



# Wyoming Landscape Conservation Initiative

*"Conserving world-class wildlife resources. Facilitating responsible development."*

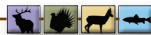


## WLCI Researchers Employ New Approaches to Help Managers Conserve Deer Migrations

Elk, mule deer, pronghorn antelope, moose, and bighorn sheep are iconic animals of the American West. These hooved animals, known as ungulates, commonly travel 30–60 miles between seasonal ranges. These migrations between winter and summer ranges are vital for survival and reproduction. As habitat fragmentation continues, the conservation of ungulate migration routes has received considerable attention in the West and across the globe. For example, it is estimated that many ungulate migration routes in the Greater Yellowstone Ecosystem have already been lost. The traditional migration routes of Wyoming ungulates are threatened by unprecedented levels of energy development and by increasing levels of rural ranchette development (including fences, structures, and roads). In the past, migration corridors have been mapped based primarily on the expert opinions of state game managers, but long-term conservation of Wyoming's ungulate migration routes requires a better understanding of migration ecology and more sophisticated management tools. Wyoming Landscape Conservation Initiative (WLCI) researchers investigated the migration of a large mule deer herd across the Dad and Wild Horse winter ranges in southwest Wyoming, where 2,000 gas wells and 1,609 kilometers of pipelines and roads have been proposed for development.

Although humans have tracked seasonal animal migrations for thousands of years, managers today who seek to conserve historical routes must understand the intricacy of the route taken by an animal as it moves to better ground. Wildlife biologists commonly use GPS radio collars to track animals. However, these collars only collect location data at specific time intervals (for example, every two hours). They do not show biologists the detailed path an animal took along its seasonal migration.

For example, it is easy and compelling to simply connect the dots between GPS locations. However, by just drawing a straight line, a scientist assumes the animal simply walked from point A to point B. The path taken by a migratory deer is not so linear and simple. Data from GPS alone do not allow scientists to answer questions such as: Did deer spend some time foraging at an abundant patch of vegetation along the route? Do all of the animals follow the same path, or do they spread out across the range? Connecting the dots does not tell scientist when an animal traveled from point A to point B, how long it traveled to get there, or if all of the animals traveled the same path to get there. Researchers from the WLCI found that deer in southern Wyoming follow a network of migration routes that radiate from relatively small winter ranges to much larger summer ranges (fig. 1). Indeed, migration-route networks such as this are common in the intermountain West, but mapping them in order to quantify a herd's use of a landscape has proven difficult. Time and money are limiting factors; it is simply cost prohibitive to employ enough field staff to follow thousands of animals as they travel between their seasonal ranges.



*The WLCI is a long-term, science-based program to assess and enhance aquatic and terrestrial habitats at the landscape scale in southern Wyoming, while facilitating responsible development through local collaboration and partnerships.*

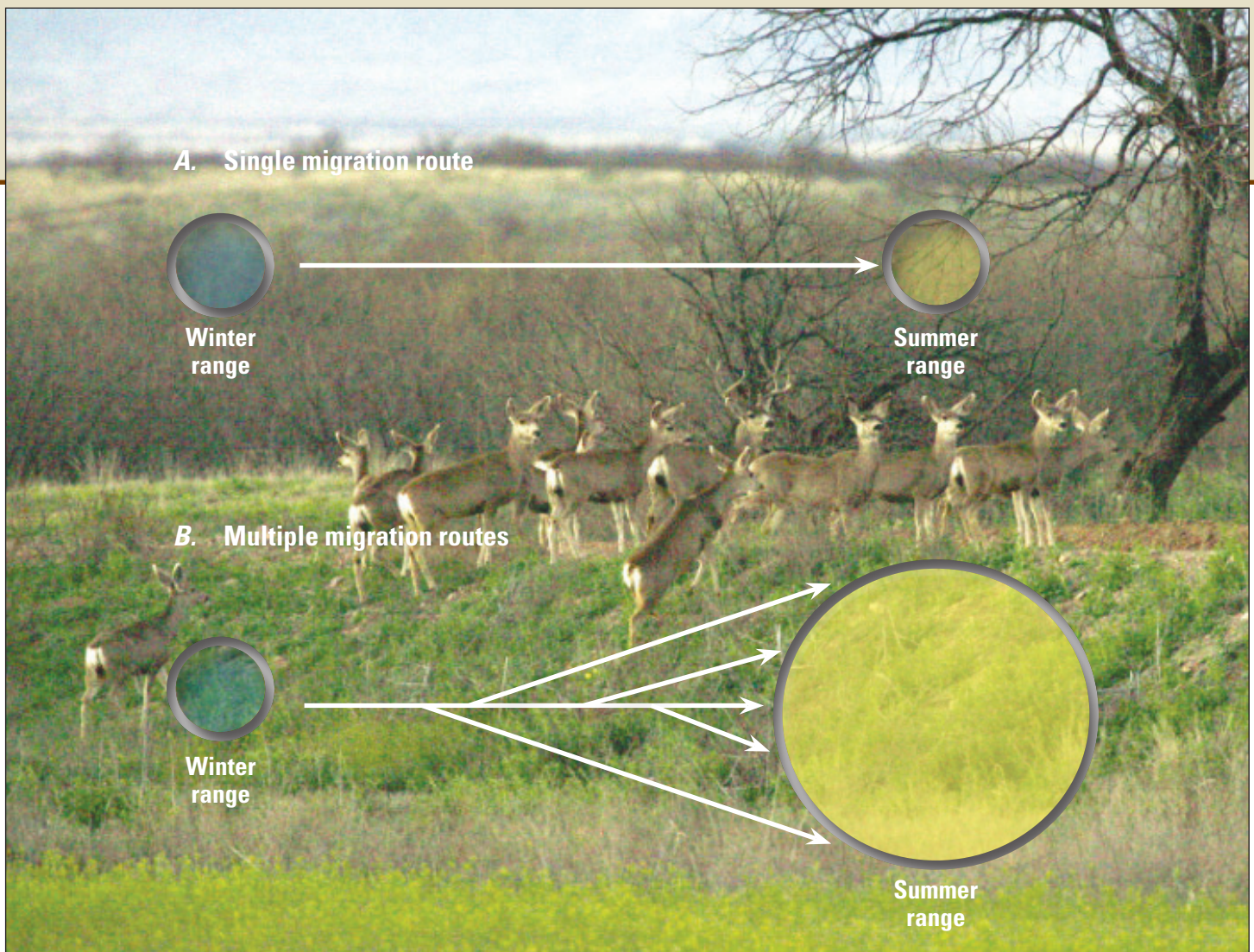
## Fast Facts



- The WLCI area encompasses 19 million acres—roughly the size of South Carolina.
- 1,700 family farms and ranches support 225,000 cattle and 120,000 sheep.
- An estimated 100,000 deer; 100,000 antelope; 40,000 elk; 8,000 moose; 1,400 bighorn sheep; and 151 non-game species of greatest conservation need make their home here.
- Historic and recreation sites include five national forests, a national recreation area, and a national monument.
- Portions of the historic Oregon, California, and Mormon Trails and the Pony Express route run through the area.
- Enough natural gas is produced to heat 4 million homes per year.
- Approximately 14 million tons of coal are mined.
- The area has premium wind sites that could produce billions of kilowatt hours of electricity.
- The area has the world's largest deposit of trona, supplying 90% of the nation's soda ash.

Prepared in cooperation with the





Photograph courtesy of U.S. Fish and Wildlife Service.

**Figure 1.** A, a single migration route: a common, but incorrect, perception of deer migration. Rather than a single migration route, WLCI researchers found that deer in southwest Wyoming move along a network of migration routes from relatively small winter ranges to large summer ranges as shown in B.

To overcome the limitations of time and money, WLCI researchers used an innovative application of the Brownian Bridge Movement Model (BBMM) to identify and prioritize migration routes for conservation. This mathematical model provides an estimation of all the possible paths an animal could have travelled between two known locations; that is, it gives an estimation of the potential deviations an animal may have made from the straight-line distance between two known locations. With this tool, biologists can now have some statistical confidence in delineating the path an animal takes to get from one location to another. The BBMM allows wildlife managers to have a better idea of how

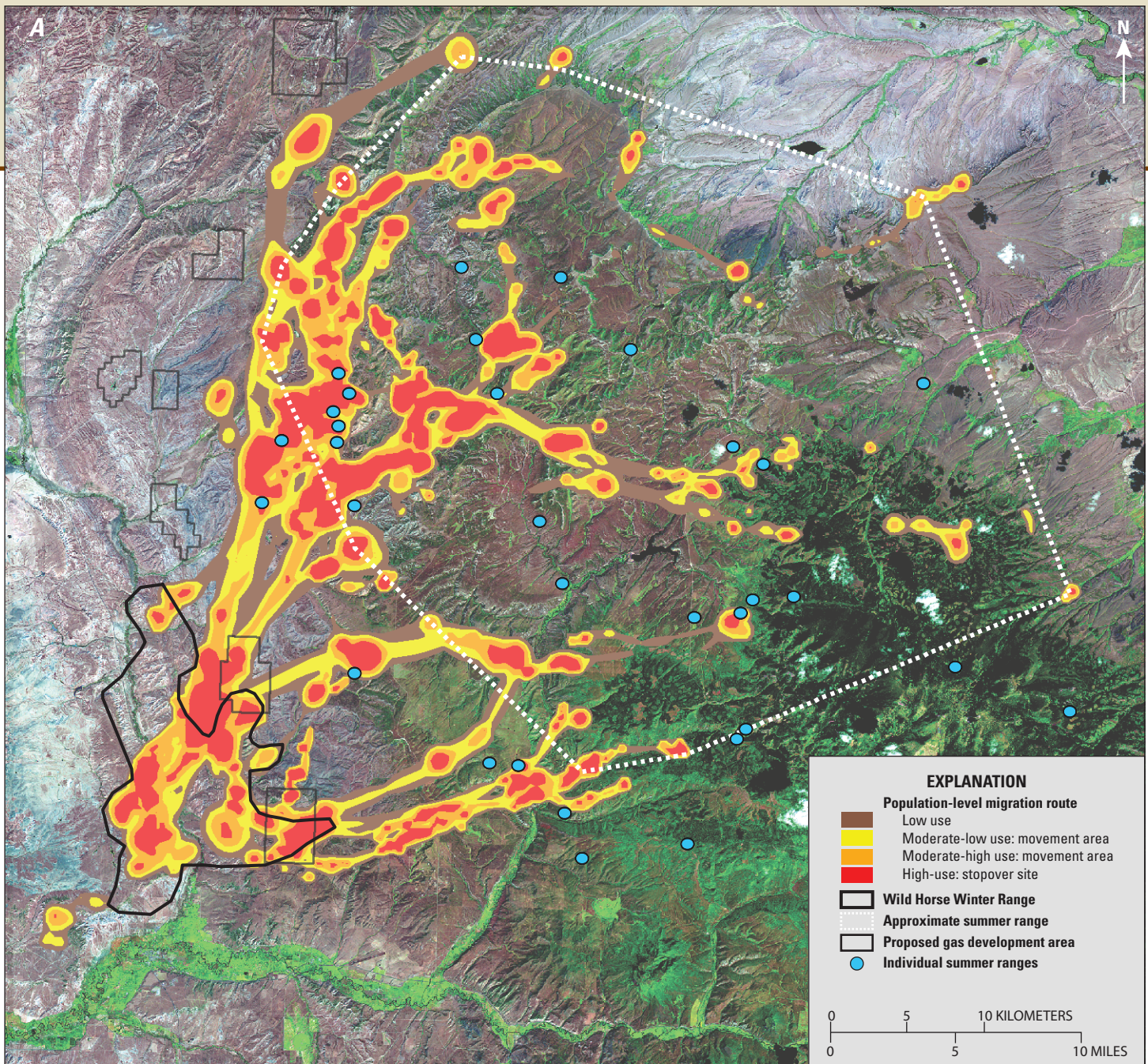
animals use a given landscape. The tool also provides a means by which to ascribe a functional width to migration routes for conservation planning.

Researchers with the WLCI used this model to provide a probabilistic estimate of the migration routes of two winter deer herds; this estimate then allowed them to prioritize routes for conservation based upon the number of migrating deer that used them. On both the Wild Horse and Dad winter ranges, researchers found that deer used multiple migration routes to disperse from a concentrated winter range to many individual summer ranges in the Sierra Madre Mountains. Researchers looked at these “traffic networks” to see which corridors were the largest and

used by the most animals. Maps of these prioritized migration routes are being used by managers to (1) conserve and enhance habitat in critical route segments, to (2) identify proposed energy-development areas that would have the least effect on migrating deer, and to (3) identify where highway-crossing structures (for example, underpasses) would be most effective.

An unexpected finding that resulted from the application of the BBMM method to deer-migration routes was that the method also allowed researchers to distinguish between route segments that function as stopovers sites (or areas where deer spent most of their time) and those that function as migration corridors





**Figure 2.** A, WLCI researchers found that deer migrate seasonally along multiple networks from a concentrated winter range to diffuse individual summer ranges. Areas in red are high-use stopover sites; areas where deer linger for a significant time as they make their way to their summer ranges. Used with permission by the Ecological Society of America.

(through which deer moved quickly). These stopover sites corresponded to high-use areas where forage quality was better than other parts of the route. Researchers with the WLCI predict that disturbance in stopover sites is more likely to affect migrating deer than disturbance in low-use migration corridors, so long as functional connectivity is maintained. Thus, knowing which corridors have stopover sites presents

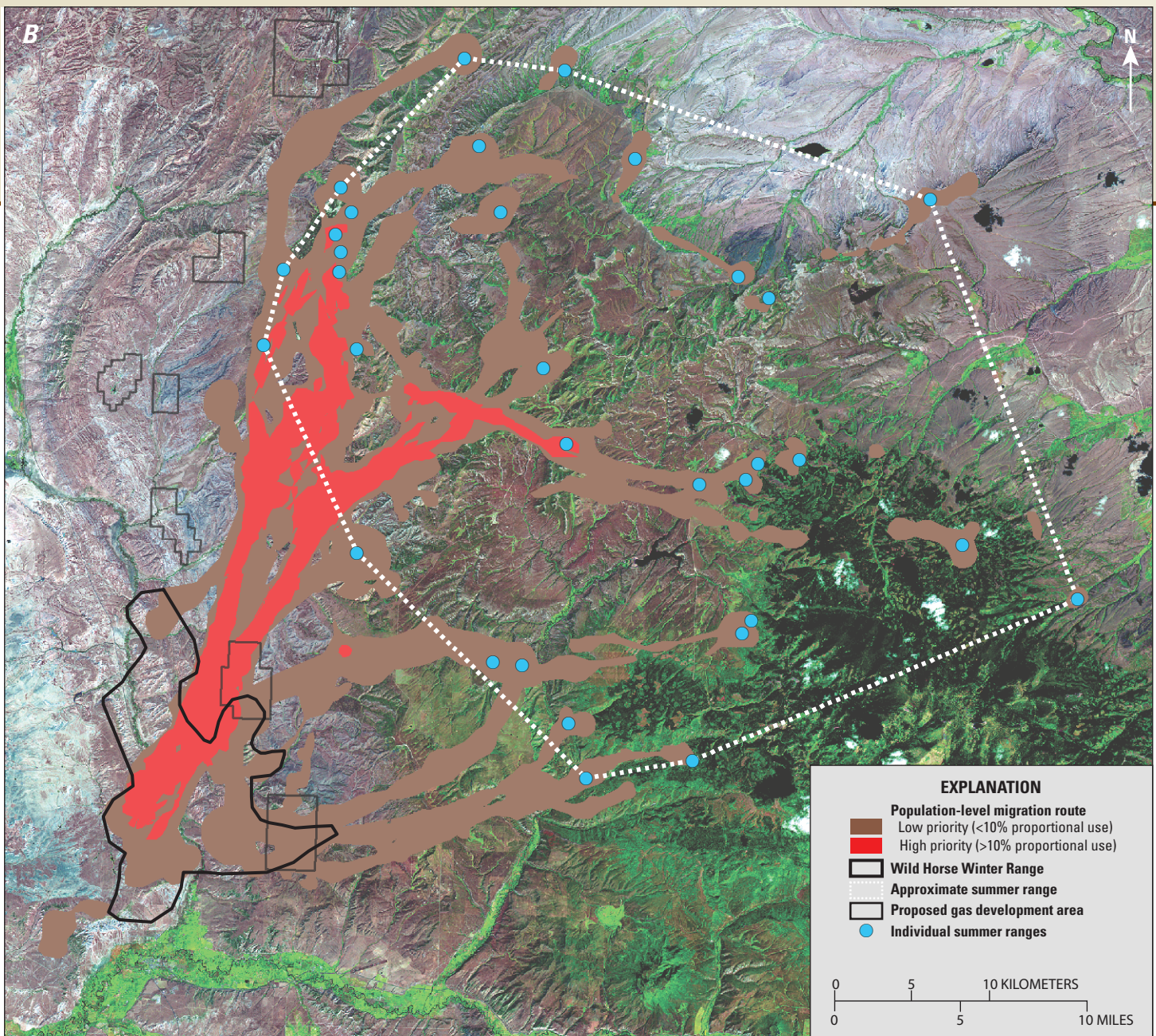
land managers with a means of targeting key habitat where deer seek forage during their seasonal migrations.

Conserving connected habitat is the best way to manage wildlife, and WLCI research suggests that conserving migration routes can best be achieved by minimizing habitat loss in stopover sites and managing movement corridors to maintain connectivity. Through this work, WLCI researchers are providing valuable

scientific information that Wyoming land managers can use to determine the best development scenarios for energy development, where best to establish conservation easements, and where to remove fences. Local land trusts and the Bureau of Land Management are currently using this information to prioritize land-management activities in southwest Wyoming.

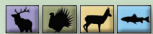
—Leslie A. Allen and Matthew J. Kauffman





**Figure 2.** B, WLCI researchers were able to prioritize migration routes (shown in red) as deer move from their winter range to summer ranges. This information may help land managers determine the best development scenarios for energy development, where best to establish conservation easements, and where to remove fences. Used with permission by the Ecological Society of America.—Continued

## Donate!



The WLCI has an agreement with the Wildlife Heritage Foundation of Wyoming to manage contributions for WLCI work. Donations can be made through [www.wlci.gov](http://www.wlci.gov) or send a tax-free contribution to:

**Wildlife Heritage Foundation/WLCI**  
P.O. Box 20088  
Cheyenne, WY 82003

## Partnerships

The WLCI partnership formally includes the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), U.S. Forest Service, Wyoming Department of Agriculture, Wyoming Game and Fish Department (WGFD), local conservation districts, and local county commissions. Additional groups and individuals participate as well.



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