



FEELING THE HEAT

CLIMATE CHANGE IS ALTERING MONTANA'S WILDLIFE AND FISH POPULATIONS, HABITATS, AND RECREATION

BY TOM DICKSON

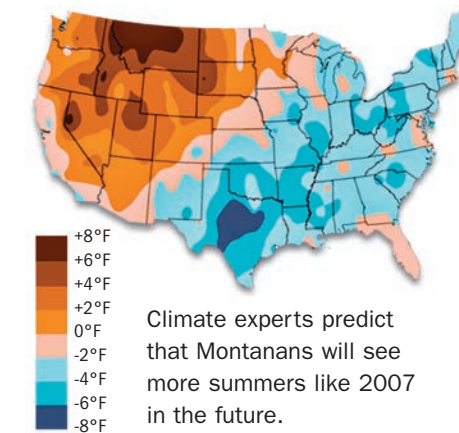
One of the great joys of midsummer trout fishing in Montana is standing waist-deep in a cool river as a refreshing breeze wafts off the water. Unfortunately, such pleasures are disappearing as the state's famous blue-ribbon rivers simmer under some of the hottest summers on record.

Trout anglers thought things were bad enough in 2001 and 2006, when thermometers registered unprecedented summer highs across much of Montana. But 2007 was worse. In July both Helena and Billings recorded eight days above 100 degrees. On July 6, when Missoula's afternoon temperature usually tops out at about 83, the city set a record of 107, the first of an unprecedented 11 days above 100.

The same blistering heat was heating up nearby trout rivers. Yellowstone National Park's Firehole River, just a few miles from the Montana border, was closed after it hit 82 degrees, killing hundreds of trout. The Big Hole River upstream from Wisdom reached nearly 80 degrees and dwindled to a trickle of just 13 cubic feet per second. Water temperatures on the Yellowstone, Blackfoot, Beaverhead, Big Hole, and other blue-ribbon rivers topped 73 degrees for three consecutive days, triggering mandatory stream closures to protect trout from the added stress of being caught and released. By summer's end, Montana Fish, Wildlife & Parks had been forced to close or tightly

restrict fishing on a record 29 rivers. As the heat wave drove thousands of disappointed anglers indoors, it scorched the fishing in-

July 2007 Temperature Departure from the 1971-2000 normal average SOURCE: NOAA



industry's bottom line. "August that year was just dead for us on the Missouri," says Chris Strainer, owner of the Cross Currents fly shops in Helena and Craig. "I'd look out the window on a Saturday afternoon and not see a single boat on the water."

Hotter, longer summers and shorter, warmer winters have become the norm in Montana over the past decade. The cause, say climate scientists, is a changing global climate. As temperatures continue to increase, Montanans will see even greater alterations in precipitation, drought duration, snowpack levels and runoff, and the timing of plant and animal cycles. Already the warming has delayed waterfowl migrations, shortened ice-fishing seasons, and made elk hunting tougher by allowing the animals to stay high in the timber throughout the season. "Hunters and anglers are often the first people in Montana to witness the effects of climate change," says Bill Geer, Climate Change Initiative manager with the Theodore Roosevelt Conservation Partnership. "Climate change isn't some abstract theory to a trout angler who can't fish the Beaverhead because it's closed, or an elk hunter who waits all fall for elk that never come down. It's a reality we've been dealing with for years."

And there's no relief in sight. In the not-too-distant future, Montanans could see smallmouth bass replacing trout in some

BRIAN & JENNY GROSSENBACHER

CASTING FOR SMALLIES? "It's clear that the future implications of climate change in Montana are fewer trout and fewer opportunities to fish for trout," says Bruce Farling, executive director of Montana Trout Unlimited. Farling notes that hotter temperatures over the past decade have often shut down Montana's most popular trout streams during the height of the fishing season. FWP officials say portions of some blue-ribbon rivers could soon become better suited to smallmouth bass.

GRINNELL GLACIER, 1938–2006



MELTED ICE NATIONAL PARK As seen from the summit of Glacier National Park's Mount Gould, Grinnell Glacier has shrunk over the past several decades while Upper Grinnell Lake has grown from the melted ice. Scientists estimate that by 2025 warming temperatures will have melted all the park's glaciers. The heat could also force pikas and other alpine wildlife to smaller areas at higher elevations.

ivers, fewer mountain goats and other alpine species, earlier and more widespread summer stream closures, and millions more acres of dead and dying beetle-infested forests (see sidebar, page 20). Concerned about these and other warming-caused scenarios, FWP officials have begun studying how a changing climate might help or hurt fish and wildlife and figuring out ways to revise management activities in response. “We certainly can’t stop climate change,” says Ken McDonald, FWP Wildlife Division chief, “but we know it’s coming, and we have a responsibility to prepare for the impacts on Montana’s wildlife.”

HOT SKY COUNTRY

People may argue over how much of climate change is manmade, but there’s no disputing that the planet is warming. The latest report from the Intergovernmental Panel on Climate Change (IPCC) says temperatures have increased an average of 1.5 degrees F world-

wide over the past century and are expected to climb another 4 to 12 degrees, depending on carbon dioxide levels, by 2100. According to Dr. Steven Running, an ecology professor and climate expert at the University of Montana, the average annual temperature in Montana has increased 2 degrees over the past 50 years, even more than the global average. “There’s no doubt in my mind that global warming is real and that the impacts to Montana will accelerate,” says Running, a lead author of the IPCC’s most recent report.

Climate has been in flux throughout history, Running says, but temperatures since the late 1800s, and especially during the past three decades, are higher than at any time in at least the past 13,000 years. The warming is the result of what’s known as the greenhouse effect, caused when carbon dioxide—produced by the burning of oil, coal, or gas—traps heat within the earth’s atmosphere. Even with new efforts to cut down on emissions, Running says, global oceans dur-

ing the past 50 years have absorbed so much additional heat—which will be released later—that continued warming is inevitable. He and other climate experts predict that Montana’s average temperatures will rise another 3 degrees by 2050.

One of the most noticeable and significant effects will be a thinner and faster-melting mountain snowpack. Snowpack keeps valley rivers cool and flowing as it slowly melts in summer. Though total snowfall in western Montana will likely remain the same, says Running, “warmer late-winter temperatures will mean the snowpack won’t stay on the mountains and politely melt in June and July when we need it.” That’s trouble for trout. Without adequate snowpack, river water can warm to the point where the fish die of heat stress or levels drop so low they become stranded. Monitoring stations in Billings and Kalispell show that average March air temperatures are up 6.2 degrees and 7.8 degrees,

“We’re particularly concerned about the black swift, which is an uncommon species that nests behind glacier-fed waterfalls.”

respectively, from what they were 50 years ago. April 1 snowpack in western Montana has declined 30 to 40 percent and peak river runoff arrives on average ten days earlier. “In a few decades, Montana’s climate could look a lot more like what Utah now has,” Running says.

BAD FOR BULL TROUT AND GRAYLING

“Global warming is the single greatest threat to the survival of trout in America’s interior West,” concludes a recent report jointly published by the Natural Resources Defense Council and Montana Trout Unlimited. To make matters worse, the trout and other salmonids most vulnerable to warming are already in trouble.

Numbers of arctic grayling in the Big Hole River dropped from an average of 60 per mile in the 1990s to roughly 10 in 2006. And rising temperatures could drastically shrink the range of bull trout, which need extremely cold water for spawning and rearing, says Dr. Bruce Rieman, research scientist emeritus with the U.S. Forest Service’s Rocky Mountain Research Station in Missoula. Other possible losses in Montana include shrinking wetlands, smaller cutthroat populations, withering sagebrush ecosystems, and fewer high-elevation birds (see sidebar, pages 18–19). Montana also stands to lose most of its whitebark pines, which produce seeds eaten by grizzly bears, Clark’s nutcrackers, and

other wildlife. A critical subalpine ecosystem species, whitebark pines are being “devastated” by heat-loving mountain pine beetles, says Diane Six, a University of Montana professor of entomology.

A warmer, drier Montana would not threaten all wildlife. Adaptable species such as Canada geese and white-tailed deer would likely thrive. Woodpeckers, bluebirds, and other cavity-nesting birds would benefit from the snags created by beetle infestations and wildfires. There would be fewer March blizzards, which often kill winter-weakened elk, mule deer, and pronghorn. And wild turkeys and other species restricted by Montana’s frigid temperatures would prosper from milder winters.



WINNERS AND LOSERS Woodpeckers would thrive in a warmer Montana, at least temporarily, in forests killed by beetles and fire. Elk numbers would grow due to expanded foothill grasslands and fewer March blizzards. But alpine species such as pikas could disappear, and Yellowstone cutthroat trout would be restricted to colder headwater streams, disappearing from the Yellowstone River entirely.

LEFT TO RIGHT: T.J. HILEMAN, GNP ARCHIVES; CARL KEY, USGS; DAN FAGRE, USGS; KAREN HOIZER, USGS

CLOCKWISE FROM TOP LEFT: ISTOCKPHOTO; JAMIE AND LISA JOHNSON; MACQUEL LYONS; JESSE VARRADO

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“The idea would be to focus attention on species with the best chances of survival and...reconsider the effort we spend on species we probably can't save.”

Some fish species also would thrive as Montana streams and rivers warm up. Brown trout already are appearing farther upstream on the Yellowstone River than ever before. Less turbidity from fewer summer thunderstorms has benefited the non-native smallmouth bass, a sight-feeding fish spreading west in the Yellowstone from Miles City to Billings.

“We know that changes in fish populations will continue to occur, but no one really knows what the tipping point is for natural aquatic systems and how well they can adapt to change,” says Chris Hunter, chief of the FWP Fisheries Division.

Tom Dickson is editor of Montana Outdoors.

HABITAT-BASED RESPONSE

FWP officials say the best response to climate change is to redouble efforts to protect and restore vital habitat. “What’s essential is to maintain water in streams, no matter how warm it gets,” says Hunter. One successful example has been to obtain water from landowners through leases, donations, and cooperative agreements that maintain the minimum river flows fish need to survive. “We also have to restore and protect more streamside vegetation that shades and cools water,” Hunter says. FWP fisheries biologists aim to replicate successful landscape-scale conservation work already underway in several watersheds. On the Blackfoot River, for example, landowners, trout anglers, and

other conservationists have restored 80 miles of river and tributaries and protected 95,000 acres of private land with perpetual conservation easements. On the Big Hole, state and federal agencies have worked out an agreement with ranchers, who agree not to draw water from the river and its tributaries for irrigation when late-summer flows decline to dangerously low levels. Other projects that help Montana trout survive: reconnecting stream stretches blocked by culverts and dams, reducing siltation from old logging roads, and building watering tanks so cattle can be fenced away from stream banks.

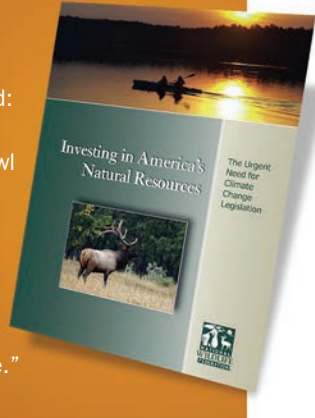
Wildlife officials advocate a similar multi-pronged, habitat-based approach. “Our goal is to protect and restore ecosystems to make

them more resilient to the effects of climate change,” says McDonald. Identifying critical habitats and protecting them by purchasing conservation easements and wildlife management areas will be key. Especially important will be riparian habitats—what McDonald calls “ecological arteries for the entire landscape”—such as the Marias and Yellowstone wildlife management areas acquired in 2008. Conservation agencies and organizations will also need to maintain connections between critical habitats so wildlife such as wolverines and lynx can move across the landscape as they seek cooler temperatures.

Those efforts may still fall short for particularly vulnerable species. At a recent climate change workshop sponsored by FWP, the National Wildlife Federation, and other conservation organizations, Dr. Molly Cross of the Bozeman-based Wildlife Conservation Society predicted that “species unable to

Hunting, fishing, and conservation groups nationwide take climate change seriously

- In 2008, more than 670 conservation clubs from all 50 states, including Montana, took out a full-page ad in *USA Today* expressing their concerns about how climate change is affecting fish and wildlife populations.
- Trout Unlimited, Pheasants Forever, the National Wildlife Federation, and the Theodore Roosevelt Conservation Partnership have made climate change among their top policy issues.
- In spring 2008, the Bipartisan Policy Center and the Wildlife Management Institute jointly published a report on climate change and its effects on outdoors recreation. “Season’s End: Global Warming’s Threat to Hunting and Fishing,” prepares readers for changes such as dwindling Great Plains waterfowl and expanding white-tailed deer populations. The future for hunting and fishing is definitely not all bad, the report concludes, but it will be substantially different from today.
- Montana Audubon has recently released a report on how climate change has affected bird movement over the past 40 years. Visit mtaudubon.org and click on “Birds and Climate.”



POSSIBLE FISH AND WILDLIFE LOSSES AS CLIMATE CHANGE CONTINUES:

FEWER DUCKS AND OTHER WETLAND SPECIES

Federal waterfowl managers say warming temperatures could dry up wetlands in North America’s Prairie Pothole Region (including portions of northeastern Montana), halving waterfowl populations by the end of this century. “Several large public wetlands in central Montana have been dry for going on nine years now,” says Jim Hansen, FWP wetland wildlife coordinator. “The lack of winter runoff and heavy spring rains might be reducing duck production in that region, not to mention waterfowl hunting opportunities.”



MONTANA FWP

FEWER YELLOWSTONE CUTTHROAT TROUT

“The Yellowstone cutthroat trout would eventually be restricted to the cooler headwater streams,” says Chris Hunter, chief of the FWP Fisheries Division. “We won’t find them in the big rivers like the Yellowstone anymore.”

DEPRESSED SAUGER POPULATIONS

“Sauger need the turbid water that comes from runoff, and we expect to see less of that in the future,” says Matt Jaeger, FWP Yellowstone River fisheries biologist at Glendive.

INCREASED WILDFIRE

The combination of unlogged century-old stands, earlier snowmelt, longer and drier summers, and increased beetle infestations (see sidebar, page 20) would increase the intensity and duration of Montana wildfires. The U.S. Forest Service predicts



USFWS

that if average summer temperatures warm by just 1.6 degrees over the next century, wildfire acreage in Montana would at least double. Periodic wildfires are essential for recycling nutrients in forest ecosystems. But intensely hot fires can sterilize soil and cause silt and ash to wash into trout streams during subsequent rains.

SHRINKING SAGEBRUSH-STEPPE ECOSYSTEMS

The U.S. Forest Service estimates that each 1.8-degree temperature

increase would cause the loss of 12 percent of the West’s current sagebrush habitat, essential for sage-grouse and important for mule deer, pronghorn, and other wildlife. Plant ecologists say a major reason for the loss is that cheatgrass—an invasive species that thrives in hot, open, fire-prone environments—will crowd out native sagebrush.



MONTANA FWP



KERRY MCKOUI

FEWER MOOSE

Moose need cool, wet habitat. Though Montana’s population appears stable so far, another northern moose state, Minnesota, has seen its population decline by 35 percent since the 1980s. The main cause appears to be heat stress from warmer winters and springs.

FEWER BREEDING BIRDS

In addition to shorebirds and wetland species, warming would put the white-tailed ptarmigan, gray jay, and other high-elevation birds at risk. “We’re partic-

ularly concerned about the black swift, which is an uncommon species that nests behind glacier-fed waterfalls,” says Amy Cilimburg, director of bird conservation for Montana Audubon.

DECLINING WOLVERINE POPULATIONS AND RANGE

Because wolverines need deep mountain snow for denning, warming temperatures could reduce the species’ range in Montana. “In the Sawtooths, for example, every den is above 5,000 feet,” says Dr. Kevin McKelvey, of the Rocky Mountain Research Station in Missoula. “A mother will actually move her litter uphill if the snow begins to melt, even if the young aren’t ready to emerge.”

DELAYED BEAR HIBERNATION

Warmer fall temperatures are delaying grizzly bear hibernation. Many bears now stay out



TOM BURCH

during the big game season, increasing incidents of hunters surprising grizzlies feeding on downed elk and deer. “Delayed denning has become a factor we now have to consider when addressing conflicts between humans and grizzlies,” says Ken McDonald, chief of the FWP Wildlife Division.

OTHER POTENTIAL PROBLEMS

- loss of brushy habitat in eastern Montana draws due to heat and drought;
- declines in toad and frog populations; and
- fewer snowshoe hares, mountain goats, and pikas as alpine areas shrink.

FROM EVERGREEN TO EVERRUST

In recent years, western Montana forests have been hit by a massive infestation of mountain pine and Douglas fir beetles, transforming them from a sea of green into a sea of rust red. More than 1 million acres of forestland across western Montana have been killed by tiny beetles that have thrived in the state's warming climate. Millions more acres are at risk, according to the U.S. Forest Service.

One of the hardest-hit areas is the 1-million-acre Helena National Forest. Amanda Milburn, the forest's silviculturist, says infestations have exploded from 19,000 acres in 2004 to 350,000 in 2008, an 18-fold increase. In portions of the Bitterroot National Forest, nearly every conifer has been killed by beetles. And vast tracts of the Beaverhead-Deerlodge National Forest have turned gray as needles fall to the forest floor, leaving only bare trunks and branches.

The native insects, of the genus *Dendroctonus* (Latin for "tree killers"), bore through a tree's outer bark and lay their eggs. The larvae eat the sweet layer of inner bark a tree needs to transport water and nutrients from the soil to the branches. Healthy trees fight back by producing a resin that drowns the insects. But old and drought-weakened trees cannot produce enough resin to fight off the invaders.



BUEWOOD.ORG

“We're seeing 700-year-old whitebark pines being killed off by this epidemic. It's tragic.”

Forest ecologists say the beetle epidemic has several causes. Decades of fire suppression has produced forests of similarly aged lodgepole pine. Many trees are now a century old, near the end of their natural lifespan. Recent intense heat and drought further weaken trees. And mild winters allow beetles to thrive during colder months when large numbers historically have died.

Beetle infestations are natural to forests. Dying trees provide habitat for woodpeckers, bluebirds, and other tree-cavity dwellers before falling to the forest floor and decomposing into soil. But recent infestations—when added to dryer summer temperatures—have greatly increased the risk of intense wildfires. Another concern: The beetles are spreading to higher elevations. Scientists are particularly worried about the loss of whitebark pine. The thick-trunked trees produce cones heavy with high-caloric seeds that grizzly bears need to build fat in late summer. Dr. Diane Six, a professor of entomology at the University of Montana, says scientists previously thought whitebark pines grew at elevations too high and chilly for beetle infestations. “We're now seeing 700-year-old whitebarks being killed off by this epidemic. It's tragic,” she says.

Though the beetle infestation is too vast to be treated with insecticide spraying, thinning stands can help reduce the beetle's spread. The dead trees can be salvaged for lumber, though the boards have a blue stain from a fungus the insects inject into trees. According to Milburn, the beetles eventually will run out of live trees and die from lack of food. “Other than that, the only thing that will knock them back is several weeks of extremely cold temperatures in midwinter or sustained late-spring frosts,” she says.

KENTON ROWE

“Our focus continues to be to protect and restore critical habitats so that landscapes and wildlife can, to the extent possible, withstand climate change.”

adapt or migrate will be in big trouble.” She said that if adjusting management activities does not work, conservation agencies and organizations may need to consider triage. “The idea would be to focus attention on species with the best chances of survival and, hard as it might be, reconsider the efforts we spend on species we probably can't save because the warming will make it useless to try.”

To learn which species will likely fare best and worst under warmer Montana skies will require more research and population monitoring. The Association for Fish and Wildlife Agencies recommends that Montana and other states boost efforts to identify and assess likely effects of future warming on populations and habitats.

Where would new money for accelerated habitat conservation and research come from? According to Tom France, director of the National Wildlife Federation's Northern Rockies office at Missoula, one option is to use revenue generated by the so-called cap-and-trade system, proposed to encourage industries to reduce carbon dioxide emissions.

Under a provision of the Climate Security Act added by Montana's Senator Max Baucus, states would share in roughly \$9 billion of additional funding. Though the proposal had widespread bipartisan congressional support last year, “with the current economic climate, it's hard to predict if the fish and wildlife component will survive,” France says.

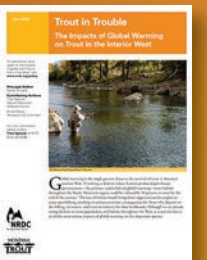
New funding sources will be essential if Montana wants its fish and wildlife management programs to adapt to changing climate conditions. No matter how budget scenarios play out, however, FWP officials say they will continue to focus on making the state's most important land and water habitats as resilient as possible. “Montana's fish and wildlife are also feeling impacts from many other sources, such as invasive species and growing transportation and energy development,” says McDonald. “Our focus continues to be to protect and restore critical habitats so that landscapes and wildlife can, to the extent possible, withstand climate change—or whatever other stresses they face in the future.” 🐾

Learn more

For additional information on the effects of climate change on fish and wildlife and hunting, fishing, and wildlife watching in Montana and elsewhere in the United States, visit:

- Targetglobalwarming.org (sponsored by the National Wildlife Federation)
- Seasonsend.org (sponsored by the Bipartisan Policy Center).

To read the report “Trout in Trouble: The Impacts of Global Warming on Trout in the Interior West,” produced by the Natural Resources Defense Council and Montana Trout Unlimited, visit: MontanaTU.org



A grim forecast for Montana's famous trout waters.

DON'T TOSS OUT THE LONG JOHNS

“Every time it gets cold, someone comes up to me in the grocery store and says, ‘See Steve? What's all this about global warming?’” says Dr. Steven Running, an ecology professor and climate expert at the University of Montana. But Running points out that frigid days, weeks, and even winters will still occur, just not as frequently. This past December, for example, temperatures never rose above zero for an entire week in much of western Montana.

“What we're talking about is climate, which is the decades- and centuries-long trend of weather conditions, not the daily weather people see out their back window,” Running explains. “When we say the climate will be trending warmer, we know we'll still have cold years, but we'll have fewer of them, and the cold generally won't last as long as it did in the past.”

Another common misconception is that increased snowfall disproves predictions of warming. “In fact, warmer winters in Montana generally have more snowfall, not less,” Running says. “In warm winters, we get the moist Pacific air that produces heavy snows. It's the brutally cold winters, where we get that dry Arctic air mass coming down from Canada, when we have the least amount of snow.”



PLENTY OF COLD AHEAD Frigid weather will not disappear entirely from Montana, but it will be less frequent and severe.

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