Craighead Wildlife-Wildlands Institute

Natural Connections

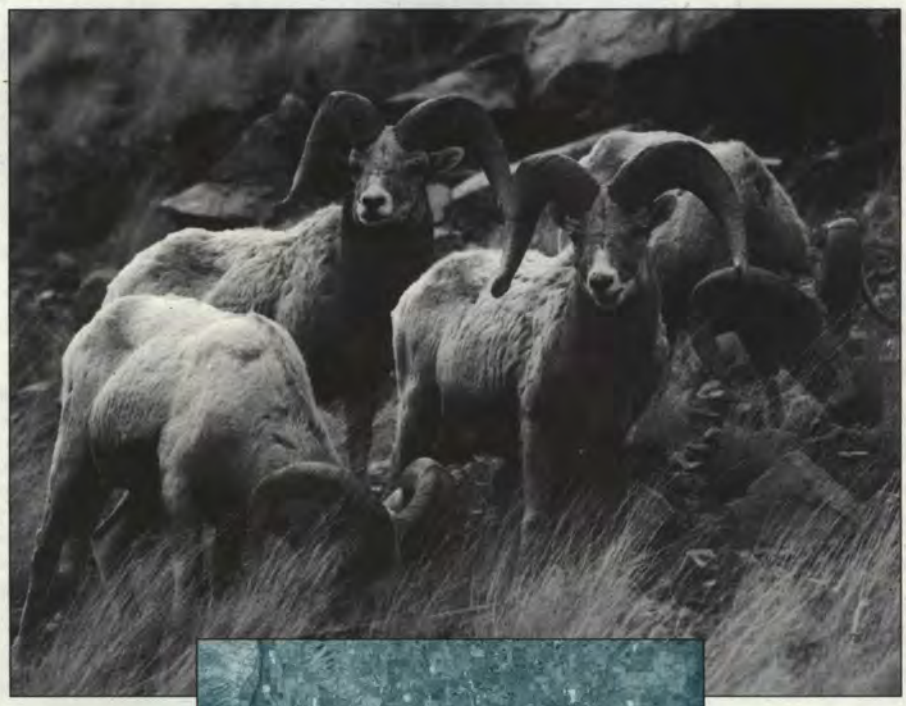
April 1998 / Issue No. 8

Ecological Islands

By Jack Hogg

Oceanic islands have been home to some of the planet's most peculiar–and now all too often extinct–creatures. Flightless birds, pygmy elephants and hippopotami, giant land tortoises, sea-going iguanas *and*... well, the list is very long. This association between ecological oddity and geographical isolation puzzled and inspired Charles Darwin and Alfred Wallace during their voyages to the nooks and crannies of the natural world. And now, a century after these two naturalists changed our understanding of the origin of biodiversity on earth, the study of islands is changing our understanding of its preservation. In a wink of planetary time, human activity has converted North America's once vast and interconnected forests, prairies and mountain ranges into disconnected archipelagos of natural habitat. Hundreds of species designed for life on a continental mainland suddenly face the special hazards, uncertainty and transience of an island existence. The obvious treatment for the ills of habitat fragmentation is to restore some measure of ecological connection. And so it is heartening how rapidly the concept of "corridors," or "linkage zones," has moved from science into the realm of policy and advocacy. But, knowing the general remedy for isolation is a far cry from knowing how to design linkages for particular species and locales. Here the ball bounces back into the court of science.

IMAGE: J. Hogg



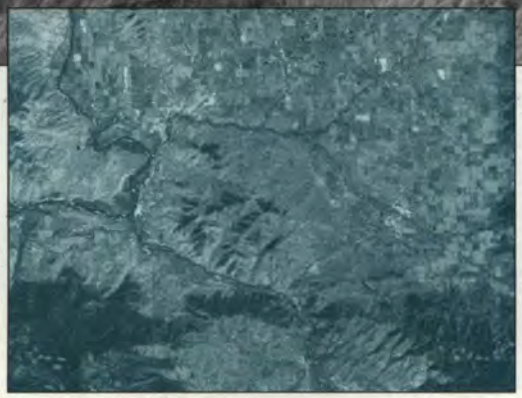


IMAGE: Ecology Center/GIS

Many natural reserves, such as Montana's National Bison Range (center of bottom photo), are ecological islands in a sea of human activity.

The problem is not simple. The scientist-architect, mulling over options for linkage zones for a given species, would like to know who moves, why and when they move and the kinds of habitat migrants can reside in or travel through. How can science learn these things? Successful migrants leave genetic as well as actual foot prints, which means that genetic surveys can inform us about past levels of connectivity. However, for unraveling the behavior of animals as they move in present-day landscapes there is no substitute for mud-and-boots biology.

Migratory Corridors

Gibraltar Mountain looms bare and steep, like its namesake, over the stunted spruce forest of the upper Sheep River valley. Beyond Gibraltar, the river bends northwest, ascending to headwaters ringed in shining limestone peaks and dusted with light snow. I part with the river and tread south along the mountain's western flank. My destination is a low grassy ridge and a series of open, windblown bowls at the head of Mist Creek. An oasis of year-round habitat for a small population of bighorn sheep, the area is some eight miles

Continued on page 3

IMAGE: William T.P. Zader

Craighead Institute office in Missoula, Montana

Dear Friend of the Institute,

Our twentieth anniversary year was an exciting year of growth and change here at the Institute. There are many wonderful things going on at the Institute that you will learn about as you read this newsletter.

There are a couple of new faces around the office these days. I am the new Director of Development and Finance. I joined the staff in August of 1997, although my involvement with the Institute spans nearly twenty years as a supporter and board member. For the past two and a half years, Dr. Jack Hogg has had the responsibilities of two jobs, managing both the science program and the administrative demands of the organization. My joining the staff allowed Jack to refocus his energies as a scientist. We have also hired Julie Mae Muiderman as our Development Associate. She will be handling membership correspondence and making sure you are kept up-to-date on what is happening in our neck of the woods. I am thrilled to be working with the remarkable group of scientists and staff assembled here, and look forward to getting to know more of our *Friends of the Institute* this year.

We have received several generous gifts of support that I want to let you know about. The *Charles Engelhard Foundation*, a long-time supporter, granted us $140,000, and from the *Richard King Mellon Foundation* we received a three-year award of $150,000. *Jean Vollum*, Board member, gave a three-year award totalling $75,000. These grants will be used to continue our fundamental work of mapping wilderness ecosystems using satellite multispectral imagery and applying these maps to key issues in conservation biology. You'll find an update on this exciting mapping work and its application to grizzly bear recovery in an update on the *Northern Rockies Grizzly Bear Recovery Project (NRGBR)* on page 4. In addition to these grants, we have received numerous donations from our members throughout the year. Gifts of all sizes make a difference and are greatly appreciated. I can't thank you enough for your tremendous support!

We continue to implement our *Ark of the Rockies Initiative* launched almost three years ago. The "Ark" initiative is a campaign to expand and diversify our science program. The NRGBR project plays a flagship role in that growth. Next month, we will send you a description of another major ongoing project under the "Ark," the *Mountain Sheep Conservation and Restoration Project* (please see pages 1 and 7). To fully implement our vision for the science program will require significant investments in programs and personnel in the next few years.

We have also expanded our Board to give us greater representation across the U.S. and to include specific professional skills needed by the Institute. I'll see that you get better acquainted with the twelve men and women who give of their valuable time, talents, and treasures to advance our important mission.

I appreciate each of you and encourage you to call or write me with your concerns or questions. Thank you for your support, and best regards for a great 1998.

Sincerely,

William T. P. Zader

William T. P. Zader
DIRECTOR OF DEVELOPMENT AND FINANCE

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up river from the trail head and that far again from winter range for my primary bighorn study population on the lower Sheep River. Sheep River ewes lamb and summer east of Gibraltar in areas adjacent to and even somewhat overlapping the range of the more westerly Mist Creek population. But now, in late November at the peak of the breeding season, the two populations are separated by miles of rugged, wind-swept terrain.

Each year, some fraction of our marked resident rams have left the lower Sheep River winter range to spend the rut in populations, like the Mist Creek bighorn, living deeper in the Canadian Rockies. Although transient and difficult to detect without careful study, such "breeding migrations" are an important example of the kinds of ecological connections that once characterized and stabilized ecosystems continent-wide. In this case, the connectors are genes that rams from one population leave behind in another. Such gene flow can protect populations from the dysfunction that inbreeding and loss of genetic diversity can bring to insular populations.

On earlier trips to Mist Creek, members of my study team found marked Sheep River rams mingling with local females. Today, high in one of the bowls, above the spruce and some wind-pruned, brawny-twigged larch, I find tagged ram "WH218" defending and breeding a Mist Creek ewe. More abstractly, I am watching genes flowing. Although the day is sunny, the wind howls and spindrift flies; WH218 is not a fair weather ram migrating to mate in better climes. But what is the logic of who stays and who goes? We are just beginning a comprehensive study of breeding migrations in this complex of populations. But we know enough to sketch out some possibilities. Herds having lower ratios of resident rams to ewes probably attract more migrants. Male social rank may also be important. For example, despite being one of the older rams in our primary study population, WH218 did not have particularly high social status there. Rams like WH218 may migrate to find relatively "soft" competition.

IMAGE: J. Craighead

These ideas require more scrutiny. The general point is that the who, why, when and where of migration matters. Corridor design for bighorn would look very different if, for example, migration occurred by permanent transfers of bighorn when on their summer range instead of (or in addition to) ram visits to other winter ranges strictly for the purpose of breeding.

Residential Corridors

The isolation that threatens grizzlies in the lower 48 states operates on a much larger scale. Populations in the Greater Yellowstone and Northern Continental Divide ecosystems, and the core area for a proposed repatriation of bears to the Salmon-Selway ecosystem, are separated by hundreds of miles. Although male bears may range widely during the breeding season, there is no evidence that they routinely bridge gaps of this size. To restore linkages for grizzlies in the U.S., and maintain them with Canada, we must think in terms of protecting broad bridges of year-round residential habitat. For grizzlies, then, the immediate focus shifts from questions about bear movements to those about bear habitat.

"We know enough about bear food habits, denning requirements, reactions to roads and so on, to do a pretty good job of delineating bear habitat. But we need to do more." John Craighead is speaking over an untouched lunch at his dining room table in Missoula. As I listen, I notice that new stacks of work-related documents have appeared here and there on tables and kitchen counters already burdened with correspondence, manuscripts, notes and photographs and I am struck by how passion for a subject blurs the usual boundaries between our private and professional lives. "What we need are standardized descriptions of vegetation for entire ecosystems so that we can evaluate, compare and then prioritize areas throughout the Northern Rockies for research, protection and special management."

Realizing John's vision of standardized, all-purpose habitat maps based on satellite imagery and constructed on a landscape scale is an important part of the Institute's research program, as is the application of these maps to corridor design and other issues of grizzly bear conservation. The size and complexity of these tasks is such that one can almost understand the temptation of land-resource planners to simply hand-draw lines on basic maps. Yet the power of informed planning rooted in field-based science compels us to resist temptation. We must pay the price of learning much more about our world and the path to co-existence. ■

Bear Necessities Should Drive Grizzly Recovery in the Bitterroot

By Marcy Mahr

While last summer's debate over the U.S. Fish & Wildlife Service's (USFWS) proposal to reintroduce grizzly bears into the Salmon-Selway ecosystem intensified, five CWWI field biologists took to the wilderness to continue our ecological description of the area. With this inventory and careful analysis by our science staff and collaborators, we aim to provide objective guidelines for evaluating and protecting grizzly habitat in the Salmon-Selway ecosystem.

IMAGE: M. Mahr

In the two years since we launched our *Northern Rockies Grizzly Bear Recovery Project* and began ground-truthing satellite imagery for the Salmon-Selway ecosystem, we have built the region's first comprehensive Geographic Information Systems (GIS) database suitable for evaluating habitat for grizzly recovery. The geographic scope of our vegetation mapping effort spans nearly 22,000 square miles, from the lush northern forests of Idaho's Lochsa River country south to the drier Salmon River country. Our field crews mapped the changes in the habitats that occur from wilderness headwaters to the broad valley bottoms of the region's major rivers. This enabled us to capture the ecological complexity of landscapes characterized by diverse topography and flora. Our database includes over 3,000 botanical plots, current land ownership, drainages, roads and topographic information, such as elevation, slope and aspect. We have intensively sampled the southern portion of the ecosystem as well as the proposed reintroduction area in the north, and are on the verge of producing a revised land cover map that could play an important role in properly defining the recovery area.

Preliminary analysis of our data suggests that well-dispersed, high quality, food-rich habitats for grizzly bear occur throughout the entire area. Although the Salmon River drainages are noticeably drier and less lush than those of the Clearwater and Selway Rivers to the north, they do contain patches of moist forests with understories of huckleberry, grouse whortleberry, and beargrass. Also present are open subalpine meadows and parklands, and riparian stringers supporting sedges, currants, thimbleberry, serviceberry, and other bear foods that may, over this large area, sum to significant acreages of habitat.

IMAGE: J. Hogg

Whitebark pine nuts (the meaty seeds in pine cones) are nutritionally important to bears in late summer and early fall. Healthy stands like this one in Idaho's Bighorn Crags remain in patches throughout the southern Salmon-Selway.

Dwarfed by old growth cedar, Institute biologist Marcy Mahr records diversity, abundance and distribution of plant species as well as other site characteristics in a moist drainage in Idaho's Bitterroot Mountains.

IMAGE: D. Wirta

These observations helped shape our comments on location and size of the grizzly bear recovery area recommended in the USFWS Draft Environmental Impact Statement (DEIS) *(for CWWI comments see page 5)*. We encouraged the USFWS to define the recovery area boundaries with explicit ecological criteria and not by arbitrary administrative boundaries. Boundaries should be defined by an informed consideration of how grizzlies can be expected to use the entire Salmon-Selway landscape in view of the spatial and seasonal distribution of bear foods and other key habitat features (denning sites, road densities, etc.).

We also indicated to the USFWS EIS Team that we disagree with those who suggest that the southern portion of the Salmon-Selway will contribute little to recovery because salmon are largely absent (also true in the northern portion), whitebark pine (whose seeds are an important bear food) is declining, and the dry, granite soils reduce plant productivity. Similar

continued on next page

Bear Necessities, *Continued from page 4*

comments about lack of food resources might be made regarding habitat quality in the Greater Yellowstone Ecosystem, yet no one would argue that this ecosystem contributes little to the recovery of bears in the Northern Rockies as a whole. We suggest that: 1) the low road density (an important feature of high-quality bear habitat) afforded by the southern portion's large roadless complex of defacto wilderness fringing the designated wilderness core, and, 2) the presence of significant, if patchy, acreages of bear foods, point to the region's ability to sustain a grizzly bear population. The issue of habitat quality and quantity can be decided only by detailed ecological inventory. We are the only group currently conducting comprehensive habitat inventory of the proposed recovery area. ■

Our GIS data layers are built from recent satellite imagery, benefit from cutting-edge methods of image analysis, and contain over 20 land cover classes, including important habitat patches of wetlands and whitebark pine forests. Our vegetation classification is unique in that it combines field observations with statistical innovations that predict forest understory communities.

CWWI Stand on Repatriation of Grizzlies to the Salmon-Selway

During the public comment period on the DEIS (Draft Environmental Impact Statement) for Grizzly Recovery in the Salmon-Selway Ecosystem, the Craighead Wildlife-Wildlands Institute took a strong stand for a science-based approach to grizzly population recovery. This required us to oppose most aspects of the federally preferred alternative #1. Our comments to the U.S. Fish & Wildlife Service (USFWS) are summarized below.

I. Management and Advisory Structure

We opposed the concept of handing national public resource management authority over to a local citizens committee and advised that the USFWS retain management oversight and authority.

We advocated the establishment and the substantive involvement of two advisory committees; a citizens committee representing both the national and regional population on issues regarding grizzly bear recovery, and a scientific committee of independent scientists representing a range of disciplines appropriate to grizzly bear population recovery.

More generally, *we recommended* a considered and formal national discussion to evaluate the pros and cons of investing local and state appointed citizens committees with the responsibility of managing national resources.

II. Habitat Considerations

We argued strongly for recovery area boundaries defined by explicit ecological criteria rather than arbitrary political or administrative preferences.

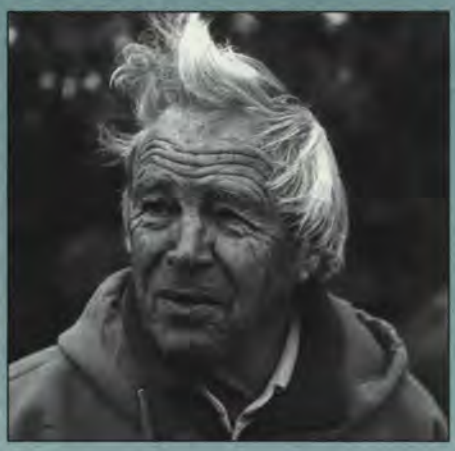
We opposed omitting Section 7 consultation, which requires a review by the USFWS of any federally proposed habitat modifications potentially affecting threatened or endangered species.

IMAGE: J. Craighead

We rejected the reclassification of the introduced population members as non-essential/experimental animals.

We recommended that, in the delineation of the Salmon-Selway recovery area, special attention be given to public lands which could act as foundations for the eventual establishment of residential and/or movement corridors, for bears and other wildlife, connecting to the Northern Continental Divide and the Greater Yellowstone recovery areas.

The public comment period revealed strong support for grizzly bear reintroduction in general. Opposition to re-introduction under any plan was largely fear-based and emotional. More and better public education about coexisting with grizzlies is needed prior to reintroduction and throughout the population recovery process. ■



To Boil Down

By **John J. Craighead**

"To boil down to its core the complex requirements for a successful grizzly bear recovery program, we can state with great confidence that the major criteria for grizzly bear persistence and/or recovery in the contiguous 48 states are:

1. Sufficient high-quality core habitat linked by migration and residential corridors to support a meta-population of grizzly bears.
2. An annual human-caused mortality rate approaching zero throughout the diffuse meta-population until long-term persistence is assured. Years of research by CWWI biologists and others have shown that given the above conditions, grizzly bears, despite a very low reproductive rate, can take care of themselves. Clearly, the survival or extinction of any grizzly population is most dependent upon human understanding and restraint."

John J. Craighead

Science Builds on Science By **John J. Craighead**

In the late 1970's, my colleagues and I initiated a pioneering project to describe and map wilderness vegetation on an ecosystem scale using LANDSAT satellite multi-spectral imagery, botanical survey and main-frame computer assistance. We chose the Scapegoat Wilderness in Montana's Northern Continental Divide Ecosystem as our study area for this work. The result was the first eco-spectral mapping of wilderness vegetation and CWWI's first monograph.[1]

Shortly thereafter the Institute embarked on an ambitious three-part research program having as its unifying goal the development of methods for determining habitat use by large mammals in wilderness ecosystems. In part one, we refined the mapping techniques we developed in the Scapegoat project to map vegetation in the Kobuk River ecosystem of Alaska.[2] We then developed and tested methods for tracking animal movements by satellite.[3] Finally, in part three of this program, we used the Kobuk River vegetation map and satellite locations of radio-collared Kobuk River grizzly bears to develop a general methodology for combining animal-location and vegetation data in studies of large mammal habitat use.[4] When plans to reintroduce grizzlies into the Salmon-Selway wilderness complex were revealed by the U.S. Fish & Wildlife Service, we immediately recognized the necessity for accurate ecosystem-wide plant community maps of the area. With our track record of mapping and describing wilderness ecosystem vegetation, we were uniquely qualified to take the lead in this vital step in grizzly bear recovery planning. Therefore, in 1996, with major seed grants from the Charles Engelhard Foundation and Board Director Jean Vollum, we began our third wilderness ecosystem vegetation mapping project in the Salmon-Selway ecosystem. Subsequently, we received important additional support from our long-time benefactor the R.K. Mellon Foundation, as well as from the Turner Foundation, Patagonia, Newman's Own, Newman's Organics ... and many individual donors.

Under the direction of CWWI Science Director Dr. Jack Hogg and collaborators Dr. Roly Redmond (Wildlife Spatial Analysis Lab, The University of Montana) and statistician Dr. Brian Steele (Department of Mathematical Sciences, U of M), with the nearly full-time efforts of Institute plant ecologist Marcy Mahr and computer specialist Noel Weaver, and with the enthusiastic assistance of the Institute's seasonal field crews, we are now in the final stages of producing the first comprehensive vegetation map of the Salmon-Selway, one of the largest wilderness ecosystems in the lower 48 states. The research team has employed state-of-the-art techniques in image processing and eco-spectral classification, old-fashioned field ecology, as well as cutting-edge methods of botanical sampling. For example, Marcy and her field crews use Global Positioning System units donated by Trimble, Inc. to navigate and locate field plots in the wilderness back-country.

This map, produced in the independent scientific sector, provides a scientific basis for a wide-range of biologic and economic decisions that must be addressed if grizzly bears are to inhabit this wilderness complex. The information will be essential to any long-range planning for the conservation of wildland biodiversity. ■

1 Craighead, John J., Jay S. Sumner, and Gordon B. Scaggs. *A Definitive System for Analysis of Grizzly Bear Habitat and Other Wilderness Resources.* Craighead Wildlife-Wildlands Institute Monograph No. 1, Missoula, MT, 1982. 2 Craighead, John J., F. Lance Craighead, Derek J. Craighead, and Roland L. Redmond. *Mapping Arctic Vegetation in Northwest Alaska Using Landsat MSS Imagery.* National Geographic Research 4(4):496-527, 1988. 3 Craighead, Derek J. *Movements of Caribou in the Western Arctic Herd.* Argos Newsletter No.26, June, pp 1,3, 1986. 4 Craighead, Derek J., and John J. Craighead. *Tracking Caribou Using Satellite Telemetry.* National Geographic Research 3(4):462-479, 1987.

In a Band of Bighorns

By **Sherry Devlin** *Reprinted by permission of the author. Originally published, July 4, 1996, in the* Missoulian.

Jack Hogg is on Sheep Mountain this soft morning, looking across to the steep, south-facing slopes where the bighorns slumber.

To the left, he locates the nest from which bald eagles monitor the bighorn ewes and lambs, occasionally picking a newborn out of the nursery band and carrying it away. To the right is Bobcat Draw, the boundary between the ewe and ram ranges. Straight ahead is the grassy bench where Hogg once saw a ewe looking for her newborn lamb, back and forth, back and forth, for more than an hour. On no particular cue and after Hogg was sure it had been taken by a predator, the lamb popped its head out of the grass, answering the ewe's cries. Hogg christened the little creature "Mushroom."

Since 1979, Hogg has documented the life histories of every bighorn sheep on the national Bison Range, tracing their lineage, noting their progression from lamb to adolescent and adult, documenting their death. He is, by his own admission, emotionally and intellectually attached to the animals. He knows each of the 47 bighorns by sight. He has given each a name. He knows them, he says, "as individuals."

Descending Sheep Mountain, Hogg walks up the draw he calls Twin Fir and finds 6 rams dozing in the sun. A seventh strikes a haughty pose higher on the hill, mid-point between a pair of cliffs. The second ram from the right, he says, is Sundog. He has an albino nose. He was transplanted to the Bison Range in 1993 from Thompson Falls. Sundog is a handsome animal, but also feisty. "One of my favorites" he says. That's Droopy, the second from the left, the scientist continues. He is 8, clearly the biggest horned of the rams in this band. Droopy's father was an introduced ram from Rock Creek, his mother a Bison Range born ewe.

Hunkered low behind the bigger rams is Rabbit, a 2 year old born well into August, months after the other lambs. As a yearling, he reminded Hogg of Roger Rabbit — "a little bit touchy, a little bit wired." Thus, the name.

Bighorn sheep were first transplanted to the National Bison Range from Canada in 1922. Because the herd was so small and isolated, it was introduced with five Rock Creek rams in 1985 and another 10 animals from other Montana herds since. The sheep use the southern half of the Bison Range, occupying an area from Dixon to Ravalli, the ewes and lambs in the center, the rams on the outer edges. Only during the rut do the rams approach the ewes.

IMAGE: J. Muiderman

Institute biologist Jack Hogg scopes for bighorn in the Mountain Sheep Conservation & Restoration Project's National Bison Range study site.

This day, Hogg has parked his truck along Triskey Creek, intent on finding the ewes and their lambs-of-the-year. He will not be disappointed. Up and around Twin Fir Draw, past the slope where the herd's oldest ram rests in the sun, Hogg drops into a high ravine and finds all 22 ewes, 9 lambs, a yearling and a 2-year-old ram. The nursery band.

The animals are bedded down in a field of lupine, rock and native grass that looks south to Ravalli and east to the Mission Mountains. These are, in fact, the foothills of the Mission Mountains. And if there were no farms or highways in between, these bighorns would likely migrate to and from the mountains. Instead, they stay on the Bison Range, isolated from other bighorn herds, tolerant of the occasional scientist in their midst. Hogg's first field season at the Bison Range was as a graduate student at the University of Montana. His doctoral work was a behavioral project on the mating system of bighorn sheep. He was the first to document the mating tactics used by subordinate rams. The dominant rams in a herd tend the ewes as they come into estrus. The ewes are obliging, mating is cooperative.

The subordinate rams must resort to alternative, sometimes brutal, always spectacular, tactics. In "coursing," subordinate rams move in on a mating pair, butting the ram and chasing the ewe, attempting what Hogg calls a rape. The ewe runs from the subordinate ram, the dominant ram in pursuit, in chases that typically cover hundreds of meters of cliff, scree and

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In a Band of Bighorns, *Continued from page 7*

grassy slopes. Copulation takes only about two seconds. In "blocking," a subordinate ram locates a ewe before she comes into estrus and tries to

keep her away from the dominant rams. The ram will threaten and sometimes physically push the ewe, desperate to keep her to himself. It is, says Hogg, "kind of a kidnapping."

The mating research led Hogg to paternity studies that documented the reproductive success of subordinate rams versus the reproductive success of socially dominant rams. And that led to his current work, as Science Director of the Craighead Wildlife-Wildlands Institute in Missoula, on the population viability of bighorn sheep–both the Bison Range transplants and a herd of native bighorns at the Sheep River Sanctuary on the East Front of the Canadian Rockies in Alberta. Hogg's is a combination of mud-and-boots field biology and space-age work in molecular genetics and remote sensing, a combination of basic science and conservation biology. The result, he says, will be a definition of the population size and habitat needed for bighorn sheep to persist.

This year's lambs look good, Hogg says from his cross-ravine vantage. There were 10 the last time he checked, only 9 today. But losses are normal. There are cougars, bobcats and bald eagles on and above these slopes. One newborn earlier this year was taken before he even saw it.

Hogg weighs and takes a tissue sample of each lamb within a day or two of its birth. Because he knows when the adult sheep mate, he can also calculate–with some certainty–when the lambs will be born. Gestation is 173 days; ewes almost always give birth between 170 and 175 days. Just before the lamb drops, the ewe separates from the band. Hogg must find each, knowing the ewes prefer steeper, tougher terrain for lambing, not knowing precisely where they will be, relying on instinct. Newborn lambs are easily caught for inspection. The ewe maintains a tight circle around Hogg and the lamb, allowing the intrusion, but quickly returns to the lamb when Hogg departs. "They do not accept me," he says, "they tolerate me." UM geneticist Stephen Forbes analyzes each tissue sample taken from a lamb and helps Hogg trace the paternity. Hogg knows the father of all 142 lambs conceived during 10 rutting seasons on the Bison Range and at the Sheep River sanctuary.

IMAGE: J. Hogg

On both ranges 42.5 percent of the lambs were fathered by subordinate rams skilled in the alternative mating tactics. If the dominant ram in a herd monopolized reproduction, the animals would lose their genetic variation—and their vigor, requiring a larger herd size to maintain the population. The intrusion of the subordinate rams makes possible a smaller herd size.

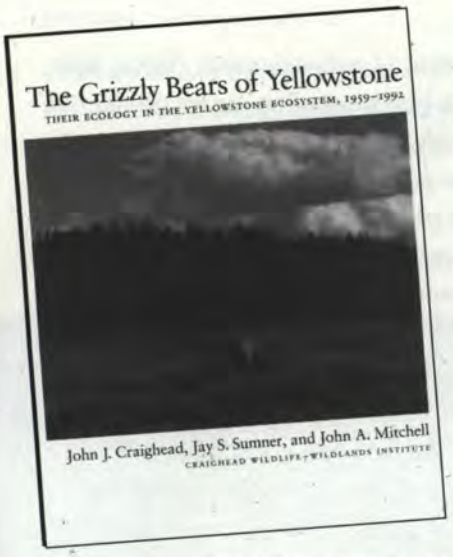
Hogg says the Bison Range bighorns have also benefited from the introduction of new rams to the herd—Rock Creek and Thompson Falls transplants of recent years. The "hybrid" lambs born of newly introduced rams have larger birth weights, shorter gestations and higher pre-natal growth rates than do their cousins born of rams descended from the original 1922 transplant.

Between 1922 and 1985, the Bison Range herd lost half of the genetic variation present in the source herd, by Hogg's estimation. Rams hit a physiological wall at 8 to 9 years old and died soon thereafter.

The transplants appear to be living longer: Sam, a 1985 transplant, is robust at 13. Hogg likens it to the difference between two competing brands of pile jackets, alike in every way when purchased. Same number of snaps. Same pockets. Same color and heft.

Some years later, though, one of the jackets is flat, its stitches pulled, its loft diminished. The other still looks new. It is a metaphor for what happens when a population of bighorn sheep loses its genetic diversity. "They don't do everything quite as well," he says. "They don't wear as well." Because it spans so much time and space, Hogg's research at the Bison Range can document—as shorter-term research could not—changes in a population when new animals fatten the gene pool. Ultimately, he says, he will be able to combine all of the information on the mating system, reproductive success, ram and lamb fitness and demography–any of which could create fluctuations in her size–and produce an estimate of how many bighorns are needed to keep the Bison Range herd intact into the future. ■

Craighead Wildlife-Wildlands Institute

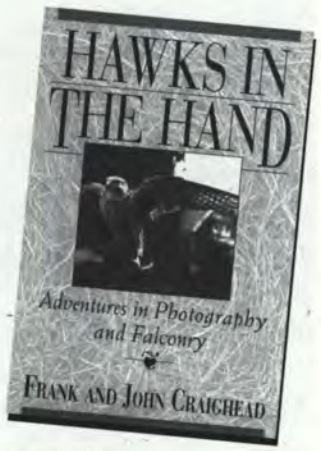


The Grizzly Bears of Yellowstone Receives Best Book Award

The Wildlife Society presented the *Best Wildlife Publications Award* to John Craighead, Jay Sumner, and John Mitchell for their book, *The Grizzly Bears of Yellowstone: Their Ecology in the Yellowstone Ecosystem, 1959-1992.* This prestigious award was given to the authors at the Wildlife Society's 1996 annual banquet. The book is a comprehensive, 560-page scientific treatise on grizzly bear ecology, a careful evaluation of the bear's past and present relationship to man, and an innovative blueprint for a more harmonious future.

This is the second time John Craighead, and colleagues from the CWWI, have received the Wildlife Society's Best Wildlife Publications Award. In 1984 they were given the award for their monograph, *A Definitive System for the Analysis of Grizzly Bear Habitat and Other Wilderness Resources*. ***The Grizzly Bears of Yellowstone*** is available through the publisher, Island Press, by calling (707)983-6405 (ISBN 1-55963-456-1), or by calling CWWI.

Hawks in the Hand



John and Frank Craighead's recent receipt of the *North American Falconry Heritage Award* arrived coincidentally with the 1997 re-release of *Hawks in the Hand*. The following is taken from the introduction to *Hawks in the Hand* by Stephen Bodio.

"***Hawks in the Hand***, understand, is not for children, or at least not just for children. It is, in the best sense of the word, a young person's book, brimming over with enthusiasm and the wonder of discovery. Frank and John, twenty-three when it was published, were already among the first pioneers of an American falconry movement that is now the world's best and most knowledgeable. In the next year they would spend three months in India as guests of Prince Krishnakumarsinhji of Bhavnagar, then join the Navy, where they would develop survival techniques for the naval aviators in World War II. Their triumphs and travails as independent scientists, grizzly bear researchers, defenders of Yellowstone's integrity, were far in the future. But the roots of all their adventures are here in this book, the story of how two young naturalists learn to become falconers and wildlife photographers." ***Hawks in the Hand*** (ISBN 1-55821-560-3) was published by Lyons & Burford, and is available through our office or at your local bookstore.

Montanans Receive Special Tax Credit

Montana residents are eligible to receive a credit against Montana State income taxes in the amount of 50% of qualifying contributions. There is a maximum of $10,000 credit per year per individual, for a qualifying planned gift. For more information call our office or your tax advisor. ***Thank you*** for remembering CWWI when planning your charitable giving.

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These are examples of items that can be given to the Institute to enable us to continue our vital work of protecting our wildlands and wildlife. There are specific tax advantages also available to you. Please call or write us if you would like to discuss such gifts. Craighead Wildlife-Wildlands Institute, 5200 Upper Miller Creek Road, Mssoula, MT 59803. (406)251-3867.

Bill & Rana

By **John W. Craighead**

Behind the Institute, in a grove of towering ponderosa pines, our building-sized aviaries are home to two mature golden eagles. In past years a larger number and greater variety of raptors were kept. The origin of the aviary goes back some 40 years. At that time, concerned citizens that brought in injured birds to the agencies or universities were usually directed to my father, John J. Craighead. His experience as falconer and knowledge of raptor ecology made him the local expert and best qualified to minister to the ailing hawks, falcons, owls, and eagles. Those birds that could be returned to their natural habitat were; those that could not, became permanent residents of the aviary. These latter birds, and the rather informal rehabilitation program, spawned a variety of research studies. Tissue samples were examined to better understand the metabolic effects of DDT. Detailed studies on nesting and rearing behavior were made to better understand the havoc that DDT wreaked on raptor reproduction. Techniques were developed and tested for the release of captive-reared birds in to the wild. Captive eagles were used to develop and test transmitters and transmitter harnesses for tracking large migratory birds by radio and satellite. And much more.

The eagles, in particular, were a source of wonder and enjoyment outside the realm of science. I can still remember as a young boy, following my sister Karen and volunteer trainer Bill Staninger up the face of Mount Sentinel overlooking the University of Montana campus. Rana, a male golden eagle, was perched on Bill's gauntleted forearm. I had come to vicariously thrill in the experience of flight through Rana's incredible aerial mastery. Before we had gone more than twenty yards up the steep trail, Bill released his grip on the leather jesses fastened about Rana's ankles. Rana was in his element, soaring in the up-welling currents of air, soon no more than a dot against the blue sky, and then he was gone.

Bill Staninger "casting off" Rana.

IMAGE: J. Craighead

When released for flight, a well-trained falcon will gain his pitch (gain altitude), and then hold this position above the trainer in anticipation of prey being flushed out, or quarry released. This is called "waiting on" by falconers. Watching Rana disappear made my heart sink. Before the advent of radio-telemetry, losing sight of a bird most often meant unplanned hours spent in search and a bird not "keen" enough to stay near his trainer for rewards of food was often difficult to retrieve. Bill and Karen, were unconcerned as we continued our hike up the mountain. There Bill raised his arm and blew on his referee's whistle. "Here he comes," he announced a moment later. Wings cupped close to his body, dropping from nowhere, Rana "stooped" on Bill's outstretched arm. Flaring an instant before impact, Rana landed lightly on the gloved fist to take the offered bit of meat and was then off again soaring to invisible heights. Rana "waited on" at distances beyond our inadequate eyes.

On another outing, Rana brought notoriety to the quiet eagle research program. He was attracted to the whistles of the University football squad at practice. Diving in a fierce stoop, he plucked a practice place kick out of the air. Bill (and Rana) returned the ball amid the flash of news cameras and good natured speculation on the potential of eagle-assisted field goals. Use of a referee's whistle was subsequently replaced with a vocal "*Yo!*" by the eagle trainers.

When very young, Rana had been removed from her eyrie in south central Montana. On rapelling over Rapelje Cliff into an untidy collection of coarse branches covered with fir boughs and housing two downy golden eaglets, raptor ecologist

Continued on next page

Jerry McGahan discovered one of the two chicks suffering from a huge cyst in its throat. Its grasping for breath and weakened condition made the decision to remove the eaglet for treatment easy even though it meant that Rana would never return to the wild. Because of his age, he would pass that inscrutable phase of avian development known as imprinting in the hands of human "foster parents." As a "human imprint," his chances for survival in the wild were slim. Thirteen years after leaving the eyrie on Rapelje Cliff, Rana died of aspergillosis, a throat disease, very similar to the condition that placed him in our care.

IMAGE: J. Craighead

Rana gliding over Mount Sentinel with leather jesses dangling.

Caretaking the golden eagles and other raptors has been a constant challenge. Fortunately, we have always experienced excellent help and support from our community. Last year is a special case in point. An unprecedented snow storm caused our two aging flight cages to collapse under the weight of accumulated snow. The birds were unhurt but our aviaries were in shambles. To the rescue came the folks at Grizzly Fence, of Missoula, MT, who offered to rebuild the aviaries, donating both their labor and experience to the task. A sturdy and versatile new facility now is nestled among the ancient ponderosa pines on the CWWI grounds. Our sincere thanks to Ed Schlauch and Rob Jacobs at Grizzly Fence who made it all happen and our gratitude to the crews at Grizzly Fence who did an excellent and efficient job.

Grizzly Fence provided us with a further welcome addition: our new eagle caretaker, Barry Cummings. Barry is a student at the University of Montana studying for a career in aquatic biology and law enforcement and working part-time for Grizzly Fence. We welcome Barry to our staff. To Niaobi, the eagle caretaker who is leaving us, and to all her predecessors, we offer a special thank you for the years of service to the health, well being and understanding of the golden eagles and other raptors in their care. ■

Craighead Brothers Receive National Falconry Award

John J. Craighead, Founder and Board Chairman of the Institute, was recently recognized nationally for his work with birds of prey. ***John*** and his brother ***Frank*** were selected as the first recipients of the ***North American Falconry Heritage Award***. This honor was awarded by the Archives of American Falconry of the Peregrine Fund, and the membership of the North American Falconers Association. The purpose of this new award is to recognize those individuals who have significantly contributed to the preservation of the heritage and ethics of American falconry. The letter of award to John states,

"In this case, you and Frank, as role models, have not only encouraged an appreciation of the heritage of our sport on this continent, but are a living part of the heritage. We cannot imagine any more suitable recipients, personifying the attributes for which the award has been created, to honor in inaugurating this program."

Congratulations, John and Frank!

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Natural Connections

April 1998/Issue No. 8

Join the Institute Family Today!

IMAGE: J. Craighead

Use the enclosed envelope to join us today!

The **Craighead Wildlife-Wildlands Institute** is a non-profit organization devoted to field-based ecological discovery and scientific activism. Our mission is to generate new ecological information, and widely communicate these insights. Our aim is to influence individual behavior and public policy in directions that preserve regional biodiversity.

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