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Wyoming Wildlife

Gas Fields and Wildlife

By Chris Madson

The search for fossil energy is not a new phenomenon in Wyoming. The first coal mine in the state opened in 1868; the first oil well began producing in 1884. Following World War II, Wyoming oil production increased from less than 50 million barrels in 1945 to 142 million barrels in 1961. Drilling on the Overthrust Belt in southwestern Wyoming in the late 1970s generated a major economic boom with all the profit— and problems— that accompany a modern energy rush. The opening of the coal deposits in the Powder River Basin had similar effects in northeastern Wyoming in the 1980s. But, as monumental as these energy strikes have been for Wyoming, they pale into insignificance compared with the rush to produce natural gas that has descended on the state over the last fifteen years.

The boom has been driven by an intersection of several influences. Demand for oil and natural gas has increased; prices have gone up; new technologies have allowed the industry to get natural gas out of formations where it was once inaccessible, and new pipelines have cut the cost of delivering gas to major markets.

There are several ways to measure the impact of Wyoming's recent energy boom. In 1997, the state had 17,436 oil and gas wells; in 2005, there were 49,408 active wells, of which more than 30,000 were gas wells. Total Wyoming gas production has almost doubled in the same period. Severance taxes on minerals paid to the state increased almost four-fold. And all of this is just the beginning— permits for another 55,000 wells have already been issued, and the state and federal agencies in charge of administering energy development are gearing up to issue thousands more.

A single oil or gas well is fairly unobtrusive, but the impact of tens of thousands of wells with their attendant roads, pipelines, storage tanks, compressor stations, and power lines adds up fast. The bureaucrats who deal with this cumulative impact refer to it as the industry's "footprint," and in Wyoming, the footprint of the new energy rush is significant.

Technicians with the Wyoming Geological Survey recently mapped the seven areas in Wyoming that have the greatest potential for oil and gas production in the near future. Some, like the Powder River Basin, are already heavily developed; others, like the Great Divide Basin in southcentral Wyoming, are still being studied. Ron Surdam, Wyoming state geologist, has reported the survey's calculations. "Those areas make up approximately twenty to twenty-five percent of the state," he says.

Reserves of oil and gas aren't randomly distributed under Wyoming. Besides the reserves along the Overthrust Belt in southwestern Wyoming, Surdam adds that "almost all of the development will be down in the Laramide basins," which is a geologist's way of saying, "Out in the sage." The new quest for fossil fuel may affect

thirty-five percent of Wyoming's sagebrush habitat before it's over.
This surge in energy development raises a question: How will the new energy boom affect wildlife? When the first drilling permits were issued, biologists and conservationists who had lived through the last boom in Wyoming suspected that this new gas rush could cause significant problems, but in the 1990s, there was little research to guide wildlife professionals or drillers as permitting decisions were made.

Unfortunately, it takes a lot longer to collect data than it does to drill wells. While industry has been in high gear on the new fields for almost a decade, the scientific analysis of the impact is just beginning to mount.

Sage grouse

Two groups have been studying the effect of energy development on sage grouse. The Cooperative Fishery and Wildlife Research Unit at the University of Wyoming has supported several researchers on the Pinedale Anticline and Jonah fields in southwestern Wyoming for more than ten years. Until his untimely death last year, Dr. Stan Anderson, unit leader, organized the work. Alison Lyon, Matt Holloran, and Rusty Kaiser have been the principal researchers. Various phases of this research were supported by Ultra Petroleum, the Wyoming Game and Fish Department, Bureau of Land Management, and Shell Rocky Mountain Production.

More recently, Dr. David Naugle, professor of wildlife biology at the University of Montana, has organized a major investigation of sage grouse in the Powder River Basin of northeastern Wyoming. His work in the area began four years ago and includes graduate students Kevin Doherty and Brett Walker. This group's research has been supported by the Bureau of Land Management; U.S. Department of Energy; Montana Department of Fish, Wildlife and Parks; Wyoming Game and Fish Department; Wyoming State Veterinary Laboratory; National Fish and Wildlife Foundation; National Science Foundation; Montana Cooperative Wildlife Research Unit; Petroleum Association of Wyoming; Wolf Creek Charitable Foundation; Anheuser-Busch Companies, Inc.; the University of Wyoming; the University of Montana; Decker Coal Company; Thunderbird Wildlife Consulting; the National Fish and Wildlife Foundation; and Western Gas Resources.

Both groups have attached radio transmitters to sage grouse in order to track their movements and used geographic information system (GIS) data to help describe the landscape the birds are using. Naugle and his students have used digital information from satellite images to look at habitat and changing patterns of sage grouse use over thousands of square miles.

Alison Lyon's research focused on hen sage grouse on the Mesa, a flat-topped ridge near Pinedale, Wyoming, that has seen extensive drilling for natural gas in the last decade. In early spring, hens are drawn to gatherings of displaying males biologists call leks. The males establish a hierarchy on each lek, and when females show up, they breed with the dominant males, then move out into the sage to build nests and lay eggs.

Lyon found that hens that attended disturbed leks moved an average of 2.6 miles away to build their nests. Hens that bred on undisturbed leks moved an average of

1.3 miles away to nest. Thirty-five percent of the hens that bred on disturbed leks did not nest at all.

Lyon found no difference in cover— the only apparent difference was disturbance during breeding. She concluded, "Our study suggested that traffic disturbance of one to twelve vehicles per day during the breeding season might reduce nest-initiation rates and increase distances moved from leks during nest-site selection. . . . As gas development continues, new impacts on sage grouse populations could occur."

Matt Holloran analyzed the effects of gas development on sage grouse in an area that included major gas development on the Pinedale Anticline and parts of the Jonah field between Pinedale and Farson, Wyoming. He compared sage grouse activity during spring courtship, breeding, nesting and brood-rearing.

Leks within 3.9 miles of drilling rigs had fewer males than the number of males on undisturbed leks. Leks within 3.8 miles of a main hauling road had fewer males than undisturbed leks. Although producing gas wells have much less human activity than haul roads or drilling sites, they still disturbed courting sage grouse— leks within 2.9 miles of a producing well had fewer males than undisturbed leks.

Holloran found fewer yearling males on disturbed leks. Once a male begins using a lek, he develops a strong attachment to it and will do his best to return each spring, even in the face of major disturbance, but with no yearlings to replace the veterans, the number of males on the lek declines over several years until the tradition that maintains it finally dies and the lek disappears.

Holloran's data suggest that female sage grouse may have traditions of their own. Yearling females nested farther from main haul roads than did adult females, a sign that the adults returned to places they had nested in the past while yearlings building their first nests were inclined to move away from disturbance. Hens that were exposed to disturbance around the spring leks were less likely to survive and tended to have lower nesting success than undisturbed hens. Survival of broods was slightly better closer to gas field operations than it was farther away, but the added chicks didn't compensate for the loss of breeding hens and their nests. According to Holloran's models, the population of sage grouse in his study— about 1,200 birds— is likely to disappear within nineteen years if the current trends in survival continue.

"My results suggest that greater sage grouse in western Wyoming avoid breeding within or near the development boundaries of natural gas fields," Holloran concludes. "At a minimum," Holloran suggests, "all areas within three miles of known leks should be . . . protected from development." Only sixty-four percent of the nests he found were within this three-mile radius and nests more than five miles from any lek were more likely to hatch than nests closer to a lek.

Researcher Rusty Kaiser continued the analysis of energy development and sage grouse on the Pinedale Anticline. He found that, the closer a lek was to gas field operations, the fewer young males visited it. Females nesting within two to three miles of haul roads, wells, or drill rigs raised fewer broods with fewer chicks than females nesting farther away.

Dave Naugle and his associates have reviewed seventeen years of information on Powder River grouse as part of their four-year study. From 1988 to present, sage-grouse numbers in the region have dropped to only sixteen percent of the population that existed there seventeen years ago.

In the four years of his study, the number of males on leks inside gas fields dropped by eighty-eight percent. The number of males on leks outside gas fields dropped twenty to thirty-seven percent. Seventy percent of the leks on the gas fields simply disappeared during the study. And even in years when bird numbers increased outside gas fields, bird numbers remained low inside the fields.

Drought, disease, and other disturbances were affecting the sage grouse over this four-year span, but it was clear from the data that the development of coalbed natural gas was a major factor in the decline of the region's birds.

Naugle has expanded his work to consider the impact of gas development on sage-grouse winter range. Past researchers have assumed that winter range isn't a problem for sage grouse, since they thrive on evergreen sagebrush leaves during the winter, often gaining weight between the first snow and spring. However, Naugle has found that sage grouse avoid top-quality winter range when natural gas operations intrude.

"Recent research has shown that sage grouse either avoid energy development during the breeding season or experience rates of mortality that result in extirpation," he writes. "New knowledge that sage grouse also avoid energy development during the winter shows that conservation strategies to date to protect this species have been largely ineffective."

Naugle and his team were in the process of collecting this information in 2003 when the exotic bird disease, West Nile virus, found its way into northeastern Wyoming. In that year, radio-marked populations in Alberta, Montana, and Wyoming all lost twenty-five percent of their populations to West Nile virus.

The following spring, they found a ninety-five percent decrease in the number of female sage grouse attending leks in the affected area. Peak number of males on these leks dropped by seventy-six percent.

Five leks near Spotted Horse, Wyoming, simply ceased to be.

"Those leks served about fifty square miles," Naugle estimates. "Since 2003, there have been no males on any of them. It's a local extirpation."

A companion experiment at the Wyoming State Veterinary Laboratory showed that, when wild sage grouse were infected with the virus, every bird died. This proved what field researchers had already suspected— sage grouse are highly susceptible to West Nile virus.

In Wyoming, mosquitoes seem to be the vector of the disease. Relatively cool summers in 2004 and 2005 cut the population of these insects and probably explain the reduced incidence of the disease among sage grouse. With the return of warmer weather in the summer of 2006, the disease has re-emerged in sage grouse across the West.

“It’s a bad year,” Naugle says. He has already heard reports of West Nile outbreaks among sage grouse in Wyoming, Idaho, Oregon, California, and Colorado, and he points out that there is no coordinated effort to find dead grouse— these were reported because the birds were part of radio telemetry studies.

There are two connections between West Nile virus, coalbed natural gas development, and sage grouse. First, the virus is a new source of stress for the grouse at a time when other stresses are already driving populations down. These losses come at a time of year when survival should be high. The combination of these stresses may well prove to be more dangerous than the sum of their individual effects.

And coalbed natural gas development produces huge quantities of water, which, if left on the surface, provides abundant breeding habitat for mosquitoes and midges in a region that is mostly desert. Unless this water is carefully managed, it may support vectors for West Nile virus on parts of the landscape where vectors were once in short supply. The gas fields could help bring disease to sage grouse.

Elk

The desert herd around Steamboat Mountain north of Rock Springs comprises about 1,200 animals that spend the entire year in the sagebrush steppe of the Jack Morrow Hills east of the town of Farson. This area has a few oil wells, but up until now, energy development has been limited. This is likely to change, since the Bureau of Land Management has just adopted a coordinated activity plan for the area that anticipates at least 250 new wells in the near future.

Hall Sawyer, a wildlife specialist with Western Ecosystems Technology, put radio collars on thirty-six elk in the Steamboat herd and collected information on their movements from the spring of 2003 to the end of 2004. He collected more than 60,000 locations for these animals over twenty months. This project was supported by the Bureau of Land Management and the Wyoming Cooperative Fish and Wildlife Research Unit.

He found that elk avoided roads in the area in all seasons of the year. During the summer, elk in the study favored places that were 1.7 miles away from the nearest road. During the winter when traffic on back roads almost disappears, elk still preferred habitat that was three-quarters of a mile away from the nearest road. During the winter and hunting season, radioed elk spent much of their time in wilderness study areas in the Jack Morrow Hills.

Judging from his findings, Sawyer expects that a new round of energy development in the Jack Morrow Hills will “likely affect the distribution and habitat use patterns of the Steamboat elk herd.” While little research has been done on elk using desert habitats year-round, this conclusion is consistent with studies of several elk herds in foothills and mountain habitats.

Mule deer

Sawyer's work with Steamboat Mountain elk is really only a footnote to his primary research interest in the last decade— mule deer and gas development on the Mesa near Pinedale. The Mesa supports some of the highest densities of wintering mule deer found anywhere in the world. Every fall, 4,000 to 5,000 deer travel to the Mesa from mountain summer ranges as far as 125 miles away.

Sawyer's research has been supported by his firm, Western Ecosystems Technology, Inc., and the Wyoming Game and Fish Department; Ultra Petroleum, Questar Exploration and Production Company; the Bureau of Land Management; the Wyoming Cooperative Fish and Wildlife Research Unit; and TRC Mariah Associates, Inc.

Sawyer and his colleagues began their radio telemetry work on Mesa mule deer in 1998, three years before the Bureau of Land Management approved permits for 700 gas well pads along with 400 miles of pipelines and 275 miles of road in the Pinedale Anticline, a deep natural gas field far under the sagebrush of the Mesa. The first two years of data collection gave the researchers a baseline of information they could compare with mule deer activity after the drilling began. In addition, they put collars on deer that were wintering several miles away in an area known as the Pinedale Front at the foot of the Wind River Range where there was no natural gas development.

The first three winters after gas drilling began were unusually mild— with little stress from the weather, deer on the Mesa could choose a variety of habitats. Mostly, they chose places far from gas field activity. In the first winter after drilling began, they favored habitat that was 1.7 miles from the closest well pad. In the second winter, they selected habitat that was 1.9 miles away from the nearest well, and in the third winter, they preferred habitat at least 2.3 miles away from the nearest well.

The fourth winter of the study— 2003-2004— was much snowier than the previous three. Deer that used the Mesa moved back onto some of the best range, whether there were gas wells in the vicinity or not but still tended to avoid areas with lots of roads. However, overall deer population on the Mesa during the winter has dropped from more than 5,000 animals in 2002 to less than 3,000 in 2005, a decline of forty-six percent.

The fifth winter of Sawyer's research— 2004-2005— the weather turned mild again, and deer returned to their pattern of avoiding gas wells and heavily used roads. Their preferred habitat was at least 1.6 miles away from the nearest well pad.

Before the drilling began, Sawyer identified areas on the Mesa where the deer spent most of their time. During the first three mild winters, gas development expanded into these preferred areas, and deer moved out— in the first winter of development, only sixty percent of the areas that deer had used heavily continued to attract concentrated deer use. In the second winter, only forty-nine percent of the heavy use areas were still being used heavily, and in the third winter, only thirty-seven percent of the original heavy-use areas were still seeing large numbers of deer.

In the stern winter of 2003-2004, some deer returned to some of the best habitat on the Mesa. Seventy-one percent of the range where Sawyer had seen heavy deer use before gas development had heavy deer use again in 2003-2004. In the mild winter of

2004-2005, there was heavy deer use on only fifty-two percent of the habitat that had been heavily used before development.

Before the drilling began, deer were focusing on the best winter habitat, those places that provided high-quality forage even when there was deep snow. As energy operations moved into these preferred spots, the deer tended to move out, settling into areas that were less desirable, probably because they offered poorer habitat but less disturbance. It took a severe winter to drive deer back toward the better habitat around the gas wells. The drop in population combined with some of the transmitter locations suggest that many deer that once used the Mesa either wintered elsewhere or had died. In the mild winter that followed, they once again moved away from disturbance on the gas field.

Deer that moved back onto prime winter range near gas wells in 2003-2004 faced increased levels of disturbance, a fact that may have affected their chances of survival. Deer that chose to stay in poorer fringe habitat faced the challenge of finding enough quality food to survive the winter, clearly a threat to their survival. The steady drop in deer numbers on the Mesa over the course of this study could conceivably be the result of deer moving to other places or dying.

Sawyer and his associates have done their best to investigate the decline. Winter survival of fawns and adult does on the Pinedale Front, the area with no gas development, appears to be slightly higher than survival on the Mesa, but so far, the difference is within a statistical margin of error.

Besides reducing the amount of winter range available on the Mesa, energy development is complicating deer migrations in and out of the area. Sawyer's telemetry information shows several bottlenecks on the migration route north of Pinedale, the most famous of which is Trapper's Point a narrow ridge between the Green and New Fork rivers. Expanding housing developments, growing businesses, and spiraling vehicle traffic in and around Pinedale make the passage more difficult and dangerous for migrating deer. All these trends have accelerated with the advent of natural gas production in the region.

Sawyer estimates that 2,500 to 3,500 mule deer move through the Trapper's Point bottleneck twice a year. This amounts to as much as eleven percent of all the mule deer wintering in the upper Green River drainage.

"Small changes in land use or habitat alterations could potentially sever established migration routes," Sawyer explains. "Management of migration bottlenecks should be a top priority for land and wildlife agencies."

Work has already begun to preserve migration corridors in the Pinedale area. Progress has been made, and the effort offers an obvious way to help mule deer that are under increasing stress. But migration corridors, while necessary, aren't enough to maintain the herds. As Hall Sawyer points out, "Summer, transition, and winter ranges are equally important components of mule deer and pronghorn ranges in western Wyoming. The relative importance of each likely will change annually, but loss or degradation of one will not be compensated for by others."

Pronghorn

In 2005, Joel Berger, a biologist with the Wildlife Conservation Society, began a five-year radio telemetry study of pronghorns in the upper Green River basin, marking fifty animals, half from in or near the Jonah and Mesa gas fields, half from areas to the west with no natural gas development. This research was supported by the Shell Exploration and Production Company, Ultra Petroleum, Anschutz Exploration, and the Wyoming Game and Fish Department.

It's too early in the study to draw hard-and-fast conclusions, but the preliminary results are interesting. The radioed pronghorns completely avoided the dense cluster of gas wells on the Jonah field; not a single one of the 56,000 locations came from inside the Jonah.

Gas wells on the Mesa are more widely spaced than they are on the Jonah field, and the pronghorns that were captured on the Mesa stayed in the area for much of the year. Still, a detailed plot of movements show that most of the marked animals spent their time on the edges of development. When they traveled through the middle of the gas field, they moved relatively quickly.

Early models using the data from this first year suggest that the pattern of human activity in this sagebrush basin is beginning to fragment habitat. Berger reports that pronghorns are neglecting patches of habitat that are smaller than 600 acres and may abandon them altogether.

In his year-end report, Berger wrote, "To date, the data suggest that a growing array of gas fields, roads, and attendant human infrastructure is altering the suitability of habitat for wildlife."

Like Mesa mule deer, many of the pronghorns in the area migrate long distances to get the upper Green River basin, and like mule deer they move through a corridor that is bordered by rivers, heavy timber, and mountain ranges. In earlier research, Berger has found four places where this corridor pinches down to as little as 100 yards. Hall Sawyer has also followed radioed pronghorns along the upper Green River and has found bottlenecks in the migration path.

"The existence of future migrations of both pronghorn and mule deer is tenuous," Berger has written. "Although much of the wintering areas and migration bottlenecks involve federal land in the upper Green River basin, habitat protection is no longer assured because of possible incompatibilities with U.S. energy policies."

Conservation groups, state and federal agencies, and many private citizens in the Pinedale area have taken action to protect the migration corridor at Trapper's Point. Whether that action is enough to preserve the pronghorn migration itself remains to be seen.

Songbirds

In 2001, Franz Ingelfinger completed a study of songbirds on the Mesa and Jonah gas fields under the supervision of Stan Anderson at the University of Wyoming's Cooperative Fish and Wildlife Research Unit. Ingelfinger surveyed birds and vegetation along roads and pipelines in the gas fields, looking for changes in bird abundance along these disturbed corridors.

His research was supported by the National Fish and Wildlife Foundation, U.S. Geological Survey, Wyoming Game and Fish Department, the Murie Chapter of the Audubon Society in Casper.

He found that roads affected populations of the sage sparrow and Brewer's sparrow, two species that seldom breed outside of sagebrush country. Numbers of Brewer's sparrows dropped by as much as fifty-nine percent, while sage sparrow numbers declined by as much as seventy-six percent. Generally, there was a fifty-percent drop in the numbers of Brewer's and sage sparrows.

This effect on sagebrush birds reached at least 100 yards on either side of roads. The decline was greatest along roads with lots of traffic, but it was significant even along roads that saw fewer than twelve vehicles a day. In fact, there was even a decline along pipelines where there was no traffic, just disturbance of vegetation.

Ingelfinger speculates that the horned lark, a common grassland bird, is more aggressive than the sage and Brewer's sparrows along the roads and pipelines and force the sagebrush specialists away from the disturbed corridor. Out in the unbroken sagebrush, the horned larks can't find the sparse grassy cover they prefer, and their numbers decline.

He points out that the Bureau of Land Management has approved the construction of more than 275 miles of roads in the Pinedale Anticline. Using his findings, he estimates that the typical gas-field road will affect sage and Brewer's sparrows in a 210-yard swath. When road construction is complete, this swath will touch nearly fifteen percent of the Pinedale Anticline.

Ingelfinger concludes, "Based on this study, sagebrush obligate passerines are expected to decline within the study area. The magnitude of this decline will depend on the amount of road construction and on bird response to other development activities such as edges created by pipelines, habitat fragmentation, and perhaps increases in horned lark abundance.

"Given the inability of sagebrush obligate passerines to expand their populations quickly," he writes, "sagebrush obligate recovery may take decades after reclamation of the Pinedale Anticline Project Area."

Fish

In order to extract coalbed natural gas, producers typically have to pump large quantities of water out of the ground. The removal of the water releases gas in the coal seam and allows it to come to the surface.

The quality of the water taken out of the coal varies. Some of it is pure as groundwater can be, but much of it carries dissolved minerals and salts. In 2005, gas wells in

Wyoming brought 2.1 billion gallons of water to the surface, much of it in the Powder River basin.

The Powder River is a tributary of the Yellowstone and one of the last undammed watercourses in the United States. Like many other prairie streams, it is murky, warm, and slow-flowing. It may not have the esthetic appeal of high-country trout water, but it is a unique system with its own set of specialists.

Many wildlife managers and conservationists are concerned about the changes that may occur in the Powder River and its tributaries if billions of gallons of groundwater are released on the surface.

Wyoming Game and Fish biologist Dave Zafft has been surveying fish populations in the Powder River drainage to track possible changes in the abundance and distribution of fish native to the region. Windy Davis, a graduate student at Montana State University, is in the second year of a similar study. As is so often the case, the scientific analysis of the impacts of a broad change in land use will lag more than a decade behind the change itself.