The [Right] Rain

Sage grouse chick production was terrible in north-central Montana's Phillips County that spring. It was 2001, the first year of University of Montana doctoral candidate Brendan Moynahan's three-year study on how habitat conditions affect sage grouse populations, especially during the nesting and brood-rearing season. Largely due to drought, sage grouse recruitment (the number of young that survive to adulthood each year) was extremely low that year. However, a few months later, several upland bird hunters told the research scientist they'd seen more sage grouse in his study area than they'd seen in ten years.

Why were hunters seeing abundant grouse when Moynahan had just documented low production? And how are the timing and amount of precipitation, habitat conditions, and wildlife populations related?

The answers reveal much about the complex ways sage grouse and other wildlife respond to moisture. And how, to the average hunter or other wildlife watcher, precipitation amounts that appear to be beneficial—or harmful—to birds and other wild animals may in fact have the opposite effect. What Moynahan learned during his study reaffirms what other wildlife biologists have noticed over time: It is primarily the timing and type of precipitation that falls during the year—not necessarily the total annual amount—that affects the size of wildlife populations and influences public perceptions of how those populations are faring.

Why the timing of precipitation may mean far more to wildlife populations (and hunters' perceptions) than total inches

by Sam Curtis

A Three-Year Eye Opener

At the start of the sage grouse study, several previous years of drought had robbed the birds of crucial habitat needed to nest successfully. The lack of moisture meant there was little residual (brown) grass cover from the previous year and even less new (green) grass cover in spring of 2001. Nests, usually under sagebrush plants, were poorly hidden and much more exposed to coyotes, raptors, and other predators.

Things were even worse for the few chicks that hatched. "The forbs and insects that chicks eat before switching to sagebrush in the fall were almost entirely lacking because of the dry spring," says Moynahan, who now works for an environmental consulting firm in Helena.

Big Hole Valley near Dillon by Jeff Erickson

Of the 85 hens Moynahan radio-marked that year, only 35 built nests that hatched young. From those nests, only a single chick survived predation, starvation, or dehydration.

The next year, moderate amounts of rain fell evenly across the study area during the nesting and brood-rearing months of May through July. "We saw nearly double the nest success of 2001," says Moynahan. "Nearly all the hens that failed in their first nesting attempt tried to nest again, and chick survival was much improved over 2001."

Nesting conditions were even better in 2003. That spring, sage grouse nests were better protected by residual grass cover from the year before. Mild temperatures and abundant rainfall caused sweet clover to grow waist high. In addition, insects were plentiful. That year, says Moynahan, "brood survival went through the roof."

What's perhaps most interesting is that the entire study period of 2001–03 was considered part of the region's sustained drought, yet recruitment varied widely during the three study years. What mattered most to grouse was the timing and amount of precipitation in May, June, and July. In two of the study's three years, enough rain fell during that period to foster good to excellent grouse production.

The study also demonstrated that not all precipitation is beneficial to sage grouse. In late December 2003, a storm swept across the study area, dumping 2 to 3 feet of snow and covering much of the sagebrush that grouse depend on for food and cover. The following two weeks, cold and calm, lacked the wind that typically clears snow off sagebrush and blows it into coulees. As a result, many grouse starved. At the end of the two weeks, 30 percent of 248 radio-marked hens were dead.

"It had never been documented before that winter weather could affect sage grouse this profoundly," Moynahan says.

The study also showed how precipitation can distort hunters' perceptions of what's happening to wildlife. During the dry year of 2001, when almost no young grouse survived, adult birds concentrated in isolated pockets of high-quality habitat during fall.

"Hunters who found those habitat pockets saw a lot of birds, even though the population was down," Moynahan says.

On the other hand, hunters reported seeing very few sage grouse in 2002 and 2003, even though grouse production had increased significantly. "During those falls, the birds were widely dispersed over plenty of suitable habitat," explains Moynahan. "That made them difficult for hunters to find."

Good Weather for Ducks

The timing of precipitation also affects other species. Certain ducks, for example, have their best nesting success after ample fall rains and winter snows produce temporary "seasonal" wetlands used for nesting the following spring.

"When the top 4 or 5 inches of soil has adequate moisture in the fall, it freezes and forms what's called a frost seal," explains Jeff Herbert, assistant chief of FWP's Wildlife Division. "Then when snow starts to melt in the spring, it can't soak into the ground because of the frost seal. Instead, the snowmelt runs off into potholes and small reservoirs, forming temporary shallow wetlands on the prairies of eastern Montana."

BRENDAN J. MOYNAHAN

DRY VS. WET SPRING Sage grouse chicks suffered terribly from lack of cover in 2001 (left) but thrived two years later (right and far right) after abundant spring rains produced lush sweet clover and other vegetation.

BRENDAN J. MOYNAHAN

GARY LEPPART

According to Jim Hansen, FWP's Central Flyway coordinator in Billings, these temporary wetlands supply two important ingredients for nest success. "First, they give ducks more private places for spring nesting," he says. "Ducks are territorial during breeding season, and nesting pairs need nesting space that's all their own."

Also, these seasonal wetlands have grassy bottoms where many invertebrates live. "Because they are shallow, the temporary wetlands are the first to warm up in spring," Hansen says. "They turn into a bug soup that provides the high-protein diet that early nesting ducks, such as pintails and mallards, need to fuel egg growth."

But that's only if things work out just right. If any part of the perfect precipitation equation is off, nesting success suffers. For example, after the snowy winter of 2003–04, biologists thought spring snowmelt would create great conditions for breeding mallards and pintails in northeastern Montana. But it turns out there wasn't a good frost seal in the fall of 2003.

"So in the spring of 2004, the ground sucked up all the moisture and the shallow wetlands never amounted to much," Herbert says.

As was the case with sage grouse in the Phillips County study, precipitation conditions that affect duck production also influence hunter perception of duck numbers. "Sometimes, when water is low and there are fewer bodies of water, hunters may see a pile of ducks in certain areas because the birds are forced to concentrate," Hansen says. "Hunters may think there are birds all over the place, when in fact the opposite is true. Then, in real wet years, it may seem that

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Freelance writer Sam Curtis lives near Bozeman.

duck numbers are down. Hunters' favorite spots may not have a whole lot of ducks because the birds have room to spread out."

That difference between reality and perception can also apply to news reports that focus on only one aspect of precipitation and the landscape. Thomas Baumeister, chief of FWP's Education Bureau, says he read several news reports the past spring with headlines predicting that abundant May and June rains would create a huge vegetation buildup. When the abundant growth dried in August, the reports stressed, it could create a potential tinderbox for wildfires.

"That was really only the fire specialist's perspective," Baumeister says. "The headlines struck me as alarmist, saying how 'bad' those early rains could be. But there's always another side to the precipitation story. Those rains also created the abundant succulent vegetation essential for many wildlife species. So what may be bad for fires may be good for wildlife, and vice versa."

"When the ground is parched, it takes a certain amount of moisture to fill the spaces between the little soil particles so roots can start pulling moisture out of the soil," he says. "If it has been really dry for two years, and all of a sudden we get 18 inches of moisture, plants may not get 18 inches of positive benefit because the soil absorbs 10 inches of moisture before it gets to the plants' root systems."

Just as there are lag times in the positive effects of moisture, there may be delays in the negative effects of drought.

"Mule deer does may be able to raise fawns for several years as conditions worsen," says Hamlin. "But drought slowly drains their reserves until they can't produce fawns that survive. When drought gets severe enough, even does may die during a severe or even average winter."

Researchers also found that snow depth greatly influences mule

DIANE HARGREAVES

DIANE HARGREAVES

WHIMSICAL WEATHER

Rain can drench one county but miss another entirely. That can produce superb habitat for waterfowl and deer in parts of Montana, while habitat remains sparse just a few miles away.

DEA VOGEL

It's All Connected

The more biologists study wildlife, the more they learn how rain and snow affect populations. For the past 40 years, FWP research biologists have studied mule deer in the Missouri River Breaks. There, they have learned how precipitation patterns can set off an ecological chain of events that works for or against healthy wildlife populations.

For example, mule deer does can't produce enough milk to raise healthy fawns without the energy, protein, and moisture provided by succulent forbs (flowering plants) and other forage. Abundant and persistent forage growth requires high soil moisture and cool temperatures at the start of the spring growing season.

Prolonged vegetation growth also provides cover where fawns can more effectively hide from predators. It also gives voles and mice the thick carpet of grasses they need to make tunnels. Among their many findings, FWP researchers have discovered a relationship between rodent numbers and mule deer fawn survival.

"When vole and mice numbers increase, they're easy for coyotes to catch," says Ken Hamlin, the long-term mule deer study's lead research scientist. "Coyotes concentrate on voles and mice instead of fawns. So, while we can talk about the individual effects of precipitation, often it's the whole ecology that turns on these moisture and growing cycles that then influences wildlife populations."

Hamlin explains that during a sustained drought, soil moisture may be so depleted that even above-average precipitation, such as in spring of 2005, may not produce abundant forage growth.

deer survival in ways that aren't immediately apparent. For example, heavy snowfall covers forage, making it tough for deer to find enough to eat. Deep snow, especially when covered with an icy crust, can also hamper deer movement, but not that of coyotes and other predators. The thin, sharp hooves of deer punch through the ice crust, while the soft pads of coyotes allow the predators to race across the snow pack.

On the other hand, deep snow can also benefit deer. It protects voles from predators, allowing them to breed and produce young during the winter. That provides more alternative prey for coyotes in spring and summer.

"Populations are very difficult to model in precise mathematical terms," Hamlin says. "It's the interaction of all these factors that makes predicting wildlife population numbers almost an art."

Wildlife managers continue to learn how precipitation affects wildlife. And the more they learn, the more accurately they can predict how well wildlife populations are faring—and how much harvest to allow each fall.

"Research investigations like those on sage grouse and mule deer provide us with specific information on environmental conditions and their influence on wildlife habitat," says Herbert. "We then use that information to manage populations and set appropriate hunting seasons. Just as important, studies gather information we provide to the public so that people have realistic expectations for the upcoming fall hunting seasons."