to ensure that recently detected leks are included when mitigating fence collision risks. Note the variability in the amount of predicted high-risk areas within and between leks (1.8-mile radius).



high-risk areas indicated in red—predicted to have more than one collision per lekking season if fences are present. Strategically focusing initial fence risk reduction efforts in red, high-risk areas will help maximize biological return on investment. While the tool does not include information about existing fence locations, local data on planned or existing fences can simply be overlaid in GIS to help planners identify specific fences that need to be addressed. Since this is a model of predicted risk around breeding habitats surrounding certain leks, this tool can be combined with newer lek location data, known or predicted problem areas in other seasonal habitats, field inventories, and best professional judgment to ultimately determine specific high-risk fence segments to be addressed.

### Recommendations for Reducing Fence Strike Risks

In its 2010 Conference Report on the SGI, the U.S. Fish and Wildlife Service (USFWS) recognized accidental mortality as a potentially adverse effect of fences (USFWS 2010b). Conservation measures to mitigate that adverse effect were developed that include—

- avoiding placement of new fences near all leks;
- removing or relocating existing fences near all leks where feasible; and
- at a minimum, marking all existing fences within ¼ mile from all leks and in areas where collisions are known to occur.

NRCS agreed to incorporate these conservation measures into the SGI to ensure that efforts result in benign or beneficial effects on grouse. Furthermore, NRCS National Bulletin 190-12-22, September 13, 2010, required NRCS to coordinate with respective State wildlife agencies on certain conservation measures in the Conference Report. Many states recommended addressing fences beyond the ¼-mile minimum.

The Fence Collision Risk Tool uses the latest science to move beyond criteria based solely on distance from lek and incorporates another important variable, topography, in predicting areas where fences may pose problems. This allows conservationists to refine conservation measures and better target investments

to ameliorate fence collision risks in areas most likely to affect grouse. The Fence Collision Risk Tool can be used as a first step in the process of identifying areas of potential high risk and developing appropriate measures to reduce that risk. NRCS is also applying all the Conference Report measures to reduce adverse effects of new and existing fences, but recommends applying the ¼-mile treatment area criteria only when collision risk model data are not available for a lek.

### Guidelines for Applying the Fence Collision Risk Tool

Following are step-by-step instructions for use of the tool to maximize reduction of fence collision risks.

- From the conservationist's desktop in GIS, combine the Fence Collision Risk Tool classified data with any State-level lek location data available over aerial imagery to identify areas of potential concern within the planned land units (fig. 4). Since the collision risk model is based on 2007 lek data, check for data on new leks for which risk was not mapped by the model. Incorporate any additional information about known problem areas. Overlay any planned or existing fence locations for which data are available. Sometimes indications of existing fence lines can be seen on aerial imagery. *Note: It may be helpful to set the model layer display transparency to 70 percent in order to pick out features on the aerial photo in high-risk areas.*
- Identify planned or existing fences that intersect red areas in the collision risk tool as potentially high-risk fences in need of treatment. Of particular concern are contiguous areas of red representing large, flat areas near leks. In some cases, the model has generated patchy areas of red intermixed with areas of lower risk. Best professional judgment will need to be used to determine if those areas should be treated as high risk (i.e., gentle topography near a lek) or if it is simply a result of modeling with little ecological relevance. Sage-grouse typically fly low just above the sagebrush in flatter topography but will fly much higher when topography becomes steep. Bear in mind

that the tool represents model results (30-meter resolution) and does not supplant basic biology of the birds.

- Using the most recent state lek location data, locate any leks present in the planned land units that were *not* covered by the collision risk tool. Note any planned or existing fences within at least ¼ mile of those leks as potentially in need of treatment. Apply best professional judgment here as well by looking for fences in flat, open spaces in the ¼-mile radius around the lek which may present a risk. Use local knowledge to note any additional high-collision-risk areas where planned or existing fences may overlap.
- Generate a map, using the Fence Collision Risk Tool layer and additional information listed above, highlighting potential high-risk areas of concern with known or suspected fence lines.
- Conduct a field visit to ground-truth. Verify areas requiring fence risk treatment and adjust as needed based on site conditions. Dismiss areas where potentially high-risk fences would obviously not be problematic due to other site conditions. For example, a fence running through a woodland or forested ecological site that is not suitable grouse habitat would not need to be treated. Likewise, existing fence lines in tall brush with top wires barely exposed would not present a risk for birds flying above the brush. Conversely, there may be a need to include additional treatment where local knowledge or site conditions warrant.
- Check other seasonal habitats, outside of lek sites, that have high concentrations of sage-grouse moving through landscapes with fences. For example, sites where a flock of sage-grouse is known to regularly forage in an alfalfa field or irrigated meadow that requires them to cross fences on a daily basis to access the fields, or where a wintering concentration of birds is located in a flat landscape with fences. Where applicable, and with the landowner's permission, consult with the local State wildlife agency biologist to gain fur-

ther insights into actual sage-grouse use in the project area.

- With this refined map of potential high-risk areas and fence lines in need of treatment, work with the landowner to develop alternatives for reducing risks associated with fences. Avoid planning new fences in high-risk areas altogether if practicable. Propose removing or relocating existing fences outside high-risk areas if feasible. As a last option, mark planned or existing fences located within high-risk areas using proven marker devices and techniques (Example: fig. 5, NRCS 2011).
- Additionally, it is recommended that abandoned or unused fences be removed anywhere they occur because they can be problematic for wildlife and livestock. Woven wire fences are of particular concern because they can serve as barriers to grouse traveling along the ground. Mammalian predators may also hunt along woven wire fence lines and may be more effective at taking grouse trying to cross.

Other considerations:

- Consider marking all new fences with temporary flagging to allow big game and livestock time to become acclimated to the fence location.
- Marking fences also benefits antelope, mule deer, elk, and other wildlife by reducing entanglement risk. Consider applying this practice to heavily traveled corridors.

- Marking fences can also significantly reduce fence maintenance costs accrued by ranchers by avoiding wild ungulate caused fence damage.

For more information about the Sage Grouse Initiative visit:

[www.sagegrouseinitiative.com](http://www.sagegrouseinitiative.com).

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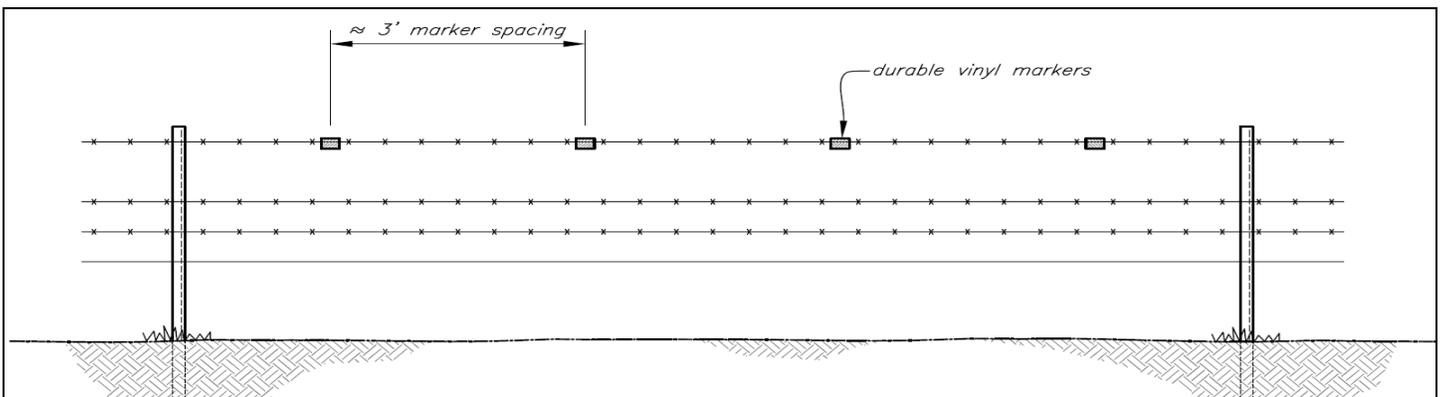
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**Figure 5.** Example of typical fence marker placement. On most wire fences, it will be necessary to mark only the top wire. Snap markers on top wire between barbs at approximately 3-foot intervals; posts can serve as markers. Three inches is the standard marker width to fit between barbs. Fence posts can be incorporated into the spacing interval between markers.



### The Conservation Effects Assessment Project: Translating Science into Practice

The Conservation Effects Assessment Project (CEAP) is a multi-agency effort to build the science base for conservation. Project findings will help to guide USDA conservation policy and program development and help farmers and ranchers make informed conservation choices.

One of CEAP's objectives is to quantify the environmental benefits of conservation practices for reporting at the national and regional levels. Because fish and wildlife are affected by conservation actions taken on a variety of landscapes, the wildlife national assessment draws on and complements the national assessments for cropland, wetlands, and grazing lands. The wildlife national assessment works through numerous partnerships to support relevant studies and focuses on regional scientific priorities.

This assessment was conducted through a partnership among NRCS, the University of Montana, and the University of Idaho. Primary investigators on this project were David E. Naugle (UM), Bryan S. Stevens (UI), and Tim Griffiths (NRCS), with additional support in product implementation provided by Jeremy Maestas (NRCS) and Thad Heater (NRCS).

For more information: <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap>, or contact Charlie Rewa at [charles.rewa@wdc.usda.gov](mailto:charles.rewa@wdc.usda.gov).



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